TEXTBOOK

André Dechange

Project Management

From Traditional Project Management to Hybrid Forms

Second Edition

Recommended in Germany

Springer Gabler

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Foreword to the 2nd Edition

Due to the rapid progression of project management through agile topics and the resulting new approaches, methods and procedural models, the 2nd edition of this book has been created. The book has been expanded and rewritten in some areas regarding the following topics.

- Update and expansion of the chapter "Agile Project Management".
- In particular, the Design Thinking approach has been newly included.
- New chapter on hybrid project management
- The increasing importance of hybrid project management has been addressed by a own chapter. As a result, there is now a chapter on traditional, agile and hybrid project management.
- Update of the chapter structure analogous to the approach in practice.
- This then results in an equal weighting of the three basic forms of modern project management.
- Expansion of the Ei-Ti AG case study to include agile, hybrid topics and within the scope of the topic "Personal and social competencies".
- Error corrections of the 1st edition.
- Sharpening of terminologies (such as the distinction between "procedural model" and "approach").
- Redesign of all illustrations.

▪ How Is the Book Structured?

First, in the first chapter (► Chap. 1), the theoretical foundations for projects and project management are described and explained using examples. As part of the project presentation, it deals with the characteristics and terminologies as well as the structuring and categorisation of projects. Project management is first defined, in addition, traditional and agile procedural models are presented. Subsequently, the process-oriented and functional perspectives of project management are explained. They are among other things also the basis for the structure of this book.

► Chapters 3–5 reflect the three essential areas of modern project management: traditional project management (► Chap. 3), agile project management (► Chap. 4) and hybrid project management (► Chap. 5). In these chapters, particular attention is paid to the tasks, approaches, procedural models, methods and tools of project management.

Since the so-called soft skills *(soft factors)* have a high importance for project success and are important for the satisfaction of project participants, the sixth chapter (► Chap. 6) presents the relevant competence areas of self-management, communication, leadership, teamwork and conflict management.

The seventh chapter (► Chap. 7) is dedicated to multi-project management.

Structure of the Book

A practical example that runs throughout the entire book illustrates the various methods and tools and enables the reader to better apply them. In addition, at the end of each chapter, questions and exercises are provided, with which the reader can check his learning success and deepen the topic.

Examples, tips and other aids are placed in clear boxes for quick recognition.

André Dechange
Dortmund, Germany
January 2024

Foreword to the 1st Edition

■ What Is This Book About?

Working in project form has been steadily increasing for decades and the increase will continue in the coming years. Projects do not stop at any industry or any form of company anymore. They are now also increasingly found in non-profit organisations (associations, public institutions, NGOs) and industries that previously had less to do with projects. In 2013, every German workers spend, on average, about a third of their working time on projects. This proportion is expected to rise to 40–50% in the coming years (GPM Deutsche Gesellschaft für Projektmanagement e. V. (Hrsg.), 2015, p. 1).

To successfully manage projects and meet the ever-increasing complexity due to globalisation, digitalisation, mobility, technology on the one hand, and the demand for health consciousness, flexibility, self-organisation on the other hand, knowledge and application of professional project management is required. This includes adequate procedural models, methods and tools, as well as well-trained project managers.

■ What Does the Book Offer?

The aim of this textbook is to provide an overview of projects and project management and to present the essential methods and tools of traditional and agile project management. The practical relevance is established through a continuous example and with the help of questions and exercises. When using the book, the reader should be able to structure and independently manage small and medium-sized projects.

The book aims to support "project management novices" in working more successfully and satisfactorily in their projects.

■ Who Is the Book Aimed At?

Against this background, the book is written for students, participants in further and advanced training events, as well as practitioners who want to look up certain topics, methods and tools or want to understand them theoretically.

■ What Characterises This Book?

The book is characterised by the following features:

- It is **process-oriented** in structure. That is, the sections of the book correspond to the course of a project, especially in traditional project management.
- A project is viewed as a **holistic** system that also includes its environment and all relevant elements.
- The book describes the project management topics **comprehensively.** In addition to traditional and agile single project management, multi-project management is also presented, and the relevant topics of personal and social competence (soft skills) are explained.
- With the help of the continuous example, the topics are presented **in a practical manner.** In addition, there are numerous specific practical tips.
- Clear definitions of terms and a comprehensive index make the book an easy **reference work.**

- A summary at the end of each chapter and review questions underline the character of a teaching and **exercise book.**

▪ Notes on Handling This Book

The continuous example in this book has been deliberately developed to be simple and thus easily understandable. In practice, not all methods and tools need to be applied in the depth of detail presented. For didactic reasons, however, almost all methods and tools are practically explained using this example. All names in the practical example are fictitious.

If, despite thorough research, copyright or product name references have been overlooked, we apologise.

André Dechange
Dortmund, Germany
March 2019

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List of Abbreviations

APM	Agile Project Management
DIN	Deutsches Institut für Normung (German Institute for Standardisation)
i.e.	Id est (that is)
NGO	Non-governmental organisation
PCM	Project Core team Member
PM	Project Manager
PMBOK	Project Management Body of Knowledge
PMgt.	Project Management
PMO	Project Management Office
PNN	Process Node Network Plan
PO	Project Owner
PRINCE2	Projects in Controlled Environments
PS	Project Staff
R&D	Research and Development
RASCI	Responsible, Accountable, Supportive, Consulted, Informed
TPM	Traditional Project Management

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Project Management Fundamentals

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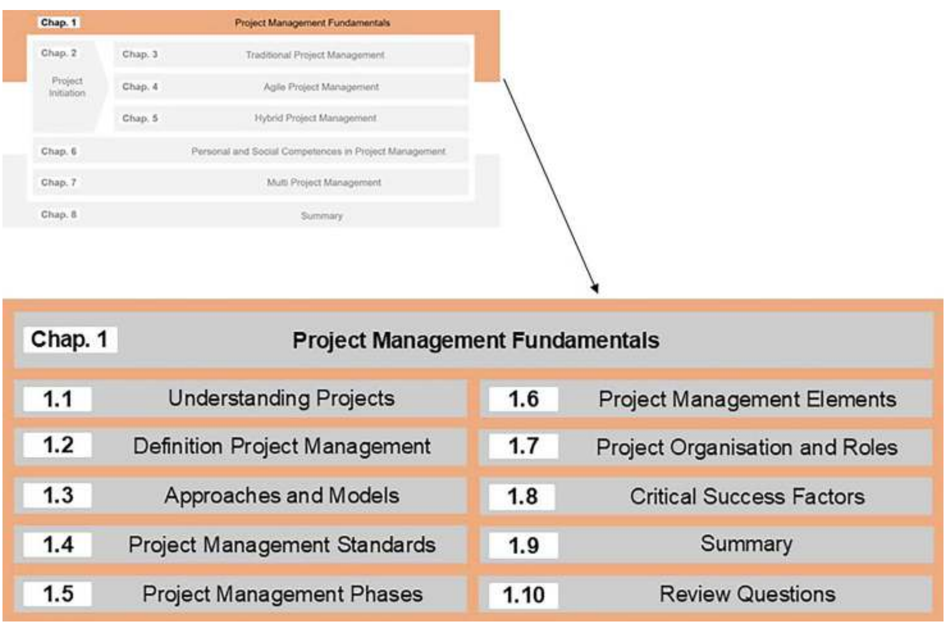
A. Dechange, *Project Management*, https://doi.org/10.1007/978-3-662-71462-1_1

Learning objectives of this chapter

After reading this chapter ...

- you can understand the different project characteristics, and types.
- you know the definition and demarcation of projects from other ventures.
- you can derive the project constraints.
- you know the definition and characteristics of project management.
- you know the most important project management standards and can distinguish them from each other.
- you understand the different approaches and procedure models in project management from the traditional and agile area.
- you can understand the distinction between project phases and project management phases.
- you can derive the project management elements.
- you know the different roles within the project organisation.

The first chapter has the structure shown in ◘ Fig. 1.1.



◘ **Fig. 1.1** Structure Chap. 1

1

1.1 Understanding Projects

As already mentioned in the preface, more and more activities in organisations are carried out in project form. The term organisation includes all companies, associations, public institutions etc., i.e. all structured groupings of people who pursue a common goal (cf. Robbins & Fischer, 2017, p. 25 f.).

Projectification

This is often referred to as projectification. The reasons for this primarily lie in the trends of globalisation, digitalisation, corporate networks, shorter product life cycles, new forms of work and leadership as well as the increased competitive pressure and the resulting more complex environment of organisations.

The first question that arises is: What is a project? This question is of great importance in theory and practice, because there are numerous methods and tools,[1] which simplify planning and controlling and thus make it more efficient. However, if these methods and tools are applied outside of projects, e.g. to routine activities, in many cases the opposite of efficiency increase occurs: The activity is slowed down and leads to inefficiency. Therefore, it is important to distinguish between projects and other forms of work.

1.1.1 Definition and Characteristics of Projects

Against this background, the term *project* with its essential characteristics should be defined and the project can be delineated from other initiatives. In particular, the characteristics of a project are of great importance, which are in line with the common project management standards and usually only differ in the emphasis of some characteristics.

A widespread and comprehensive definition of the project concept is provided by DIN 69901-5:

1 Since in this book *methods and tools* are frequently discussed, a brief definition of terms should be made at this point to avoid misunderstandings: A method is a systematic procedure for achieving a goal, i.e. the way in which a goal is achieved. The tool is a concrete tool, i.e. a means used to achieve the goal. For example, the written addition of numbers is a method. A piece of paper, a pen and our mind are possible tools.

Project

"A project is an undertaking that is essentially characterised by the uniqueness of the conditions in their entirety, such as:
- Goal specification
- Temporal, financial, personnel and other limitations
- Delineations from other initiatives
- Project-specific organisation" (DIN, 2009c).

Project

Based on this definition, a number of essential project characteristics can be derived, which are important for the determination of projects, the so-called project worthiness, and on the other hand, pose important requirements for project management.

Project Worthiness

Project worthiness refers to the assessment and determination of whether an initiative is actually a project.

Project Worthiness

Project Characteristics

◘ Table 1.1 provides an overview of the essential characteristics of a project and the importance for the management of these characteristics (project management).

As can be seen from the table, all characteristics of a project are taken into account in project management. The characteristics of goal specification, temporary, project budget, project-specific organisation and risk are transformed into so-called project management elements (► Sect. 1.6). The planning and controlling of these project management elements make up a significant part of project management.

A clear demarcation between project work and routine activity must definitely be made, i.e. the project worthiness must be determined. Because projects cannot simply and successfully be processed within the routine of "day-to-day business". Over time, methods and tools have been developed that enable efficient management of these projects. But it can also be just as inefficient to handle routine tasks with the methods and tools of project management.

Work form

Basically, three forms of work can be distinguished in organisations. This distinction is shown in ◘ Table 1.2.

Project

The umbrella term for all three forms of work is ventures. Thus, it should initially be checked for each project which form of work is the most sensible and therefore also the most efficient one.

Table 1.1 Characteristics of projects

Characteristic	Explanation	Importance for project management
Novel, unique	The project result has not been developed before	– A project must be prepared and planned. – An agreement in the form of a project order (Sect. ► 2.7) should be in place before the official start. – The essential restrictions, such as time, cost, resources and project organisation, should be transparent
Goal specification	There are specifications and agreements about what the project is to achieve, when it is to be completed and how expensive it may become	The involved and responsible persons in a project have agreed in writing and clearly on the project goals
Temporary	The project is time-limited. There is a clear start and end date	There is an agreement on the planned start and end date, which is based on a realistic planning and is supported by the relevant persons in the project
Project budget	There is a specific financial framework (budget) or limited project costs	There is an agreement on the available budget for the project as well as the costs incurred
Project-specific organisation	There is a temporary project organisation with specific project roles (e.g. project sponsor, project manager)	– The roles in the project are defined and described, e.g. client, project manager, project core team. – The personnel resources are planned qualitatively and quantitatively. – The necessary roles are assigned to persons taking into account the individual availability. – The persons have regulated the type of cooperation
Social system	Any organisation where people work together on something can be understood as a social system. Social systems are per se complex and cannot be completely planned and controlled	The following elements help to make the joint work more efficient and to make it conflict-free: – clear goals and demarcation from the environment, – structural and procedural structures within the project, – role descriptions, – communication structures within the project
Complexity	The project is not 100% planable, i.e. there are always new challenges that need to be overcome	– People with different competencies are needed who work together in an interdisciplinary team – On the one hand, planning should be done in advance, on the other hand, the project team should be sensitised so that it can react quickly and flexibly to changes
Strategic Importance	Projects often have a strategic importance for the organisation or a unit of the organisation, usually in the form of profit increase, cost reduction or image improvement	The reason or purpose of the project and the project goals derived from it must be known and regularly reflected upon during the project
Risk	There are uncertainties (risks and opportunities) during the project (► Sect. 3.1.10)	A professional risk management must be set up that identifies the risks and opportunities, reduces risks and realises opportunities

Table 1.2 Overview of work forms

Criterion	Routine	Project	Process
Type of Management	Line Management	Project Management	Process Management
Time Horizon	Rather short-term	Medium to long-term	Short to medium-term
Degree of Repetition	Often multiple identical or similar activities	Unique	Repeating
Degree of Complexity	Rather simpler/ standard activities	Complex	Complicated
Additional Management Tasks	No	– Planning effort in advance including risk management – Control effort during execution	One-time effort in defining and establishing processes
Team Composition	Alone or within an organisational unit	Cross-organisational unit in a team	Cross-organisational unit alone or in a team
Examples	Creating spreadsheets, making travel bookings	Building a structure, product development, creating a sales concept, Planning and execution of events	Production of consumer goods, goods orders (workflow)

Routine

Routine is primarily characterised by simple standard tasks that usually do not require any preparation time and have a low level of complexity.

The characteristics of a project have already been presented in Table 1.1.

Process

In the case of a process, the efficiency approach, i.e. productivity, is at the forefront, i.e. a process is planned and established in an organisation when there are recurring projects that are always run in the same way.

Practical tip

Project worthiness and project size

In practice, the worthiness of a project can be determined in particular by the characteristics or criteria of project budget, project duration (start and end date), complexity (number of involved organisational units) and novelty, as these characteristics are easy to determine.

In addition to the worthiness of a project, the project size can also be determined by categorising the criteria according to different values.

Here, a simple matrix can be used to determine whether it is a project and what size of project.

◘ **Table 1.3** Example utility table for determining the project worthiness and project size

Criterion	0 points	2 points	4 points	6 points
Project budget	None available	<10,000 €	10,000–100,000 €	>100,000 €
Project duration	In the range of hours or days	<3 weeks	3 weeks–3 months	>3 months
Number of involved organisational units	1	2	3–4	28 > 5
Novelty	Project carried out multiple times	Project carried out similarly	Some tasks within the project carried out similarly	Completely new

0–4 points: routine activity
5–15 points: small project
16–25 points: medium project
>26 points: large project

For this, ◘ Table 1.3 can be used, which is filled with example data. The values can vary depending on the industry and size of the organisation.

1.1.2 Types of Projects

Types of projects

The classification of projects into so-called types of projects is important for the execution of projects. This determines the approach models, methods, tools and also templates. This specification in turn increases the efficiency in the execution. ◘ Table 1.4 provides an overview of the types of projects with the corresponding characteristics and metrics.

Project size

The project size is certainly the most commonly used project type in practice. Especially with this project type depending on the size, one also speaks of the project class. Here, a classification into the characteristics, such as small, medium or large, is made via corresponding criteria, such as the project budget, the number of employees in the project, the project duration. This classification influences the use and type of methods, tools and templates.

Project class

Project client

With the project client, the distinction between a client or customer within one's own organisation (internal project) or outside the organisation (external project) is important, especially for the coordination of project management processes and templates. With an external client, their wishes and requirements for project management often have a high importance or must be implemented.

Table 1.4 Types of projects

Project type in terms of …	Characteristics	Measurement
Size	Small, medium, large	Budget, duration, number of employees
Project client	Internal vs. external projects	Client (customer) within or outside the organisation
Industry	Banks/Insurance, Information and Communication (ICT), Pharmacy, Trade, Construction, Plant and Mechanical Engineering etc.	Industry in which the project is carried out or to which the project deliverable belongs
Project content	Research and Development, Strategy, Organisation, Marketing, Investment etc.	Thematic assignment of the project deliverable within the organisation
Geography	Regional, national, international, global	Location distribution of the involved organisational units
Repetition	Once, partially repeating, repeating	Completely new or already carried out in another form
Environment	Private, Non-profit organisation, Company etc.	Legal form of the executing organisation (company; non-profit company) or in the private environment

Industry

The industry also influences the processes of project management and the project management approach (► Sect. 1.3). Thus, different industries may have their own project management approaches, such as the agile approach (► Chap. 4) in the IT environment. The characteristic depends on the industry of the deliverable and not on the industry of the customer. For example, the development of a logistics program (software) for a trading company is an IT project.

Project content

The project content refers directly to the deliverable and indirectly to the area of the organisation for which the project deliverable is primarily developed or carried out (contractor). The different organisational areas have different processes and procedures that project management must take into account. For example, in a research and development (R&D) project, whose deliverable is a new product, the company's R&D processes may need to be considered in project management. With this type of project, there can be overlaps or mixed forms. For example, a software implementation in sales can include R&D components, IT components as well as sales components.

Geography

The geography of a project, i.e. whether the execution and management of the project is distributed in a region (regional), in a country (national), between two countries (international) or across several countries (global), has a great influence on the organisational structure and communication of a project. For example, different languages, time zones or laws result in increased requirements for documentation (uniform language), meetings (Location and time), responsibilities (central vs. decentralised) and leadership approaches (e.g. virtual leadership).

Repeatability

Repeatability expresses the extent to which a project is completely new and has not been realised in this way before. This certainly includes most innovation projects. However, there are also projects that contain only some new components, such as the development of a new car prototype or a new mobile phone prototype. In addition, there are projects with a high degree of repeatability, i.e. these have been carried out frequently in a similar way with similar components, but are novel due to the different environmental conditions. These include so-called event projects (e.g. the annual Christmas party in an organisation) or the construction of identical terraced houses. As the degree of repeatability increases, project management becomes correspondingly easier.

Environment

The environment corresponds to the legal form of the organisation (e.g. company, association, private sector) in which the project is carried out. This plays a decisive role in the selection of project management methods and tools as well as in legal issues (contract law, purchasing etc.).

Thus, the type of project has an influence on the project management approach model (► Sect. 1.3).

A project can be described by all of the above types.

1.1.3 Project Constraints

Project Constraint

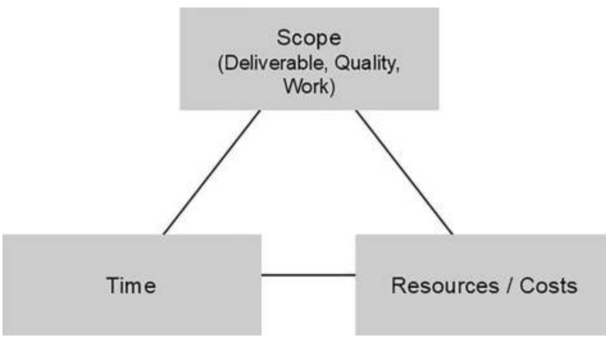
Project constraints are the limiting factors of a project that are planned, monitored and controlled within the framework of project management. The project constraints arise directly or indirectly from the above project characteristics. The temporary project character is, for example, the time constraint.

Every project always has the same constraints or limiting factors with different characteristics. The most important constraints in a business context are the deliverable, the work, the quality, the time, the resources and the resulting costs. The constraints *Deliverable, Quality* and *Work* are often combined into one element scope. The constraints scope, time and resources/costs are represented as a triangle. Since these factors influence each other, it is often referred to as the magic triangle or triple constraints, which is shown in ◘ Fig. 1.2.

In this book, the constraints *Goal/Deliverable, Quality* and *Work* are treated separately, as they have different characteristics and thus contain different methods and tools.

The distinction between the deliverable and the work and the summary including the quality under the term *Scope* is clarified again in ◘ Table 1.5.

However, there are additional project constraints, e.g. the human being itself is a limiting factor in both quantitative and qualitative terms. The environment also limits the project. ◘ Figure 1.3 provides an overview of the limiting factors of a project.



◘ **Fig. 1.2** The triple constraints of project management

◘ **Table 1.5** Difference between deliverable and work

	Deliverable	**Work**
Explanation	Output of the project in the form of a material or immaterial product or a service	Activities in the context of creating the deliverable
Alternative Terms	Object, delivery object, result, product, project subject, project content, project result, product performance, product scope	Project tasks, project activities, project activities, project performance, project scope,
Scope Division	Deliverable incl. product quality (► Sect. 3.1.2)	Work incl. project quality (► Sect. 3.1.2)

1

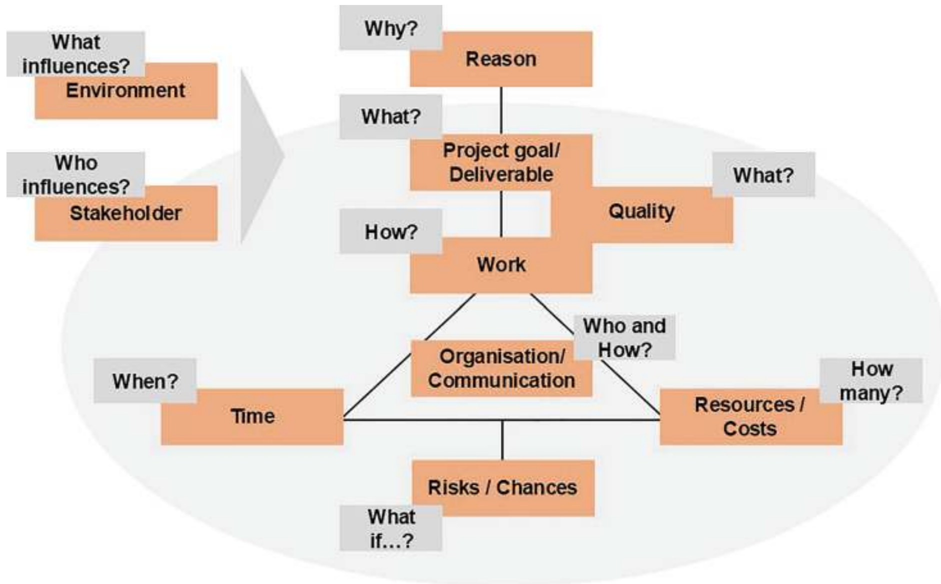


Fig. 1.3 Project constraints

The following briefly discusses the individual limiting factors and provides a reference to the section where the constraint is explained in more detail.

Reason

The reason is the trigger of a project and answers the question, *why a project is being carried out.* Reasons can be of various nature. It can be legal regulations, ideas, strategies, company goals etc. that trigger a project. Examples are an environmental regulation, the idea of a sales manager to optimise sales processes or the strategy to set up a new production site in a certain country.

Project Goals

Project goals are derived from the reason. A goal is a desired state in the future, especially in terms of the three target sizes scope, time and resources/costs (more on this in ► Sect. 2.4). The project goal answers the question, *what should be achieved at the end of the project.*

Project Deliverable

The project deliverable is the result of the project in the form of a material or immaterial good, e.g. a house, a prototype, an app, a concept in paper or electronic form. But it can also result in a licence at the end. The project deliverable answers the question of what will be created or delivered at the end of the project. The deliverable is very closely related to the objective in terms of performance. Against this background, these two constraints are considered together (more on this in ► Sect. 2.4).

Work

The work corresponds to the activities that must be carried out to develop the deliverable. The activities are bundled in projects into so-called work packages. Thus, the work describes the *how* and thus the implementation of the deliverable (more on this in ► Sect. 3.1.3).

Quality

Quality is the agreement of the requirements for the deliverable with the result of the project deliverable. It is ultimately a kind of *target-/actual-comparison.* The quality also answers the same question about the *what,* as the project deliverable. In ► Sect. 3.1.2 this topic is discussed in the context of project management.

Time

Every project has at least a start and an end and thus a duration. This temporal constraint is called time. It answers the questions about the *when.*

In addition to the time constraint, the constraint regarding the resources used and the budget is an important factor.

Resources are considered to be the means relevant for the execution of a project (e.g. personnel, material, tools etc.).

Resources/Costs

The financial resources (budget), which from a business perspective also represent a resource, are considered in the context of the Project management under the project management element *Cost* is discussed. Thus, in project management, the term resources and costs answers the question, *how much is needed and consumed.* A more detailed description and explanation are given in ► Sect. 3.1.6.

Organisation/Communication

The organisation and communication describe and regulate the interaction of people in the project and thus answer the question, *who works with whom and how.* Details are explained in ► Sect. 3.1.4.

Risks

Risks also indirectly limit projects, as these in turn have effects on the other limiting factors. For example, the project risk of frost during construction affects the completion and thus the time. The corresponding question is: *What if?* (► Sect. 3.1.10).

Environment

A project is influenced by the environment[2] directly or indirectly and thus limited. A project environment also includes the people who can influence a project "from outside". These are addressed separately in the restriction *Stakeholder*, so at this point one could speak of a factual environment.

Stakeholder

The individuals or groups of people who can influence a project or are influenced by the project are called stakeholders.

Internal and external stakeholders are distinguished. The distinction between internal and external stakeholders is made based on the demarcation of the project with its environment.

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2 The environment of a project represents all norms, laws, guidelines and other projects that influence the project have. Basically, stakeholders are also part of this. However, these are listed separately, as the people who influence a project or are influenced by it, also exist within a project.

Internal stakeholders work in the project and are part of the project organisation (► Sect. 1.7). External stakeholders are found outside the project organisation. For example, the project manager is an internal stakeholder and a department manager who provides people for a project or a supplier is an external stakeholder from a project perspective. This topic is further deepened in ► Sect. 2.6.

1.1.4 Project Phases

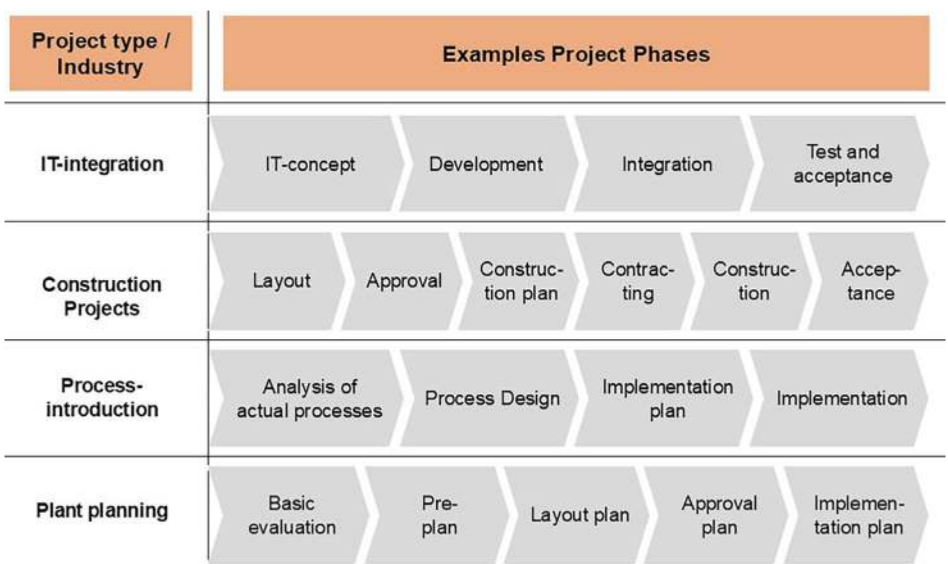
Project phase

Project phases divide a project in terms of content and time at the highest or coarsest level.

As a rule, the successive project phases form the overall process of a project.

Projects are structured into project phases in order to better plan and control the process and thus work more efficiently. The phases of a project are individual, as the project has a unique character. However, in practice, the same or similar project phases are found for different types of projects. ◘ Figure 1.4 shows four projects from different industries with possible project phases as an example.

The project phases are defined based on the project goal or project deliverable. In an organisation, they are often standardised for the same type of project.



◘ **Fig. 1.4** Examples of project phases

The project phases are further divided into work packages in the course of a project.

► Christmas party project—Project phases

Here, as an example, the project phases of a Christmas party in an organisation are presented.

Project phases of a Christmas party project

The project can be divided into three phases.

In the conception phase, the concept for the Christmas party is developed. That is, in this phase the essential components of a large celebration—such as guests, catering (food and drinks), entertainment programme, premises, service, security—are determined. During this phase, “only” intellectual work is produced and no money is spent. The result of this project phase is the concept for a Christmas party.

The preparation phase serves to implement the concept. That is, the different components, such as guests, catering, entertainment, are now invited, commissioned, procured or produced. The result of this phase is the provision of all relevant components of the Christmas party.

The last phase is the actual Christmas party (implementation phase). This lasts depending on the content definition between a few hours and a few days. The duration depends, for example, on whether an evaluation of the Christmas party takes place, which is only provided days after the Christmas party in the form of a small report.

This example is picked up and deepened in ► Chap. 2. ◄

1.1.5 Delineation of Project, Programme and Portfolio

In project management there are some terms that should be briefly explained at this point, as they also serve to delineate the project concept or are used at various points in the book.

Very closely linked to the term project are the programme and the portfolio.

In most standards and relevant literature sources, the terms are defined as follows (cf. PMBOKs, 2021; DIN 69901, DIN, 2009c, DIN; PRINCE2, AXELOS, 2017).

Programme

A programme consists of several projects that have a common objective.

Programme

A programme basically has the same characteristics as a single project (e.g. temporary character), it is just much larger and thus also more complex.

Portfolio

A portfolio is a bundling of projects or programmes within the organisation or organisational unit.

Portfolio

A portfolio, unlike a programme, does not necessarily have a common objective. Projects are bundled according to various criteria (e.g. with regard to the type of project *internal projects*) and prioritised.

◘ Figure 1.5 illustrates the delineation of projects, programmes and portfolios.

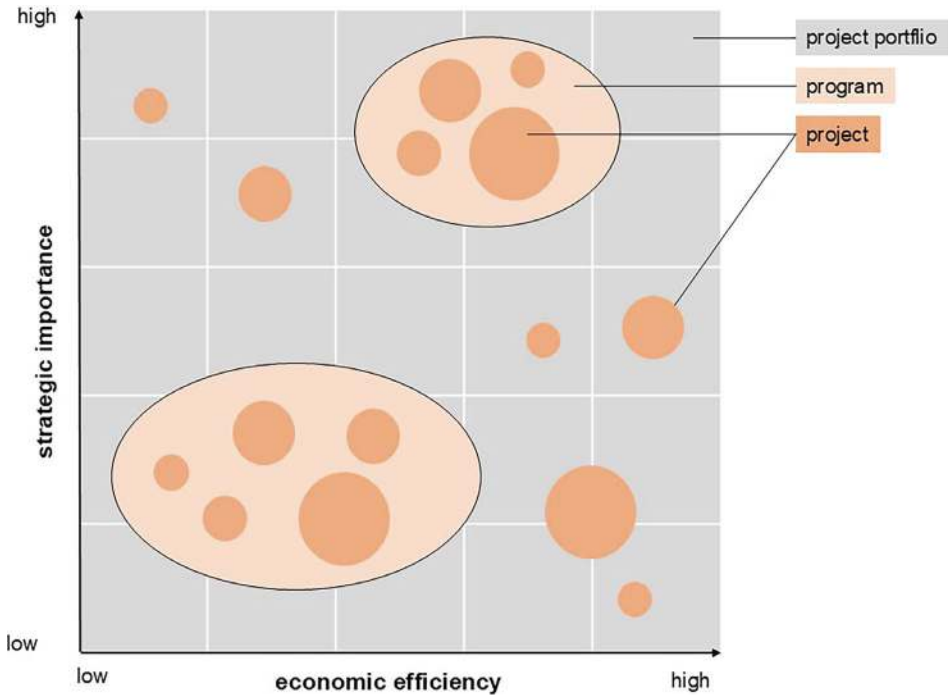
In ► Chap. 7 the management of programmes and portfolios is described in more detail, which is summarised under the term *multi-project management*.

1.1.6 Integration of the Project into the Corporate Organisation

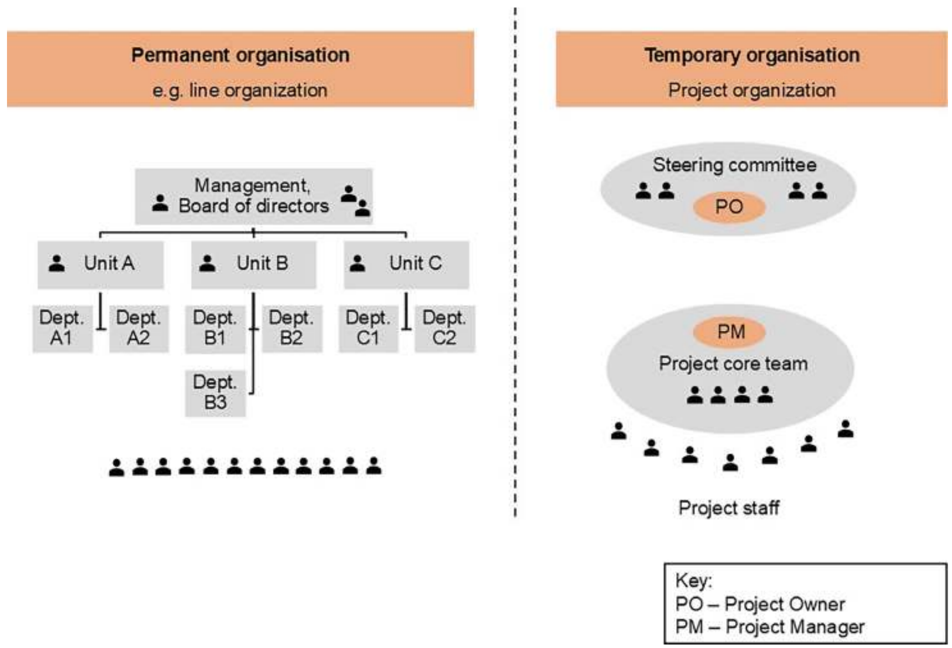
In ◘ Table 1.1, one characteristic of projects is the temporary organisation, i.e. it is an organisation for the duration of the project. This temporary organisation has its own organisational characteristics, i.e. its own structure and communication structures as well as often its own roles and rules. The same people also have a certain role or function in the permanent organisation and follow rules. Against this background, there can be conflicts between the permanent organisation and the project (temporary organisation). For example, an employee M is subordinate to department head A in the permanent organisation. In a project organisation, this employee M could simultaneously be the project manager, to whom possibly even his department head A would be subordinate, if he had a project employee role in the project.

Temporary Organisation

◘ Figure 1.6 shows both types of organisation.



■ **Fig. 1.5** Delineation of project, programme and portfolio



■ **Fig. 1.6** Permanent vs. temporary organisation

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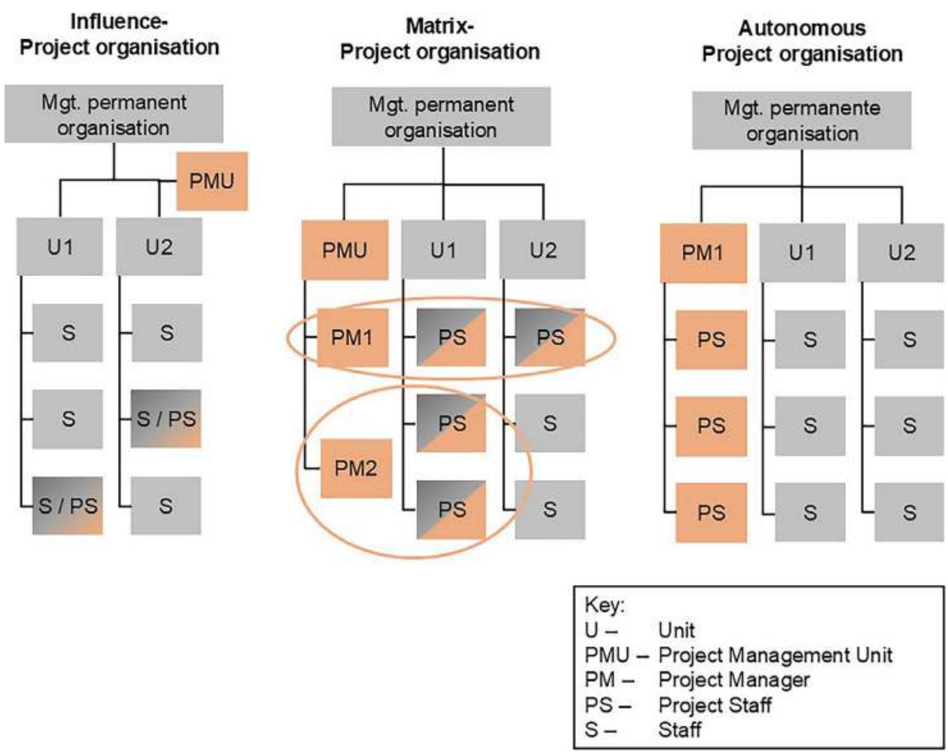
Even though they are two different types of organisations, due to the content and personnel interlocking, the project organisation must be integrated into the permanent organisation. The integration of a project into the permanent organisation can have different characteristics depending on the distribution of competencies (authorities) between the project and the permanent organisation (◘ Fig. 1.7).

Influence Project Organisation

In the influence project organisation, the project manager usually only has a coordination function, as he has no directive powers within the line. The project staff remain in the individual organisational units. This form of project integration can be implemented very quickly, as no organisational adjustment in the permanent organisation is necessary. However, due to the lack of powers, the project manager has little leadership and management options and is dependent on the leadership in the permanent organisation. The identification with the project is rather low for the employees. On the other hand, this form provides a good technical knowledge transfer. The knowledge transfer from a project management perspective is rather low. The project manager can also be located directly in an organisational unit in this form. In the extreme case, the



◘ **Fig. 1.7** Various integrations of the project into the permanent organisation project manager and all project staff come from one organisational unit.

Matrix Project Organisation

In the matrix project organisation, the project staff are technically subordinate to the project manager. The disciplinary responsibility remains in the permanent organisation. In this form of integration, the project staff have two superiors, the permanent manager and the project manager. This constellation can lead to conflicts between the permanent manager and the project manager, which sometimes goes at the expense of the employees. From an organisational structure perspective, the project staff also remain in the permanent organisation, so this form can also be implemented relatively quickly.

Autonomous Project Organisation

The autonomous project organisation represents the strongest reference to projects or is the most independent of the permanent organisation. Here, the project staff are technically and disciplinarily subordinate to the project manager. There is a clear assignment of project staff to a project, which results in a strong identification of the project staff with the project. However, setting up this form is more complex than with the other two forms. This organisational form is therefore only suitable for large projects.

Depending on the integration of the project into the structure of the permanent organisation, the project also has different communication and escalation paths. In addition, the different structures of the permanent organisation have effects on the roles of the various project participants, especially on the powers of the project manager. ◘ Table 1.6 summarises the three types of structures with their essential characteristics as well as advantages and disadvantages.

◘ **Table 1.6** Characteristics of the different types of structures

	Influence project organisation	**Matrix project organisation**	**Autonomous project organisation**
Integration of Project Manager	Mostly as a staff position outside of the OUs	PM usually in own OU, who temporarily assigns staff from other OUs	The project and the PM with his PS are integrated as their own OU into the organisation.
Distribution of Competencies	– Technical and disciplinary authority with the superiors of the PS in the OUs – PM usually only has coordination function	– PM has technical directive competence – disciplinary competence remains with the superior of the PS	Technical and disciplinary competence with the PM

(continued)

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Table 1.6 (continued)

	Influence project organisation	Matrix project organisation	Autonomous project organisation
Application of this Form	Small projects within an OU	Medium to large projects involving several OUs	– Large projects – Often with investment projects
Advantages	– No staff reassignments – Quick setup – Good technical knowledge transfer	– Clear regulation of overall responsibility – Flexibility in the utilisation of the staff	– High identification with the project – Clear regulation of overall responsibility – Full focus on the project – Simple communication and escalation paths
Disadvantages	– Limited influence of the project manager – Low identification of the project staff with the project – Long decision-making paths in case of escalations	Conflict potential due to two superiors	– Effort in setting up the project – Integration of the staff after project completion can be difficult

OU—Organisational Unit
PM—Project Manager
PS—Project Staff

1.2 Definition and Delineation of Project Management

Based on the various definitions of project management standards and other relevant sources, project management should be defined as follows:

Project Management

Project management encompasses the entirety of approaches, processes, methods, tools and templates as well as the competencies to successfully implement projects (based on AXELOS, 2017, p. 309; DIN, 2009c; IPMA, 2015, p. 36).

Single Project Management

This definition refers to so-called single project management, which refers to the management of a single project.

Multi-Project Management

In contrast, multi-project management has all or several projects of an organisation or an organisational unit in view and is defined here as follows.

Multi-Project Management

Multi-project management creates a structural and process-organisational framework for the management of several individual projects. Multi-project management can be organised in the form of programmes or portfolios. This includes in particular the coordination of several projects regarding the allocation of common resources to the individual projects (based on DIN, 2009c; ISO, 2012).

The following chapters (► Chaps. 2–5) refer to single project management. In ► Chap. 7 more detail is given on multi-project management. Understanding and applying multi-project management requires an understanding of single project management. When this book refers to project management, it refers, unless otherwise stated, to single project management.

Project management is structured according to various perspectives. ► Section 1.3 provides an overview of the different approaches and models in project management. Various standards have been established in project management (► Sect. 1.4). As with projects, project management can also be brought into a logical sequence through phases (► Sect. 1.5). Furthermore, project management takes up the constraints of the projects and provides methods, tools and templates in so-called project management elements (► Sect. 1.6).

1.3 Approaches and Procedure Models in Project Management

Before various approaches are introduced, the terms "approach" and "procedure model" should first be explained and delineated from each other.

Procedure Model

A procedure model is understood to be the description of project management based on structuring elements, functional elements, methods and tools as well as people-related topics (human). (In short: Structure, Function, Method and Human)

Procedure Model

The structure refers in particular to the sequence and structure of project management. The sequence can be structured into phases, processes, iterations, etc.

The functions reflect the topics that should be addressed within project management (e.g. content, time, cost, risk, etc.).

The methods include not only the actual methods, instruments, checklists templates.

The people-related topics include, among other things, the competencies of the project participants, cultural aspects, competence-building measures such as training, coaching, etc.

The topic of procedure models is further deepened in ► Sect. 5.4.

Not every procedure model must necessarily include all the elements mentioned such as phases, processes, iterations, methods, instruments, structures, checklists and templates. There are coarser and more detailed models.

In contrast to a procedure model, an approach is the much simplified form of a procedure model, which often only indicates the type of sequence (e.g. phase-oriented, i.e. traditional or iterative, i.e. agile). Alternatively to the term "approach", the term "procedure" is also often used.

Approach

It is not always easy to clearly distinguish between approaches and procedure models in project management, especially since both terms are often used synchronously in theory and practice. In this book, both terms are used based on their definition. Exceptions are made for already well-established terms, such as the waterfall model.

Phase

A phase in general is understood to be a temporally related section. A phase can be repetitive or one-time.

Process

A process includes defined activities and resources (means of deployment) that convert inputs into a result. Value creation takes place here. Processes are always recurring (ISO, 2000).

Both phases and processes are time-limited. The difference between a process and a phase is the value creation, i.e. the transformation of inputs (input) into results (output), which is attributed to a process, but not necessarily a phase, even though in practice most phases also experience value creation. In addition, phases are arranged sequentially and have no overlap, processes on the other hand can run sequentially, overlapping or in parallel.

Method

A method is a planned procedure for achieving a goal, i.e. the way in which a goal is achieved.

Instrument

The instrument is a concrete tool, i.e. a used means to achieve the goal. That is, assembly instructions for a cupboard is a method, the tools used, such as screwdriver and spirit level are instruments.

There are three basic approaches within project management:

- plan-based approach
- adaptive approach
- hybrid approach

The models most often mentioned in theory and used in practice are:
- sequential models,
- parallel/overlapping models,
- repeating/iterative models,
- agile models.

The first two models are clearly assigned to the *traditional approach*. Repeating/iterative models are found in both traditional and agile project management.

Traditional approach

The procedure models should not be considered in isolation and should not be categorically divided into good and bad. Rather, the appropriate model should be selected according to the type of project and project context. There can also be a mix of different models (e.g. from traditional and agile models). This is then referred to as hybrid project management (► Chap. 5).

1.3.1 Traditional Project Management

Traditional project management is characterised by an intensive planning phase in which the execution of the project is prepared as well as possible in advance (planning). In addition, they have Traditional project management models usually have a sequential or parallel process structure.

1.3.1.1 Sequential Process Models

■ Waterfall Model

Waterfall Model

This model describes a phase-oriented linear approach to project execution. In the waterfall model, the project is divided into different phases that are consistently executed sequentially. Strictly speaking, a project phase can only be started when the previous one is completed. However, unlike a real waterfall, it is possible to jump back to the previous phase if changes are necessary.

◘ Figure 1.8 schematically shows the logic of a project based on the waterfall model.

A well-known representative of this model in practice is the so-called Stage-Gate model, in which it is precisely defined in advance which results must be available in which quality so that the gate may be passed to start the next phase. Since quality is decisive here, we also speak of Quality Gates instead of Stage Gates.

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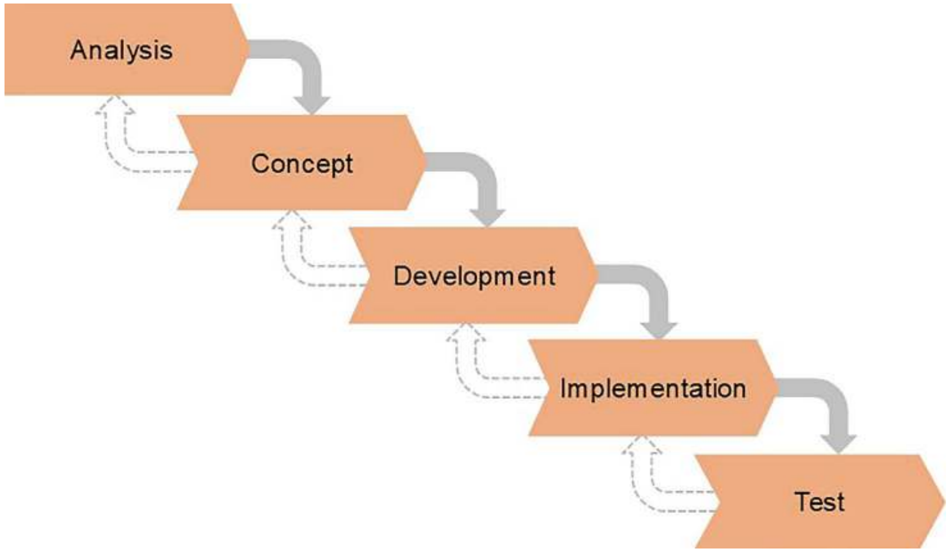


Fig. 1.8 Waterfall model

■ V-Model

V-Model

The V-model is a suitable approach for product development, where the project phases are arranged in a V-shape (**Fig. 1.9**). This shape has given the model its name.

In the left branch, the project deliverable to be created is planned top-down. The project phase *Customer request,* in which the customer requirements are determined and documented in a specification book, is started. The customer requirements are converted into technical functions in the next phase *System specification* as part of a requirement specification creation, which are then further detailed in the *System design*. The design of the individual components of the system is based on the system design. These are then implemented (Phase *Implementation*). The right branch describes the verification and validation of the implemented system. First, the components are tested and thus verified. The system design is checked by the *Integration test* before the system specification is verified in the *System test*. Finally, the deliverable is validated, which corresponds to acceptance by the customer. Therefore, at this point, we no longer speak of verification (proof that a certain requirement is met), but of validation, which refers to the fulfilment of the customer requirement as a whole.

1.3.1.2 Parallel/Overlapping Models

Parallel or overlapping process models are characterised by the abandonment of sequential phases or processes within the project. This means that phases or processes can already be

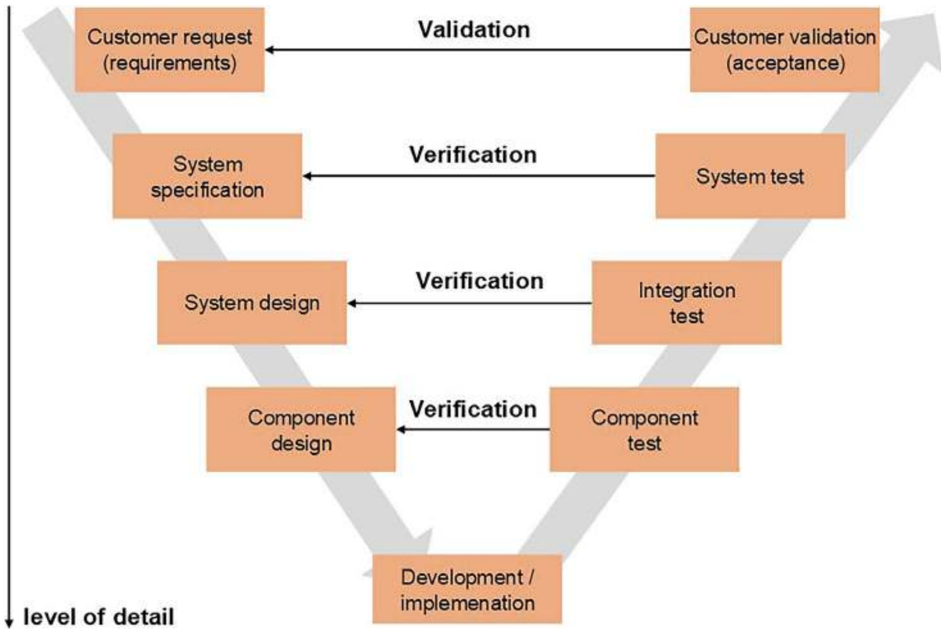


Fig. 1.9 V-model

handled earlier (overlapping) or even simultaneously (parallel) if sufficient information is available.

- **Simultaneous Engineering**

Simultaneous Engineering is the best-known methodology within the overlapping or parallel approaches. This approach is schematically represented in Fig. 1.10.

Simultaneous Engineering

The opportunity to generate time savings through parallelisation is offset by the risk of time losses or additional effort due to corrections in the parallel or overlapping phases. An important prerequisite for the opportunity being greater than the risk and thus generating a benefit compared to a serial processing is the presence of sufficient resources, especially personnel, as well as sufficient information and results from the previous phase or the upstream process.

1.3.1.3 Repetitive/Iterative Models

Repetitive or iterative project management approaches can be found in projects that have a high degree of repetition with similar sub-products, such as a roll-out project for several IT jobs in a company at various locations. In this case, the same steps are always taken for each workstation (requirements gathering, infrastructure provision, hardware and software installation, system testing). This type of repetitive/iterative models can be assigned to traditional project management.

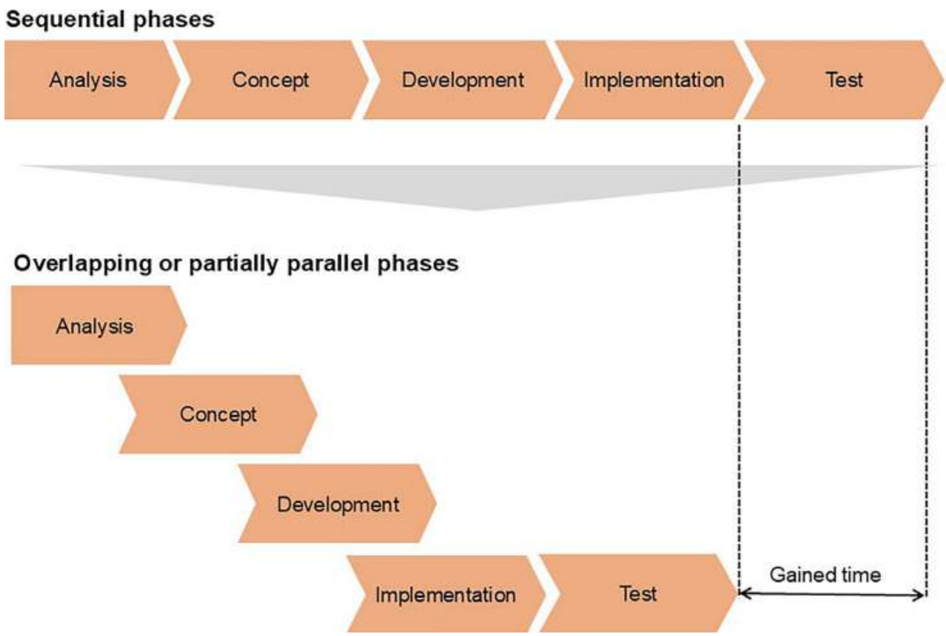


Fig. 1.10 Schematic representation of simultaneous engineering

Furthermore, this approach is chosen when the requirements for a project deliverable are not completely known and the development is carried out step by step for individual components of the entire project deliverable. This type of repetitive/iterative models can rather be attributed to the agile approach. The fundamental decision whether a project is carried out more traditionally or more agilely depends significantly on the possibility of complete planning before the implementation (traditional project management).

- **Incremental model**

Incremental model

The incremental model is a kind of step-by-step (incremental) approach to the product deliverable by creating parts of the whole, with the results of a partial deliverable (increment) always feeding into the creation of the next increment. This model is schematically represented in Fig. 1.11.

- **Spiral model**

Spiral model

In the spiral model, the cycles of goal definition, risk analysis and -minimisation, development and testing as well as planning of the next cycle are run through until the planned deliverable is satisfactorily achieved. This approach is illustrated in Fig. 1.12.

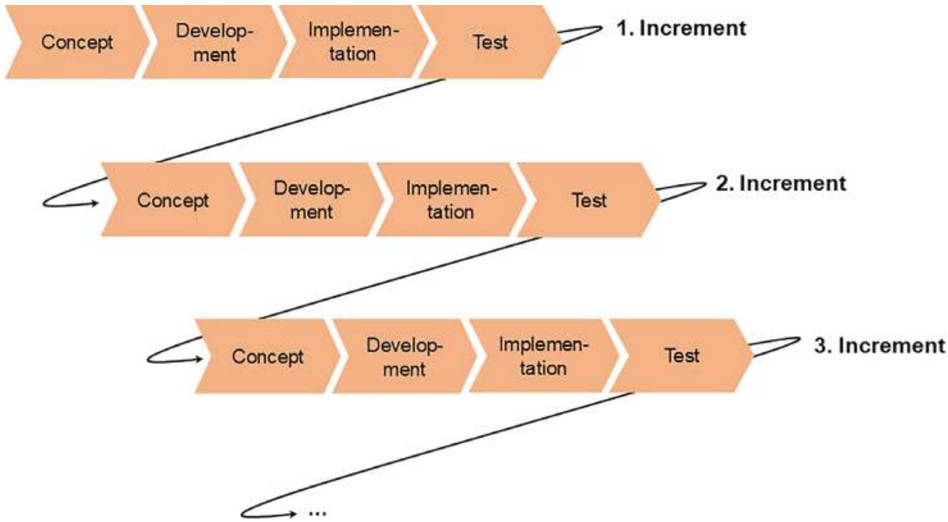


Fig. 1.11 Incremental approach

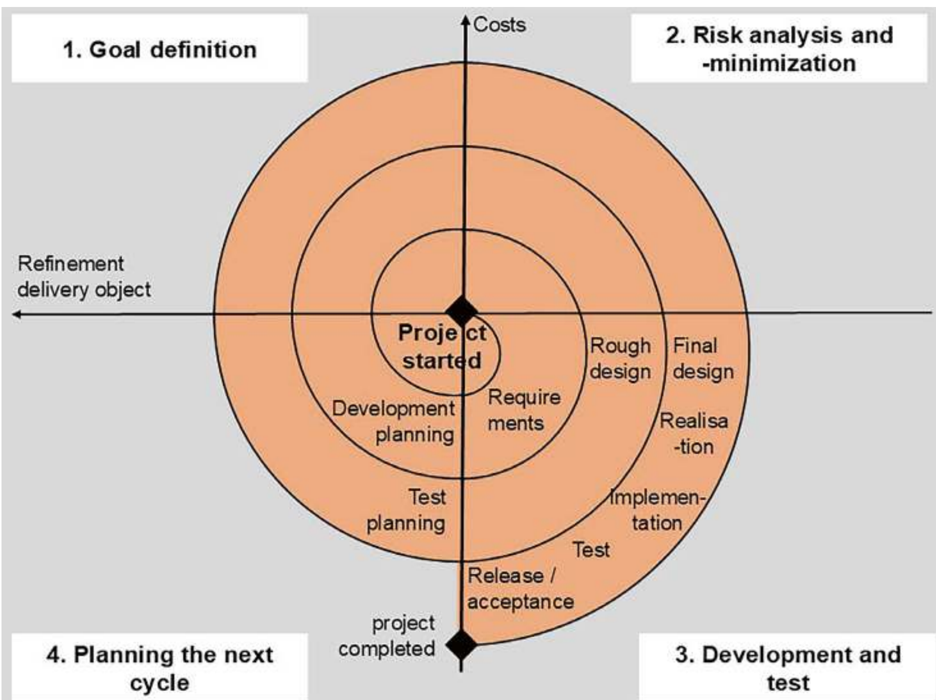


Fig. 1.12 Spiral model

1.3.2 Agile Project Management

Agile Project Management

Agile project management has become of significant importance in project management today. Against the backdrop of many unsuccessful projects, particularly in the IT environment, there was the development of new approaches to software development at the end of the last century. All approaches share the agile character. Agile here should be understood in the sense of *nimble* and *adaptable*.

The essential difference to traditional project management lies in the philosophy, the values and principles of agility. In contrast to traditional project management, in agile project management the project is not completely planned at the beginning and an attempt is made to adhere to this plan as well as possible, but instead, an iterative and adaptive approach is taken. Against this background are the repetitive/iterative models (▶ Sect. 1.3.1.3). Furthermore, it is the values and principles that make up agile project management.

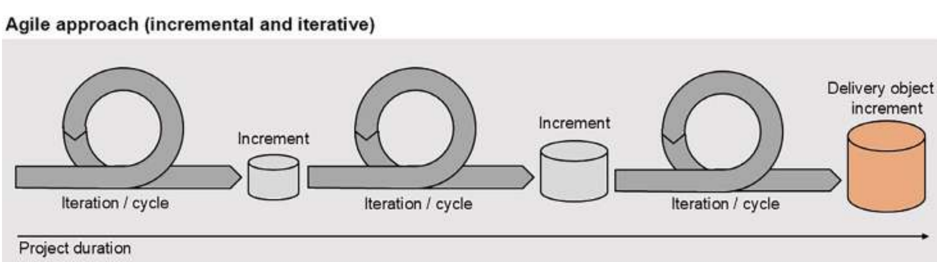
Agile project management is based on the Agile Manifesto for Software Development, developed in 2001, which is based on four values:

Agile Manifesto

- "Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan" (Beck et al., 2001).

Agile projects thus have a strong focus on people (stakeholders) and communication among each other. They put the result, which is worked out in close coordination with the customer, as well as opportunities for changes in the project in the foreground (◘ Fig. 1.13).

In practice, the agile methodologies Scrum, Kanban, Design Thinking as well as hybrid models, which often represent a combination of traditional and agile methodologies, are widespread.



◘ **Fig. 1.13** Agile project management

Due to the high importance of agile project management, in ► Chap. 4 goes into more detail on agile project management with its various approaches and special features.

1.3.3 Hybrid Project Management

Hybrid project management attempts to combine the best of various approaches from traditional and agile methods to deliver the most suitable approach for a project or a type of project. In addition to combining existing models, hybrid project management also develops individual approaches. How this works and what standard approaches and standard models exist in hybrid project management is explained in ► Chap. 5.

1.4 Standards of Project Management

Approach model

Standardisation is an important issue in project management. In terms of project management, standardisation means handling projects based on unified approach models.

As part of the standardisation of project management, a balance between rigid approach models and flexibility is important. On the one hand, due to the characteristics of a project as a unique undertaking, flexibility is required, as each project requires individual management. On the other hand, efficient and effective handling is also of great importance, as this is what determines the success of the project. Effectiveness and efficiency are achieved, among other things, through a certain degree of standardisation. This balance is a challenge for many organisations, i.e. the answer to the question: *How much standardised project management does the organisation need?*

The most important standards include:
- DIN 69901,
- IPMA Competence Baseline (ICB),
- Project Management Body of Knowledge (PMBOK),
- ISO 21500,
- Projects in Controlled Environments (PRINCE2),
- Scrum.

▪ DIN 69901

DIN 69901 is one of the most important project management standards in Germany. It is published by the German Institute for Standardisation (short DIN) and comprises five parts:
- DIN 69901-1: Basics,
- DIN 69901-2: Processes and process model,

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- DIN 69901-3: Methods,
- DIN 69901-4: Data, data model,
- DIN 69901-5: Terms.

DIN 69901

DIN 69901-2 contains a process model that links the five phases with the 11 process groups in a matrix with 59 processes (◘ Fig. 1.14).

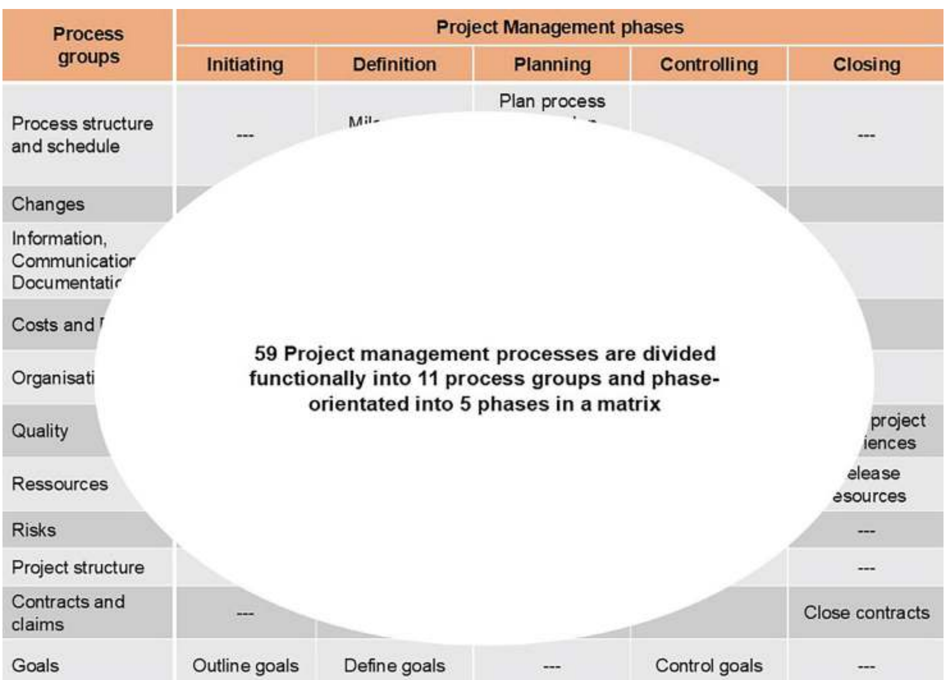
- **Individual Competence Baseline (ICB)**

Competence

The Individual Competence Baseline (ICB) in version 4.0 (short ICB4) of the International Project Management Association (IPMA) is a standard that focuses on the competences of individual persons in the field of project management. Competence includes knowledge, skills and abilities of a person to achieve a desired result (IPMA, 2015, p. 15).

Individual Competence Baseline (ICB)

DIN 69901 and the other standards mentioned below are more based on processes. This fundamentally distinguishes this standard from the other project management standards. The Individual Competence Baseline (ICB) distinguishes the three competence areas Context (Perspective), Person (People) and Technique (Practise) with a total of 29 competences.



Process groups	Project Management phases				
	Initiating	Definition	Planning	Controlling	Closing
Process structure and schedule	---	Mil-	Plan process		---
Changes					
Information, Communicatior Documentatic					
Costs and F					
Organisati					
Quality					project iences
Ressources					elease esources
Risks					---
Project structure					---
Contracts and claims	---				Close contracts
Goals	Outline goals	Define goals	---	Control goals	---

◘ **Fig. 1.14** Process model according to DIN 69901-2. (Source: Based on Timinger, 2017, p. 16)

This book repeatedly takes up the competence areas and individual competences at the appropriate place. Large parts of the competence area *Self-management and social competence* (People) are covered in ► Chap. 6 depicted.

The competencies are represented in the ICB4 for projects, programmes and portfolios and include a definition and description as well as the required knowledge and skills needed within the framework of a competency (◘ Fig. 1.15). In addition to the ICB, there is an OCB (Organisational Competence Baseline), which explains the project-oriented organisation, and a PEB (Project Excellence Baseline), which explains the assessment of the capabilities of organisations.

In addition, the IPMA offers certifications through its various national associations.[3] The person-related certifications are:

- IPMA Level D—Certified Project Management Professional (GPM): Basic certification for people working in projects,
- IPMA Level C—Certified Project Manager (GPM): Certification for project managers in limited complexity projects,

Competence Areas		
Perspective	**People**	**Practice**
1.1 Strategy	2.1 Self-reflection and self-management	3.1 Project design
1.2 Governance, structures and processes	2.2 Personal integrity and reliability	3.2 Requirements and objectives
1.3 Compliance, standards and regulations	2.3 Personal communication	3.3 Scope
1.4 Power and interest	2.4 Relationships and engagement	3.4 Time
1.5 Culture and values	2.5 Leadership	3.5 Organisation and information
	2.6 Teamwork	3.6 Quality
	2.7 Conflict and crisis	3.7 Finance
	2.8 Resourcefulness	3.8 Resources
	2.9 Negotiation	3.9 Procurement
	2.10 Results orientation	3.10 Plan and control
		3.11 Risk and opportunity
		3.12 Stakeholders
		3.13 Change and transformation
		3.14 Selection and balance (only for portfolio- and program management)

29 competence elements in 3 competence areas

◘ **Fig. 1.15** Competency model of the ICB4. (Source: IPMA, 2015)

3 In Germany through the Association for Project Management (Gesellschaft für Projektmanagement - GPM).

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- IPMA Level B—Certified Senior Project Manager (GPM): Certification for project managers in complex projects,
- IPMA Level A—Certified Project Director (GPM): Certification for managers of project portfolios.

■ Project Management Body of Knowledge (PMBOK)

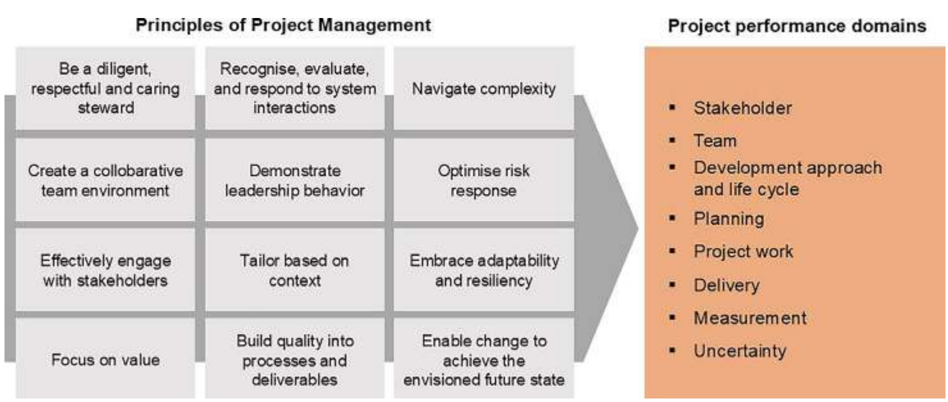
PMBOK

A Guide to the Project Management Body of Knowledge (PMBOK) is an American standard developed by the Project Management Institute in the 1980s (◘ Fig. 1.16). It is currently in its seventh version. It is used worldwide and is also a standard of the American National Standards Institute (ANSI).

It lists 12 principles that form the basis for effective project management. They emphasise, among other things, the importance of value for stakeholders, the continuous learning process, the focus on results and the adaptation to the project environment. The 12 principles form the basic values and orientation points for project management. The principles cover the following topics:

Principles according to PMBOK

- Conscientious, respectful and caring trustee
- Cooperative team environment
- Stakeholder involvement
- Focus on value
- Systemic view
- Leadership behaviour
- Adaptation to environment
- Focus on quality
- Dealing with complexity
- Risk management strategy
- Resilience
- Flexibility/Agility



◘ **Fig. 1.16** Model of the PMBOK

The 12 principles form the basis for eight performance domains, which represent the core competencies of a project manager. These domains include the aspects:

Performance domains of the PMBOK

- Stakeholder
- Team
- Development approach and lifecycle
- Planning
- Project work
- Delivery
- Measurement
- Uncertainty

By emphasising these performance domains, it is ensured that Project managers possess the necessary skills and knowledge to successfully plan, implement, and control projects. The 12 principles and 8 performance domains provide a clear framework for successful project management and contribute to making projects more efficient and effective.

The 7th edition focuses on an adaptive and agile approach, to meet the constant changes and challenges in the project landscape (see Project Management Institute, 2021).

The PMI also offers various certification opportunities for project management practitioners, such as the

- Certified Associate in Project Management (CAPM): Basic certification,
- Project Management Professional (PMP): Certification for project leaders,
- Program Management Professional (PgMP): Certification of programme leaders,
- Portfolio Management Professional (PfMP): Certification for portfolio managers.

ISO 21500

ISO 21500

ISO 21500 is a project management standard of the International Organization for Standardisation (short: ISO), which was published in 2012. ISO 21500 describes the typical terms of project management as well as the project management phases, here process groups (Process Groups), and competence areas, here subject groups (Subject Groups).

The process groups and the subject groups are based on the Project Management Body of Knowledge (PMBOK). ISO 21500 (Fig. 1.17) structures project management into five process groups and ten subject areas (Subject Groups), which form a matrix with 49 processes (ISO, 2012).

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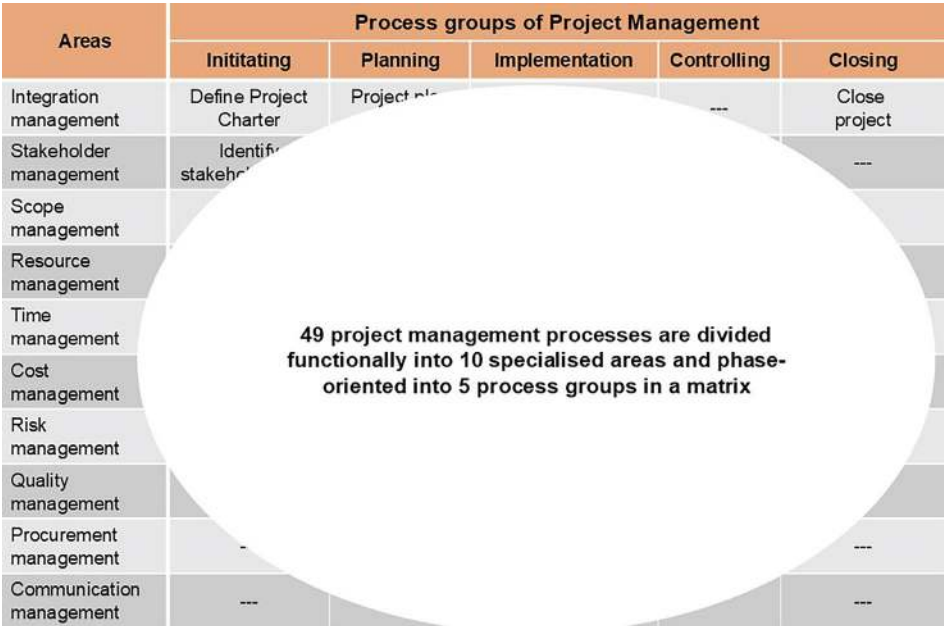


Fig. 1.17 Process model according to ISO 21500

PRINCE2

■ Projects in Controlled Environments (PRINCE2)

The standard Projects in Controlled Environments (PRINCE2) is based on seven basic principles, seven themes and seven processes. Originally published as a government standard for IT projects in 1989, PRINCE2 has also established itself worldwide and is independent of industry and project type due to the developments in 1996 and 2009. The standard is distributed by the British company Axelos Ltd.

The process model of PRINCE2 is spanned by at least four project management phases

- before the project,
- initiation phase,
- at least one subsequent management phase and
- the final phase

and three project levels,

- Directing,
- Managing and
- Delivering,

and contains seven process types:

- Preparing a project: Development of the business case to review the justification of a project;
- Directing a project: All activities of the project steering committee to control the project;

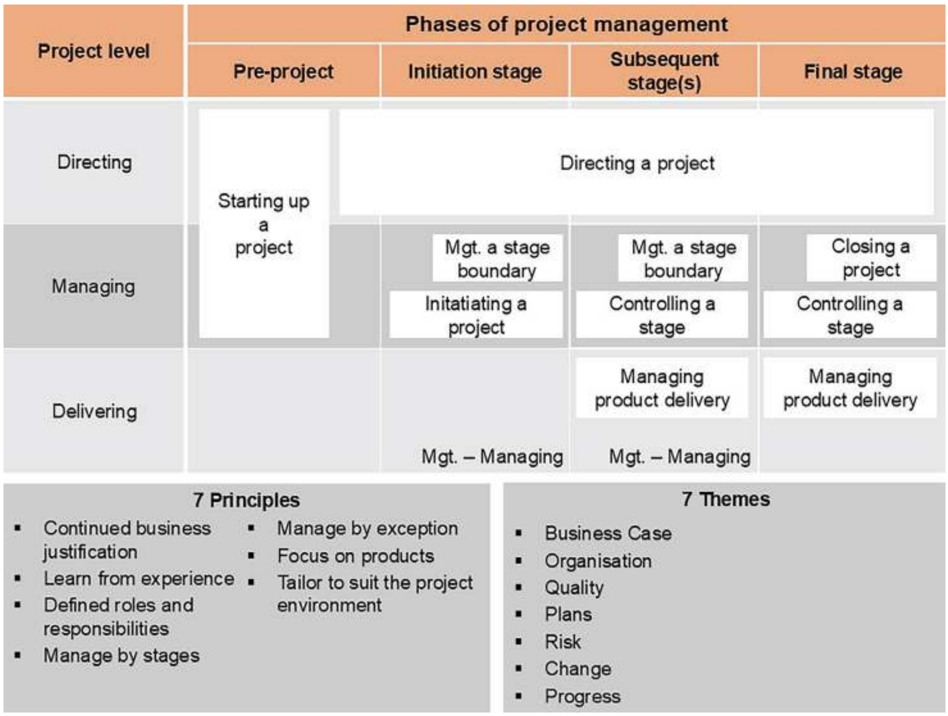


Fig. 1.18 Principles, themes and process model of PRINCE2

- Initiating a project: Definition and planning of the project at the project management level;
- Managing a phase transition: Preparation for acceptance of the current phase and preparation of the next phase incl. updating of the relevant plans and documents;
- Controlling a phase: All activities to monitor and initiate measures to achieve the project objectives;
- Closing a project: Preparing acceptances, handing over products, gathering knowledge;
- Managing product delivery: Execution of work packages, i.e. implementation of the project (AXELOS, 2017).

PRINCE2 is based on the principles mentioned in Fig. 1.18:
- Continued business justification
- Every business project should have a business reason, such as supporting a strategy, increasing profit, reducing costs, improving customer relationships. The reasons should be transparent and regularly reviewed. If a reason no longer exists, the project should also be terminated.
- Learning from experience
- Knowledge management is another principle in PRINCE2. Against this background, the knowledge and experiences

of the project should be secured at the end of a project and made available to other projects.

- Defined roles and responsibilities
- A professional project organisation requires clear roles and responsibilities. Therefore, roles and responsibilities need to be defined and made transparent.
- Managing by stages
- The PRINCE2 process model includes at least four project phases (before the project, initiation phase, at least one subsequent management phase and the final phase). The transition takes place as in a stage-gate model ► Sect. 1.3.1.1 by approval at the phase transitions by a project steering committee.
- Managing by exception
- Tolerances are defined for the project objectives at the beginning of the project. Only when these tolerance values are exceeded must escalation occur. Thus, the project manager has a certain scope for action and does not have to escalate with every deviation from the target.
- Product focus
- The project deliverable is called a product. The product is at the centre of the project and the entire project is to be aligned, i.e. planned and controlled, with it.
- Tailoring to suit the project environment
- The PRINCE2 approach can be adapted to any project environment. This makes PRINCE2 independent of the type of project (e.g. industry or project size).

Furthermore, PRINCE2 focuses on seven themes that can be compared with the process groups according to DIN 69901 or the knowledge areas according to PMBOK. The seven themes answer relevant *W-questions.* Some of these questions can already be found in the project constraints in ► Sect. 1.1.3.

The corresponding questions in PRINCE2 are:

- Business Case: Why?
- Organisation: Who?
- Quality: What?
- Plans: How?, How much?, When?
- Risks: What if?
- Changes: What are the impacts?
- Progress: Where are we?, How do we proceed?

There are three certification levels for PRINCE2:

- PRINCE2 Foundation: Basic certification,
- PRINCE2 Practitioner: Certification for people with Foundation certificate,
- PRINCE2 Professional: Certification for people with Practitioner certificate.

1.5 Project Management Phases

This book refers to project management phases when the project management is to be structured in time. Four phases are defined, which are often found in practice.

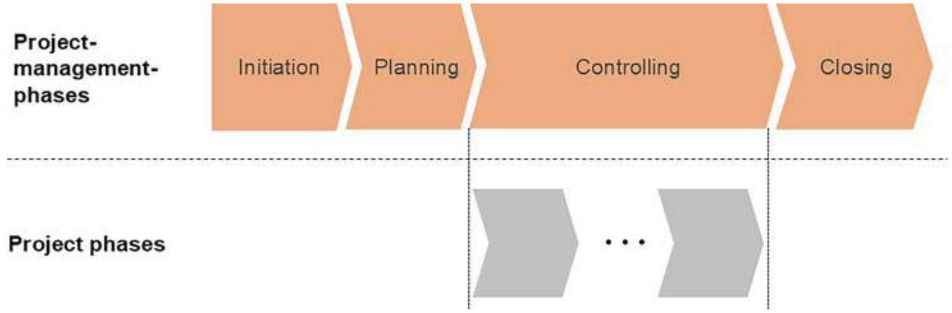
In contrast to the project phases, in which the value creation of the project takes place, i.e. the project deliverable is created, the project management phases refer to the management activities within the project. ◘ Figure 1.19 illustrates this distinction.

- **Initiation phase**

In the initiation phase, a project idea is evaluated in terms of feasibility, strategic importance, and project worthiness, and roughly estimated in terms of the essential project management elements, such as deliverable, times, costs, risks. The aim of this phase is to create a basis on which a go/no-go decision can be made and to lay the essential planning basis to officially start the project. The main result document of this phase is the project order. Generally, this phase ends with the official approval of the project. It makes sense to appoint the project manager at this stage.

- **Planning phase**

The planning phase includes all activities, methods, and tools necessary to create a solid project plan, which is the basis for project implementation. The project management elements described in ► Sect. 1.6 are planned. This requires a project core team, which is assembled in this phase and plans and controls the project together with the project manager. The planning phase usually ends with the completion and approval of the project plan.



◘ **Fig. 1.19** Relationship and distinction between project management phases and Project phases. (Source: Dechange & Friedrich, 2013, p. 104)

- **Controlling phase**

The controlling phase involves the monitoring and control of project execution. That is, in this phase, the plan created in the planning phase is compared to the actual situation. If there are deviations, measures are taken to get the project back on track, if necessary, the plan must be adjusted. Alternatively, this phase is also referred to as the steering phase. However, since the term *controlling* is more comprehensive than the term *steering,* this phase is referred to here as the *controlling phase.*

- **Closing phase**

In the closing phase, the final project documentation is created, a reflection of the project is made, and the project is administratively closed.

1.6 Project Management Elements

In addition to the temporal structuring of project management in phases, a functional structuring into project management elements can take place. The standards mentioned in ► Sect. 1.4 use different terminologies (process groups according to DIN 69901, competencies according to ICB, knowledge areas according to PMBOK, specialist groups according to ISO21500, topics according to PRINCE2). In this book, the neutral term *project management element* is used, which is a summary of the existing standards. The project management elements were essentially derived from the project constraints in ► Sect. 1.1.3. Specifically, these are the following project management elements (◘ Fig. 1.20):

- Project goals/deliverable,
- Work,
- Quality,
- Organisation and communication,
- Time,
- Resources and costs,
- Environment,
- Stakeholder,
- Risk.

Depending on the type of project, there may be additional elements (optional project management elements) that need to be considered. These are:

- Procurement management,
- Contract management,
- Change management,
- Project marketing.

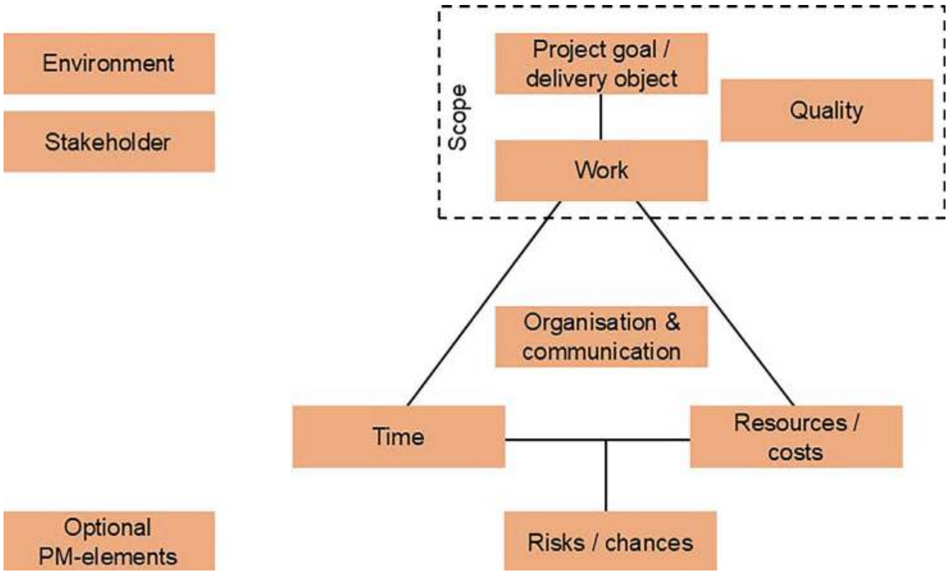


Fig. 1.20 Project management elements

As already mentioned, the deliverable and the work are summarised under the term *scope*. Quality can also be subsumed under the term *scope*, as was done in the presentation of the magic triangle (◘ Fig. 1.2).

In this book, all those processes of project management are used as a basis that can be represented in the matrix shown in ◘ Table 1.7.

The assignment of project management processes to project phases depends on the structure of the project management phases, the project management elements, and the perspective of the creator. Thus, different assignments with sometimes different terms can be found in different project management standards, different company standards, and different literature sources. However, the completeness of these processes is always crucial so that no project management activity is forgotten.

Importance of project management elements in traditional and agile areas

Furthermore, the project management elements are important in both traditional, agile and hybrid project management. The project phases refer to traditional project management and possibly, depending on the procedure model, to hybrid project management. In agile project management, the elements are managed iteratively (► Chap. 4).

The implementation of the project management processes shown in ◘ Table 1.7 is described in detail in ► Chaps. 2–5 with the relevant methods and tools.

1

Table 1.7 Processes of project management

Project management elements	Project management phases			
	Initiation	Planning	Controlling	Conclusion
Project goals/ Delivery object	Define project goals and delivery object	Validate project goals and refine if necessary If necessary define refined delivery objects	Monitor project goals and delivery objects and adjust if necessary	Evaluate degree of fulfillment of goals and delivery objects Lessons learned Goals and delivery object
Work	Define project phases	Create work breakdown structure	Monitor work breakdown structure and adjust if necessary	Evaluate work breakdown structure Lessons learned project structure
Organization/ Communication	Determine essential roles (min. PL, PAG) by name	Define project organization including communication	Manage employees Manage team Monitor project organization and communication , and adjust if necessary Carry out social controlling	Release employees Evaluate organization and communication Lessons learned organization and communication
Quality	Define essential quality requirements	Define quality characteristics and requirements	Controlling of quality characteristics and ensuring quality	Evaluate quality Lessons learned quality management
Time	Set milestones	Create a schedule	Monitor schedule and adjust if necessary	Final evaluation of time management Lessons learned time management
Resources/Costs	Determine project budget and, if necessary, internal expenses	Create resource and cost plan	Monitor resource and cost plan and adjust if necessary	Evaluate Resource and cost management Lessons learned resource and cost management
Elements of Project Management	Phases of Project Management			
	Initiation	Planning	Controlling	Conclusion
Environment	Identify key influencing factors of the business environment	Analyze factors influencing the business environment and take measures	Implement measures, monitor the factual environment, and adjust influencing factors if necessary	Evaluate resource and cost management Lessons learned resource and cost management
Stakeholder	Identify key stakeholders	Analyze stakeholders and derive measures	Implement and monitor measures, and adjust stakeholders if necessary	Evaluate stakeholder management Lessons learned stakeholder management
Risk	Identify key risks	Analyze risks /chances and derive measures	Implement and monitor measures, and adjust risks if necessary	Evaluate risk management Lessons learned risk management
Further elements as required: - Procurement management - Contract management - Claim management - Change management - Project marketing	Determining which elements are required for the project	Create corresponding subplans	Monitor subplans and adjust if necessary	Evaluate elements Lessons learned from the applied elements

1.7 Project Organisation and Roles of Project Management

As already shown in ► Sect. 1.1.6, there are various roles in project management that are temporarily structured in a project organisation.

Project roles

Role

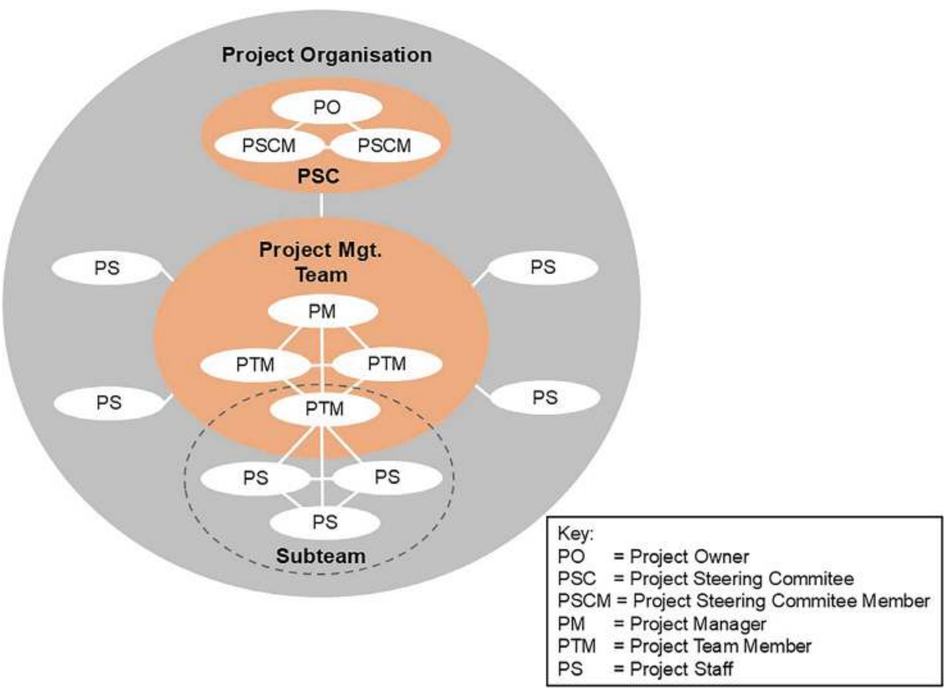
A role in project management is understood to be a temporary position of a person or a committee within or outside the project organisation, which is equipped with certain powers/competencies and responsibilities.

Roles are independent of persons, i.e. a person can, for example, perform several roles. Thus, in small projects, the project manager can simultaneously be the work package manager and project employee.

Roles are negotiated and determined on the basis of mutual expectations. In practice, however, there are often predefined role descriptions for recurring roles, such as the project manager, the project client, the steering committee (as a committee), etc. These can then be adapted in the project if necessary.

◘ Figure 1.21 shows the main roles of a project organisation.

The following briefly introduces the main roles. In ► Sect. 3.1.4 the individual roles are discussed in more detail.



◘ **Fig. 1.21** Project organisation with main roles

1

Project Steering Committee

- **Project Steering Committee**

The Project Steering Committee is a control and steering body for the entire project. Here, the objectives of the project are jointly determined and financial resources are released. All decisions leading to changes in the project constraints of goal, deliverable, time, cost and resources must be approved here. The Project Steering Committee is the final decision-making body in case of conflicts. It consists of the project client and the members of the Project Steering Committee.

- **Project Owner (or Project Sponsor)**

Project Owner

The project owner (sponsor) chairs the project steering committee and is primarily responsible for the project, from initiation to completion. In internal projects, they are often the project client or represent the end users and users of the project deliverable. The sponsor formulates and is responsible for the project goals in conjunction with the project steering committee. They are responsible for the overall acceptance of the project and are authorised to terminate the project.

- **Project Steering Committee Member**

Project Steering Committee Member

The project steering committee member is an individual of the project steering committee and usually from senior management. A project steering committee member should have a direct or indirect interest in the project.

- **The Project Manager**

Project Manager

The project manager is responsible for a successful execution of the project. They carry out all activities for planning, controlling and completing the project together with the project team and are operationally responsible for the successful implementation of the project within the objectives fixed in the project order. They have professional authority over the respective project team. The project manager is determined by the sponsor.

- **Project Management Team (or Project Core Team)**

Project Management Team

The project management team is responsible for project management. It consists of the project manager and the project team members.

- **Project Team Member**

Project Team Member

The members of the project management team plan and control sub-projects or work packages.

- **Subteam**

Subteam

A subteam works on a sub-project or a work package and consists of a project team member and the project workers.

- **Project Staff**

Project Staff

The project staff is responsible for the implementation of the deliverable and has no function within project management. Therefore, they are not a member of the project management team.

1.8 Critical Success Factors

The main challenges for project management today are in the areas of leadership, planning including goal management, dealing with complexity and uncertainties, communication as well as self- and social competence (cf. Dechange, 2016, p. 18).

Based on these challenges, the corresponding success factors can be derived, which are shown in ◘ Fig. 1.22.

Successful project management is based on the success factors mentioned in ◘ Fig. 1.22. This book describes the corresponding procedures, methods and tools as well as the required competences in the various chapters.

1.9 Summary

- **Basics of Project Management**
  - Projects can be characterised by various features—such as uniqueness, goal specifications, temporary character, financial restriction (project budget), project-specific and temporary organisation, social system, complexity, strategic importance and risky undertaking.
  - For efficiency reasons, tasks should be carried out according to their work form *(routine, project* or *process)*.
  - Knowledge of the project type (size, client, industry, project content, geography, repeatability and environ-

◘ **Fig. 1.22** Challenges and success factors of project management. (Source: Based on Dechange, 2016, p. 18)

ment) supports the selection of the project management approach model, including the selection of methods and tools.
- The essential Project constraints—such as reason, project objectives, project deliverables, work, time, resources, costs, organisation, communication, risks, environment and stakeholders—can be derived. The project constraints are planned and controlled within the framework of project management.
- The constraints of project objective, project deliverable, quality and work can be summarised into the *scope of performance* and, together with the constraint of *time* and *resources/costs*, form the so-called magic triangle.
- Project phases are project-specific and structure the project in its sequence.
- A project can be integrated into the organisation in different ways. The best-known are the influence project organisation, the matrix project organisation and the pure project organisation.
- Within the framework of project management, there is a single project management and a multi-project management view.
- The most important standards of project management are DIN 69901, ISO 21500, PMBOK, ICB and PRINCE2.
- Generally applied models in project management are within the framework of traditional project management the waterfall model, the V-model, Simultaneous Engineering, the incremental model and the spiral model. Within the framework of agile project management, they are Scrum, Kanban and Design Thinking.
- Project management can be divided into the phases *initiation, planning, controlling* and *closure* in a process-oriented manner.
- Project management can be divided functionally into the project management elements *project objectives/deliverable, work, organisation/communication, quality, time, resources/costs, environment, stakeholders* and *risk*.
- The project organisation consists of various roles, which are independent of individuals. The important roles in project management are the project steering committee, the project sponsor, the project steering committee member, the project manager, the project team, the project team member, the subteam and the project employee.
- The critical success factors in project management are *transparent and clear objectives, suitable project management models, appropriate handling of complexity and*

uncertainties, sufficient quality and quantity of personnel, modern leadership competence, high social competence and *good self-management.*

1.10 Review Questions

- Why is it important to determine the project worthiness, i.e. to state whether a project is actually a project? (Solution ► Sect. 1.1.1)
- On what criteria can one determine whether a project is a project and how can these be measured? (Solution ► Sect. 1.1.1)
- Why should projects be categorised, i.e. divided into project types? (Solution ► Sect. 1.1.2)
- Why is knowledge of project constraints important? (Solution ► Sect. 1.1.3)
- How can projects, programmes and portfolios be distinguished from each other? (Solution ► Sect. 1.1.5)
- How can projects be integrated into the permanent organisation? (Solution ► Sect. 1.1.6)
- What are the differences between the most important project management standards? (Solution ► Sect. 1.4)
- What general models are there in project management and what are the essential characteristics of each model? (Solution ► Sect. 1.3)
- What are the four phases of project management and what is the main task of each phase? (Solution ► Sect. 1.5)
- What structuring approaches are there in project management and how are they related? (Solution Answer ► Sects. 1.5 and 1.6)
- Why is it useful to structure project management? (Solution ► Sects. 1.5 and 1.6)
- Why can one speak of a magic triangle when considering the scope of performance (objectives/deliverable, quality and work), time and costs? (Solution ► Sect. 1.1.3)
- What are the key tasks and differences of the roles presented in ► Sect. 1.7 in the project? (Solution ► Sect. 1.7)

Project Initiation

Contents

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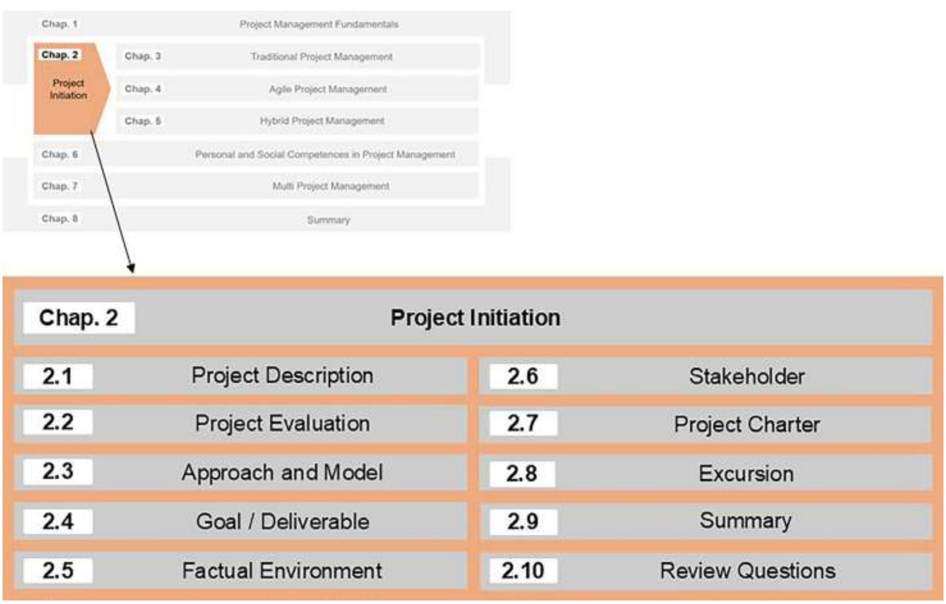
Learning objectives of this chapter

After reading this chapter ...

- you know the essential project management tasks and activities within the initiation phase.
- you know the different methods and tools of the initiation phase and can apply them.
- you know the process for determining the project management approach and the procedure model.
- you understand the importance of project goals and can structure goals.
- you understand the importance of the project environment and stakeholders and can describe these for a project.
- you can understand the structure of a project order.
- you can create a project order.
- you know the most important methods and tools of daily project work and can apply them.

The second chapter has the structure shown in ◘ Fig. 2.1.

The initiation phase is the first phase of project management. In the initiation phase, a project is first described, evaluated and partly roughly planned from various perspectives. Furthermore, the procedure model is determined. In most cases, a project is evaluated according to the following criteria:



◘ **Fig. 2.1** Structure Chap. 2

- the project worthiness, i.e.: Is the project actually a project? (► Sects. 1.1.1 and ► 2.2),
- the project type, i.e.: Which approach or which procedure model must be chosen to manage the project efficiently? (► Sects. 1.1.2 and 1.3)
- the strategy, i.e.: Does the project support the goals of the organisation? (► Sect. 2.2)
- the feasibility, i.e.: Is the project actually feasible? (► Sect. 2.2.4)

The management elements goals, stakeholders and factual environment are described in more detail in this chapter against the background of their importance in this phase.

The results of this assessment and description are in a so-called Project Application *(Project Brief, Project Specification, Project Charter)* documented (► Sect. 2.7). The conclusion of this phase is the approval or non-approval of the project application.

Since numerous operational tasks also have to be fulfilled within the framework of a project, essential methods and tools of daily project work are presented in a digression (► Sect. 2.8).

Christmas Party Ei-Ti AG—Introduction

Here we pick up our example project of the Christmas party from ► Sect. 1.1.4 again, present it in more detail now and continue it in the course of the next chapters.

Laura Leiter has just successfully completed her Master's in Project Management and started her new job at Ei-Ti AG a few weeks ago. Ei-Ti AG specialises in the development of IT solutions. The company has its headquarters in Berlin and two other locations in Germany (Dresden and Munich). In addition, there are two locations abroad, in Budapest (Hungary) and Helsinki (Finland). Laura Leiter is going through a trainee programme at Ei-Ti AG and is currently in the HR department. Due to her project management training, Laura Leiter has been given the task by her boss Paul Perso to plan and prepare this year's Christmas party.

In addition, the managing director of Ei-Ti AG, Gerd Genau, has noticed that Laura Leiter has completed a degree in project management and has expressed the wish to structure the existing methods and tools of project management, which were compiled for IT projects years ago in a folder, as part of the project and, if necessary, to document new methods and tools.

Furthermore, Gerd Genau, together with the sales manager Volker Verse and the marketing manager Martina Mark, has the idea to develop an employee app that should also be offered to other companies in the future. The app should include the following functions in a first step:

- Collect feedback on events,
- Graphical evaluation according to different functional areas,
- Company quiz with easy input of questions,
- Multilingualism,
- Communication platform for employees (messages, pictures etc.),
- Company information platform (e.g. company key figures employees, drinks & food, projects etc.).

Furthermore, Gerd Genau finally wants to establish agile project management at Ei-Ti AG. For this purpose, he also wants to start a pilot project with the help of Laura Leiter.

"The Pilot" should also be available for the Christmas party and be managed within the framework of the Christmas party project. Gerd Genau is willing to provide his own staff for this.

2.1 Project Description

First, the project[1] should be briefly described or presented in order to evaluate it afterwards. The project description also serves to create a common understanding of the project. For this purpose, methods and tools for description and structuring, such as the Project Canvas or the boundary and context analysis can be used.

2.1.1 Project Canvas

Project Canvas

The Project Canvas is a relatively young method or a young instrument. It has the following properties:

- Simple structure,
- Easily understandable language,
- Application in both agile and traditional project management (Frank Habermann, 2016).

1 At this point, it is not yet certain whether it is really a project. Against this background, the neutral term *venture* is used here instead of *project*.

Project Canvas for the project: ___			
Purpose	Delivery object	Quality	Budget
Milestones	Resources	Team	Risks and chances
Environment	Customer	Stakeholder	Date and authors
			Date: Authors:

Fig. 2.2 Example Project Canvas

Figure 2.2 shows the structure with the essential consideration elements of a Project Canvas.

The consideration elements of a Project Canvas are identical to the project management elements. Therefore, the individual fields are not discussed again.

2.1.2 Project Boundary and Context

Boundary and Context Analysis

A project can be considered as a social system (► Sect. 1.1.3). To describe social systems in general and as an analysis and structuring aid for projects in particular, a project is defined from a temporal, factual and social perspective and the context is described. This results in the following 6-field matrix, which is referred to as boundary and context analysis (Table 2.1).

Temporal boundary

The temporal boundary describes the start and end date. Some projects depend on events at the start and end in addition to the absolute start and end date. These are then important additions. For example, the development of a new sales software can only begin when the sales processes have been optimised in a preceding project. If the preceding project is delayed, the start date of the development project also shifts. Similarly, an end date can depend on an event whose date has not yet been determined.

Factual boundary

Within the factual boundary, the goals, possibly non-goals, the deliverable, the most important phases, possibly the main

Table 2.1 Boundary and context analysis based on Sterrer and Winkler (2009, p. 16)

	Temporal	**Factual**	**Social**
Boundary	**Start and end date**	**Goals, deliverable, phases, budget**	**Internal stakeholders/project organisation**
	– Start date and/or start event – End date and/or end event	Description of – Project goals, possibly non-goals, – Deliverable, – Project phases, – Possibly main components of the deliverable, – Possibly quality features, – Budget	Naming of the project organisation planned to date with project sponsor, project manager, possibly project team members
Context	**Pre- and post-project phase**	**Factual environment**	**External stakeholders/social environment**
	Identification and description of upstream and downstream projects or phases	Identification and description of the factual environment that has an influence on the project, such as – Strategies, – Standards and laws, – Other projects	Identification of external stakeholders, such as – Customers, – Suppliers, – Authorities, – Competitors

components and possibly the quality of the deliverable are described. In summary, the scope is roughly described here. In addition, the budget is set and/or the costs are roughly estimated within the factual boundary.

Social boundary

The social boundary defines the project organisation. At least the project sponsor and project manager should be identified. These roles exist in every project, they should be named. Other roles and people who are already known at this point are also represented in the social boundary. This allows a rough project organisation chart to be created. The social boundary corresponds to the internal stakeholders.

Temporal context

The temporal context describes any existing upstream and downstream projects or phases that influence the actual project and should therefore be taken into account.

Factual context

Everything that influences a project "from the outside" and does not happen directly through people is represented in the factual context. This includes, for example, strategies, laws, regulations and other projects. The factual context is therefore the factual environment.

Social context

The social context is the social environment, in other words the external stakeholders. As with the social demarcation (internal stakeholders), a rough analysis or assessment is made in this phase.

2

Overall, it can be stated for the demarcation and context analysis that it is a first rough, structured analysis or a structured assessment, on the basis of which the project can be approved and possibly prioritised. The results of the demarcation and context analysis flow into the project order (► Sect. 2.7).

Practical tip

Working techniques for creating a Project Canvas and project boundary and context analysis

In practice, it is recommended to create a Project Canvas or the boundary and context analysis together in the team that exists up to that point (possibly with the client). This creates a better common perspective and usually a higher commitment to the project.

Ei-Ti AG Christmas party—Project Canvas

Laura Leiter wants to use a Project Canvas for her project to create a common and structured overview of the project. She asks her client Paul Perso and the two potential project members Sabine Schein and Sven Soft to participate in the creation of a Project Canvas. For this purpose, Laura Leiter reserves a meeting room with a flipchart and a metaplan wall for about 90 min.

After about 60 min, in which a lot was discussed, the essential results have been worked out. They were recorded on a flipchart. Laura Leiter takes a photo of the flip and transfers the results to a table.

Project Canvas of the Christmas party at Ei-Ti AG			
Purpose	**Deliverable**	**Quality**	**Budget**
– Employee retention, improvement of corporate culture, appreciation of employees	– Deliverable: Christmas party and employee app – Not deliverable: Employee gifts	– Punctuality – Smooth process – At least good evaluation result in survey	– Budget: €75,000
Milestones	**Resources**	**Team**	**Risks and opportunities**

Project Canvas of the Christmas party at Ei-Ti AG			
– Start: 1.8. – End: after completion of the evaluation (approx. until 31.12.)	– Know-how of team members from past Christmas parties – Team room	– Project client: Paul Perso (Head of HR) – Project leader: Laura Leiter – Project team members: Sabine Schein, Sven Soft	– DJ missing due to illness – Employees missing Caterer is late
Environment and conditions	**Customer**	**Stakeholder**	**Creation Date and Authors**
– Regulation of monetary benefits – Restructuring project *Restruct* – all software development projects – Policy on handling personal data of Ei-Ti AG	Christmas party attendees, family members, business partners	– CFO Frank Findus – Marketing Manager Martina Mark – Caterer – DJ – Security company	Date: xx Authors: xx

Laura Leiter has also made the following notes:

Milestones

The start date has been set by the client based on the experiences of previous years.

The end date is fundamentally tied to the event evaluation created, but has also been set with the date 31.12. as the latest date.

Deliverable

Due to the wish of the managing director Gerd Genau, there are two deliverables in this project. In addition to the Christmas party, an employee app is also to be developed. Paul Perso is also excited about this idea, as it can increase employee satisfaction and strengthen the company culture. Furthermore, the competence and personnel are located in-house, so no additional personnel expenses are incurred.

Environment and framework conditions

A restructuring project, Restruct, is currently being carried out, which envisages organisational consolidation in

2

some areas. Although no employees are to be dismissed, the rumour mill is churning and some employees are very insecure.

Team:

- CFO Frank Findus,
- Marketing Manager Martina Mark.

During the initiation phase, a rough target planning is already carried out, which forms the starting basis for the deliverable. Against this background, the project management element *goals/deliverable* is presented in more detail in the following (► Sect. 2.4).

2.2 Project Evaluation

In a next step, the project is evaluated in terms of project worthiness, project type, economic significance and technical feasibility. The strategic importance of the project is estimated within the framework of multi-project management (► Chap. 7). In addition, the project management approach (traditional, agile or hybrid) and the procedure model are determined based on the project type and other criteria.

2.2.1 Project Worthiness Analysis

Once a project idea has emerged, it should first be evaluated what kind of project (line activity, project, process) it is. If the project is a project, the project type should then be determined in order to define a suitable project management approach (► Sect. 1.3).

Ei-Ti AG Christmas Party—Project Worthiness Analysis

Laura Leiter heard something about a project worthiness analysis in her studies and that it is important in the first step to determine whether a project is actually a project, so that the right procedure model including the corresponding methods and instruments can be selected.

The criteria of novelty, size (duration) and complexity (involved organisational units) are used for this at Ei-Ti AG.

Laura Leiter then checks the three criteria for the upcoming project:

- **Novelty:** Laura Leiter is not sure whether it is really a new project, because after all, there is a Christmas party every year. Therefore, she asks the experienced project manager Emil Expert how he assesses this criterion. Emil Expert explains to her that novelty does not only refer to the result, but also to the path to the result. The preparation of such a large party always has a different course in terms of the different goals as well as the various stakeholders and problems that arise. He explains to Laura Leiter that there are projects that have a repetitive character, but nevertheless fulfil the project characteristics due to the always different restrictions.

- **Size:** Regarding the duration, Laura Leiter knows that the preparation and planning of the last Christmas party took almost half a year. This long duration clearly indicates that it is a project. The Ei-Ti AG has set a minimum duration of 2 weeks, at which an undertaking can be classified as a project.
- **Complexity:** Laura Leiter has never planned such a large party. Nevertheless, she knows that caterers, DJ and technology are necessary participants at such a large party. In addition, the IT department is involved in the development of the employee app, another organisational unit at Ei-Ti AG. The criterion *complexity* is thus fulfilled.

All three criteria are therefore met: the undertaking is therefore a project.

2.2.2 Determination of Project Type

The project evaluation has a major influence on the choice of project management model and thus on the efficiency of project management.

Ei-Ti AG Christmas Party—Project Type

Emil Expert goes through the project types from ► Table 1.4 with Laura Leiter and they come to the following conclusion.

Project size

At Ei-Ti AG, the project size classes are defined as follows:

Criteria	Project Class A	Project Class B	Project Class C
Duration	>24 weeks	Between 8 and 24 weeks	Between 2 and 8 weeks

Criteria	**Project Class A**	**Project Class B**	**Project Class C**
Budget/Effort	>€200,000 or >100 PD	Between €20,000 and €200,000 or between 50 and 100 PD	Between €10,000 and €20,000 or between 20 and 50 PD
Number of project participants	>10 employees	Between 5 and 10 employees	Between 2 and 5 employees

PD—Project-days
Employees—Employees

Here, at least two criteria must be met in order to assign a project to a project class.

From last year, Laura Leiter knows that the Christmas party can be assigned to class A in terms of duration, but the budget and the number of project participants from last year indicate class B. Thus, the Christmas party is a class B project. As soon as she has planned the project costs and the number of project participants exactly, she wants to check the criteria again.

Project sponsor

The project sponsor is her boss Paul Perso, so it is an internal project. That is, Laura Leiter has no contractual relationships as a project supplier. It does not matter whether there are possibly external suppliers (e.g. for catering) in the project.

Industry

The industry depends on the project delivery object. This project is an event project for the pure Christmas party and the IT area (software development) for the employee app. Since Laura Leiter learned something about standard procedure models during her studies, she knows that the Christmas party as an event project should be managed traditionally and the app development is best managed according to an agile procedure model, such as Scrum.

Project content

The Christmas party has been responsibly handled in the HR department of Ei-Ti AG in recent years, but the marketing department has strongly supported the content. Laura Leiter and Emil Expert decide that it is a combination of Personnel and marketing project.

Geography

The project is managed at only one location (Berlin). Thus, it is a regional project.

Replicability

Although the project is new for Laura Leiter, there have already been numerous Christmas parties at Ei-Ti AG. Laura Leiter can use this fact by involving the project leaders and/or experts from previous years in the project or at least planning an exchange.

Environment

Since the project takes place within Ei-Ti AG, it is a business project.

2.2.3 Economic Evaluation

The economic evaluation is made by comparing the project costs and the expected project benefits, making a statement about whether the project is worthwhile from an economic and/or strategic point of view. This comparison is calculated using a cost-benefit representation or a so-called business case. A key feature of the cost-benefit representation is the comparison of the project's costs (e.g., for personnel or materials) and the expected quantitative benefits, i.e., cost savings or revenue increases. Usually, a cost-benefit calculation is presented over a certain period of several years and provides a statement on the profitability of a project.

Cost-Benefit Calculation

Ei-Ti AG Christmas Party—Business Case

Laura Leiter remembers from her studies how important the cost-benefit calculation is. So she goes to her colleague Sabine Schein, who also works in HR and was responsible for the Christmas party last year. She asks her how best to proceed and whether there is a cost-benefit calculation from last year. Sabine Schein just looks at her blankly and says that she didn't go to such lengths last year and no one asked her for a calculation. Sabine Schein asks Laura Leiter how she imagines the calculation of the benefit side. She doesn't know the answer to this either and asks the controlling department. A controlling employee explains to her that for some internal projects a quantitative benefit calculation, i.e., the calculation in monetary units, is not or only very difficult to achieve. This problem exists with projects that are carried out, for example, to improve the image or employee satisfaction. But the management also knows this and for such projects at Ei-Ti AG, no quantitative benefit needs to be calculated. Only a few qualitative benefit arguments should be collected. Laura Leiter thanks the controlling employee and sets about creating a cost-benefit representation. She received a template for this from controlling. Together with Sabine Schein, who still has the costs from the last Christmas party saved, and Emil Expert, who makes the estimate for the employee app, the three come up with the following cost-benefit consideration:

Costs		**Benefits**	
Material costs Christmas party (food, drinks, decoration and employee travel expenses)	approx. 50,000 €	Quantitative benefit Christmas party and employee app	Not possible
Material costs employee app (licenses)	approx. 20,000 €	Qualitative benefit Christmas party and employee app	– Increase in employee satisfaction – Development of corporate culture
External personnel costs Christmas party	approx. 5000 €		
External personnel costs employee app	–		
Internal personnel expenses Christmas party	approx. 50 person-days		
Internal personnel expenses employee app	approx. 60 person-days		
Total costs	**75,000 €**		
Total internal expenditure	**110 project-days**		

2.2.4 Technical/Substantive Evaluation

Feasibility study

In addition to the economic consideration, some projects, especially innovation projects or projects with new technical components, the evaluation of the professional, especially technical feasibility is of great importance. This is done in a so-called feasibility study (Eng. *Feasibility Study*).

For very complicated technical issues, the feasibility study can initially be handled in its own project. That is, here the professional or technical evaluation is not just "done on the side", but a project team is officially named, which deals with the feasibility within the framework of a project.

Ei-Ti AG Christmas party—Feasibility study

Laura Leiter does not need to worry about this, as she knows from conversations with Sabine Schein that although it was challenging to manage such a large party, the feasibility of a party is hardly a technically unsolvable task.

More interesting is the discussion with Sven Soft, a software developer and expert in the field. Sven Soft knows from experience that the development of an employee app has not yet been carried out in this form at Ei-Ti AG, but all competencies are in principle available at Ei-Ti AG.

Thus, Laura Leiter can forego a feasibility study after consultation with the client Paul Perso.

2.3 Project Management Approach and Procedure Model

The type of project (► Sect. 2.2.1) is one of several criteria to decide whether a project is conducted more traditionally, agilely or hybridly (project management approach). In addition, it must be determined how the project is specifically handled, i.e. the project management procedure model must be defined. The process for deciding on the project management approach and the procedure model is shown in ◘ Fig. 2.3.

In the first step, the project is described, for which different methods are available (► Sect. 2.1). Then the project is evaluated (step 2) to select the approach and possibly a standard procedure model in the third step. There are numerous alternatives available for the evaluation, which are described in ► Sect. 2.3.1. If it is not a standardised procedure model, a procedure model can optionally be developed in step 4.

► Chapter 5 further details the topic of procedure models and in particular the development of procedure models.

2.3.1 Models for Deciding on the Project Management Approach

Two well-known models for deciding on the appropriate project management approach are the Stacey Matrix and the

1. Project presentation	2. Project evaluation	3. Select approach and model	4. Optional: design process model
▪ Project Canvas ▪ Delimitation and context analysis ▪ Project profile ▪ Project charter ▪ etc.	▪ Standard models (Stacey Matrix, Cynefin etc.) ▪ List of criteria ▪ Suitability matrix / spider diagrams ▪ Experts judgement ▪ Experience / knowledge management ▪ etc.	a) Select approach: traditional, agile, hybrid b) Select standard model e.g. Waterfall according to PMI, Prince2, Scrum, company standard	If it is not a standard model or details are open, design of the four dimensions: ▪ Structure ▪ Function ▪ Method ▪ Person

Fig. 2.3 Project design process

Cynefin Model. Both models are described in the following sections.

2.3.1.1 Stacey Matrix

To get a fairly quick and simple estimate of the appropriate project management approach, the Stacey Matrix can be used. The two criteria "requirement" and "implementation" are assessed in relation to the project on a scale from "known" to "not known". The matrix is divided into the areas "simple", "complicated", "complex" and "chaotic", from which the project management approach can be read off according to the following logic:

- Simple = Traditional Project Management
- Complicated = Rather Traditional Project Management
- Complex = Hybrid Project Management or Agile Project Management
- Chaos = Special procedure models of agile project management (e.g. Design Thinking or Scrum with short sprint durations)

Figure 2.4. shows the Stacey Matrix.

2.3.1.2 Cynefin Model

The Cynefin model generally helps to categorise systems, situations or problems and to provide general solution approaches based on the category or domains. Since a project can be considered a social system (► Sect. 1.1, ► Table 1.1), the Cynefin model can also help in determining the project management approach.

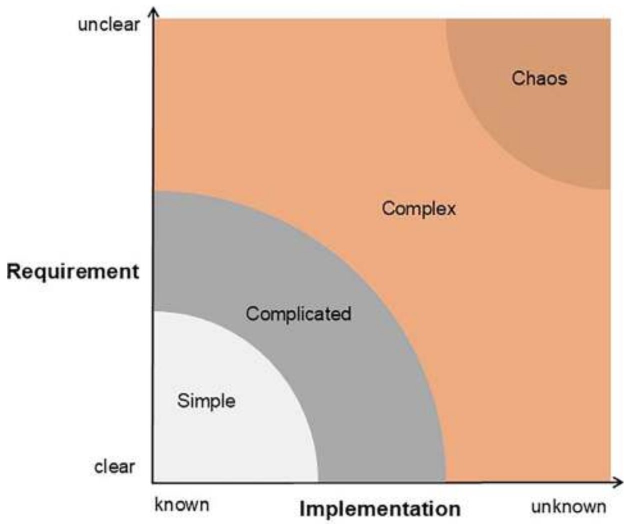


Fig. 2.4 Stacey matrix

Similar to the Stacey Matrix (► Sect. 2.3.1.1), the Cynefin model assigns projects to the domains Simple, Complicated, Complex, Chaotic or Unclear. The domains are divided into an unordered area (Complex and Chaotic) and into an ordered area (Complicated and Simple). Figure 2.5 graphically represents the model.

The model provides solution approaches in the form of action strategies. In Table 2.2, the five domains are briefly explained including examples from project management, the action strategies and possible methods of project management are presented.

2.3.1.3 Criteria

In addition to the two criteria used in the Stacey Matrix, familiarity with the requirements and the implementation, there are other criteria that can help in deciding whether to use a traditional, agile or hybrid approach.

The following criteria are used:

- Type of project in terms of project content (software project, investment project, construction project etc.),
  - Characteristics of the project deliverable:
  - Complexity,
  - Requirements known at the beginning of the project and stable during execution,
  - Possibility of producing increments,
  - Possibility of easy change of the deliverable or of partial deliverables (as in *paperwork, software development*),

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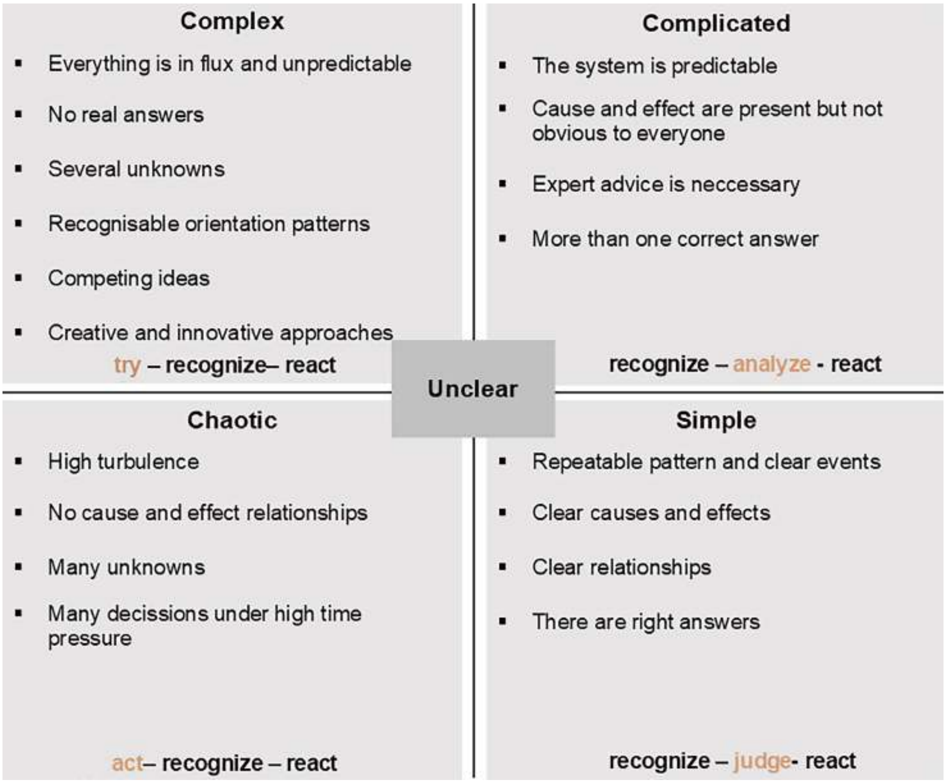


Fig. 2.5 Cynefin model

Table 2.2 Overview cynefin model

Domain	Explanation and Examples	Action Strategy	Project Management Methods
Simple	– Linear cause-effect relationship with few variables – Evaluation based on observation and experience – Prediction easily possible – Examples: Travel expense accounting, data entry, preparation of a workshop (projects with repetitive character), Simple construction projects (construction of several identical apartments)	Sense—Categorise—Respond through control approach and best practices	– Simple methods of project management – Checklists

(continued)

Table 2.2 (continued)

Domain	Explanation and Examples	Action Strategy	Project Management Methods
Complicated	– Cause-effect relationship with many variables – Evaluation based on analyses and expert knowledge – Prediction possible with effort – Example: Construction projects, Simple event projects, Development of hardware, Car manufacturing	Sense—Analyse—Respond through analysis techniques and experts	– Special methods of project management (e.g. network plans, Earned Value Methods) – Scenario techniques, – Expert sessions – Experienced project manager
Complex	– Ambiguous, non-linear cause-effect relationship with many variables – Description possible – Evaluation not possible – Prediction not possible – Examples: Large projects with many stakeholders, Innovation projects (New technologies), Development projects with unclear requirements and procedures	Try—Capture—React Through experimentation and iterative and incremental approaches	– Agile and hybrid approaches – Iterative approach – Incremental approach
Chaotic	– Ambiguous, non-linear cause-effect relationship with many changing variables – Description hardly possible – Evaluation not possible – Prediction not possible – Examples: Unpredictable projects like financial crises, pandemics	Act—Capture—React Through intuition, experience and quick action	– Prototype construction – Design Thinking – Very short iterations – PM experts with experience
Disrupted or Unclear	Uncertainty regarding the state (simple, complicated, complex or chaotic) of the project	Project analysis for assignment in one of the four above domains	– Expert knowledge – PM experts

- Type of project in terms of project size (small, medium, large project),
- Type of project in terms of regional spread (regional at one location, nationally distributed across several locations, internationally distributed across several time zones),
- Team size,
- Competence level of the team,
- Corporate and leadership culture in the organisation,
- Specifications of the client or customer,
- Legal, especially regulatory requirements for the project management,

- Requirements for reporting and project documentation,
- Workload of the employees (at least 50% in the project for Scrum).

The criteria can be weighted (Scoring Table or utility analysis (► Sect. 2.7) and graphically represented (e.g. network diagram).

Once the project management approach has been selected, the appropriate procedure model should be determined. Various standard models of traditional or agile project management are described in ► Chap. 3, "Traditional Project Management", and ► Chap. 4, "Agile Project Management". The combination of traditional and agile approaches or the combination of different standard models is described in ► Chap. 5, "Hybrid Project Management". In some cases it makes sense to develop an individual procedure model. The development or design of an individual procedure model is also described in ► Chap. 5.

2.4 Goal/Deliverable

Goals (objectives) describe desired future states (► Sect. 1.1.3). This should not be confused with the actual deliverable, which represents the result (material and immaterial output) of the project. The project goal is the starting point for describing the deliverable based on characteristics and requirements. For example, it is a goal that by the end of the year 1000 cars per hour can travel from point A to point B in 3 min (state). The deliverable is a bridge from A to B with an appropriate number of lanes to achieve the throughput of 1000 cars per hour. In practice, these two terms are often lumped together.

Goals also have other functions, which are described in ► Sect. 2.4.1.

2.4.1 Functions of Goals

Goal function

Goals fundamentally have different functions (◘ Table 2.3).

The reason for a project is also a goal at a higher organisational level. Often, companies have profit maximisation as the reason or trigger for projects (see also the example in ◘ Fig. 2.6).

Table 2.3 Functions of goals

Function	Description
Basis for planning and orientation	Classification of the project into a larger whole using a goals hierarchy (▶ Sect. 2.4.2). Goals clearly and concisely inform about essential characteristics of the deliverable and are the starting point for solid planning
Decision-making aid	Goals are the basis and support in prioritising alternatives as well as the point in time when a project is completed. A project is completed when the content-related project goals (deliverable finished) are achieved
Control function	As part of project controlling, the status of the project can be checked again and again using goals. Here, the goal indicate the target state, which is measured against the current state. Based on the comparison, control measures can be initiated. Goals are the basis for the final evaluation of a project (success/failure)
Coordination function	Through a goal hierarchy, the project can be structured and thus duplication of work can be avoided
Motivation function	The joint development of goals promotes team spirit (the we-feeling) as well as a result-oriented way of working

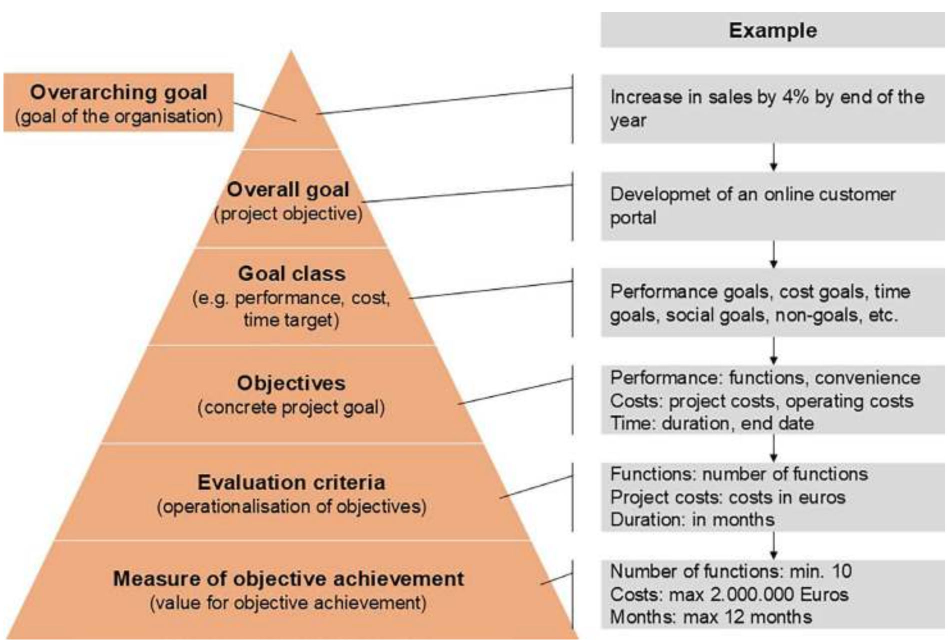


Fig. 2.6 Goal hierarchy

2.4.2 Goal Hierarchy and Goal Levels

Goal hierarchy

Goals can be defined at different levels. This is referred to as a goal hierarchy or goal pyramid. The goals of the lower level are derived from the goal of the higher level.

The overarching goal in ◘ Fig. 2.3 corresponds to the reason for the project (► Fig. 1.3).

Goals can be divided into the typical goal classes

- Performance goals,
- Cost goals,
- Time goals,
- Social goals (e.g. increasing employee satisfaction) and
- Non-goals

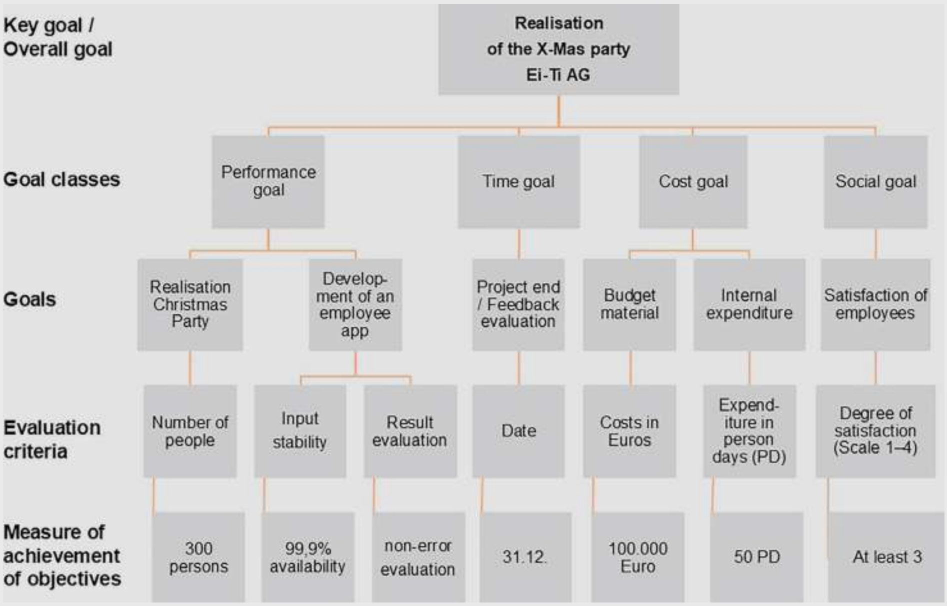
subdivide. Non-goals are states that should not be achieved by the project. This method is common in types of projects where it is important to describe things that should not be achieved. This is usually done from a contractual point of view, to exclude additional customer requests during the project.

Ei-Ti AG Christmas Party—Goal Hierarchy

Laura Leiter takes another look at the results of the delimitation and context analysis in the factual delimitation. Here she has identified the following goals in a first step together with her client and boss Paul Perso: Christmas party successfully held for all Ei-Ti AG employees.

Laura Leiter knows how important it is to break down the goals to the point where they are clearly measurable in the end. She asks Sabine Schein if she can support her based on her experience. Together, the two of them set the goal class *performance goals*.

Finally, Laura Leiter asks Paul Perso what criteria can be used to measure the project goals and when the project is considered successful. Paul Perso is thrilled with this overview and adds the missing information. This results in the following goal hierarchy for the project:



Goal hierarchy of the project *Christmas party at the Ei-Ti AG*

2.4.3 Goal Formulation and -Properties

In addition to the hierarchical dependency of the goals, there are other relationships between goals.

The following goal relationships should be mentioned:

Goal identity refers to identical goals. That is, if one goal is achieved, the other goal is automatically achieved as well.

Goal identity

In the case of goal complementarity, achieving one goal promotes the achievement of the other goal. In this case, goal 1 can either completely entail goal 2 or partially support it.

Goal complementarity

In the case of goal neutrality, the goals have no relationship to each other and therefore do not influence each other.

Goal neutrality

Goal competition means that one goal hinders the other goal, but does not completely exclude it.

Goal competition

Goal antinomy describes goals that mutually exclude each other. That is, if one goal is achieved, the other goal can no longer be achieved.

Goal antinomy

◘ Table 2.4 summarises the different relationships of goals, briefly describes the meaning and impact for the projects and gives an example for clarification.

One method of representing the goal relationships is the goal matrix, in which the goals are listed both horizontally and vertically and then for each *pair of goals* the relationships are represented. ◘ Figure 2.7 illustrates a goal matrix.

Table 2.4 Various relationships of goals

Relationship	Meaning for project management	Example
Goal identity	One goal can be neglected or deleted (redundancy)	Goal 1: The project costs must not exceed €100,000. Goal 2: The project budget must not be exceeded
Goal complementarity	If the project goals are prioritised, the dependency of goals plays a role	Goal 1: A swimming pool should be built in the garden. Goal 2: A garden shower should be built. Note: A common water connection should be laid
Goal neutrality	None	Goal 1: A swimming pool should be built in the garden. Goal 2: A sauna should be built in the house
Goal Competition	If the project goals are prioritised, the dependency of goals plays a role	Goal 1: A swimming pool should be built in the garden. Goal 2: A sun terrace should be designed in the garden. Note: In a small garden, one goal hinders the other in terms of size
Goal Antinomy	Since not all goals can be achieved here, the goal definition must be adjusted again	Goal 1: A swimming pool should be built in the garden. Goal 2: A natural garden without artificial elements should be designed

	Goal 1	Goal 2	Goal 3	Goal 4
Goal 1		=	0	+
Goal 2	=		!	0
Goal 3	0	–		0
Goal 4	+	0	0	

Legend:

=: goal identity

+: target complementarity

0: target neutrality

–: target competition

!: target antinomy

Note: work direction is line by line, i.e. the goals in column 1 work in direction of the goals in the header

Fig. 2.7 Goal matrix

With goal identity and goal neutrality, one can assume that the direction of the effect of goal 1 on goal 2 or goal 2 on goal 1 is equivalent. But with goal complementarity, goal competition and goal antinomy, the direction of effect (goal 1 on goal 2 or goal 2 on goal 1) can be significant.

SMART Rule

In practice, especially with smaller projects, the above-mentioned goal hierarchy is sometimes too complex. For this, there is the so-called SMART rule, which is a simple method for operationalising goals and also for checking the quality of goals.

The SMART rule stands for:

- **S** pecific: The goal is transparent, understandable and unambiguous.
- **M** easurable: The success of the project can be measured by a key figure.
- **A** ccepted: Both the client and project manager accept the goal.
- **R** ealistic: The goal is considered achievable.
- **T** imed: The goal has a set end date.

The agreement of SMART goals is an important step on the way to a successful project. The goals are set during the order clarification within the initiation phase. In the planning phase, the goals of the project order can be specified and detailed. As a result of the goal definition, there is a project goal catalogue.

In practice, defining and agreeing on goals often proves complicated. As part of traditional project management, it must be agreed at the very beginning of the project what characteristics and features (quality requirements, functionalities etc.) the project deliverable should have at the end of the project. This agreement is necessary in order to derive concrete work packages from the goals.

As already shown in ► Sect. 2.4.2, project goals do not only refer to the characteristics and properties of the deliverable, but also to quality, time and cost. If a goal meets the SMART rule, it already contains the time component.

The project goals should cover at least the following project management elements:

- Project deliverable,
- Time,
- Cost,
- Quality.

Ei-Ti AG Christmas Party—Goal Definition/Review of Goals with the SMART Rule

Laura Leiter checks the two performance goals of the project using the SMART rule:

SMART Rule for the Christmas party at Ei-Ti AG

Criteria	Goal 1: Conducting the Christmas party with at least 300 employees on 07.12	Goal 2: Development of an employee app with a 99.9% availability and a flawless evaluation of the feedback
Specific	Specific indication of the goal regarding the number of participating employees. It is not intended to further break down the target size of 300 employees, e.g. division into male and female participants.	Specific indication of the goal regarding availability and error-free evaluation.
Measur-able	By the numerical size of the number of participating employees.	The target is measurable by indicating availability and the error rate.
Accepted	Laura Leiter as project manager and Paul Perso as client have discussed and accepted the goals together.	This goal has also been accepted by the relevant stakeholders (project manager, client and IT).
Realistic	Based on the number of participants at the last Christmas parties (250 and 320), the target size of 300 employees is realistic.	An availability of 99.9% is realistic for mobile apps and the error-free evaluation is also considered realistic based on the experience of the IT department.
Time-bound	On 07.12.	On 07.12.

The two performance goals are thus SMART and therefore have a high target quality.

2.4.4 Process of Goal Management

Successful goal management should proceed in the following steps:

Goal management
1. Create transparency of the overarching goal (company goal) and the project rationale.
2. Derivation of the overall project goal (main goal):

3. Based on the company goal or the project rationale, there can be various project goals that support the overall goal, e.g. increasing customer satisfaction (company goal) can be achieved by improving the customer portal (overall goal possible project 1), by reducing prices (overall goal possible project 2), improving delivery processes (overall goal possible project 3) or introducing a discount system (overall goal possible project 4). Here, a cost-benefit analysis should be used in the initiation phase to determine which overall goal and thus which project the company decides on.
4. Structuring of goals into goal classes and goals (goal hierarchy).
5. Operationalisation of goals based on evaluation criteria (goal metric).
6. Review of goal relationships.
7. Goal controlling (monitoring and adjustment).

2.4.5 Deliverable

The deliverable is roughly described in the initiation phase. The depth of detail of the description depends heavily on the actual deliverable. If the deliverable is easy to understand, such as a concept paper, or if it has already been conceived in another project, the mention of the deliverable, possibly with a few new features or requirements, is sufficient to estimate the project sufficiently well in terms of costs and time and to make a go/no go decision. On the other hand, the estimation of a large construction project (skyscraper, bridge) or an innovative new software requires a more detailed description of the requirements, the features and thus a rough specification of the deliverable. This specification can cover a whole phase (specification) of the project or be carried out as an independent project.

The planning of the deliverable and the associated methods and instruments are discussed in ► Sect. 3.1.1.

2.5 Factual Environment

In the delimitation and context analysis, the factual environment is roughly examined to identify any existing *project stoppers*, i.e. framework conditions from the environment that make the project impossible or represent too great a risk. Identification is only an important, first step. In a next step, it

2

should be analysed what effects possible environmental influences have on the project.

The following parameters are important in order to assess the influences to categorise and identify appropriate measures on how to deal with these influences in the project:

- The **Name** refers to the factual environment that has an influence on the project.
- The criterion **Influence** roughly indicates the strength of the influence. In the simplest case, the scale *low, medium, high* can be used. Of course, a description should briefly present the influence.
- **Measures** are suggested on how to deal with the corresponding influence, which usually represents a problem or a risk. If it is a risk, this environment should be included in the risk list (► Sect. 3.1.10).
- There should be a **Responsible** person who takes care of the measures.
- The **Deadline** indicates by when the measure should be implemented.

The factual environment is most sensibly represented in a table, like ◘ Fig. 2.8, with the above parameters.

This table of the factual environment can be roughly created in the initiation phase, but should then be detailed in the subsequent planning phase. For example, the measures, responsibilities and deadlines can only be concretised in the planning phase. Because in the initiation phase, it is generally not yet known whether the project will be carried out at all.

Name	Influence	Measures	Responsibility	Date

◘ **Fig. 2.8** Tabular overview of the factual environment

Christmas party Ei-Ti AG—Overview of the factual environment

Based on the factual context of the delimitation and context analysis, Laura Leiter deepens the results with her future project team Sabine Schein and Sven Soft. The influence is particularly important in this phase, as decisive risks can already be derived here, which have an impact on the assessment and thus the approval of the project.

Tabular overview of the factual environment of the project *Christmas party at the Ei-Ti AG*

Name	Influence	Measures	Responsibility	Deadline
Regulation of monetary advantage	Influences the financing model	*Will be filled later in the planning phase*		
Restructuring project *Restruct*	Employees are insecure and in some departments negatively disposed towards the Ei-Ti AG			
Software development projects at the Ei-Ti AG	Can create resource bottlenecks if run in parallel			
Guideline for handling personal data of the Ei-Ti AG	Can stop the project or the function *employee database* if not applied correctly			

Laura Leiter wants to fill out the rest of the table only after official approval of the project.

The process of managing the factual environment is identical to the process of stakeholder management and is described in ► Sect. 2.6.

2.6 Stakeholder

Stakeholder

Other influences on the project are represented by individuals or groups of people, the so-called stakeholders.

In reference to the definitions of project management standards PMBOKs (2021, p. 550), DIN 69901, (DIN, 2009c, DIN) and PRINCE2 (AXELOS, 2017), stakeholders are defined as follows.

Stakeholder

Stakeholders are individuals or groups of people who can influence a project or are influenced by the project.

Stakeholders are involved in the project, interested in the project process or affected by the project's impacts.

One of the reasons why projects fail is the lack of understanding or the lack of inclusion of individuals and groups who can negatively influence a project.

Especially internal projects often cause changes in the organisation (e.g. introduction of new processes or systems, change of company structures, mergers and the integration of employees). These changes affect or—more clearly—hit individual employees or groups of employees. But also project staff, suppliers and customers have an interest in the project. All these individuals and groups are summarised under the term stakeholder.

Stakeholders have a justified interest in the success of the project. The influence of stakeholders on project success is often underestimated or neglected by project managers.

Depending on how the project is perceived by these individuals or groups, they can act as supporters or blockers. It is therefore advisable to build effective stakeholder management from the start of a project and to maintain it continuously throughout the project.

The management of the factual environment (► Sect. 2.5) and stakeholder management (► Sect. 2.6) can proceed in the following steps:

Procedure for managing the factual environment and stakeholders

1. **Identification of the factual environment and stakeholders**—This step should be carried out at the beginning of the project to identify so-called show stoppers, i.e. events that could stop a project or make it unfeasible, at an early stage.
2. **Analysis of the factual environment and stakeholders**—The analysis can be carried out using tables for the factual environment or stakeholders, as described.
3. **Planning and implementation of measures**—For each factual environment or stakeholder that poses a risk, at least one measure must be derived on how the risk can be

reduced or even completely avoided. This also includes determining a person responsible and a deadline for the implementation of the measures *(Who does what by when)*.

4. **Controlling of the factual environment and stakeholders**—Effective and efficient management of the factual environment and stakeholders is only possible if they are continuously monitored during the project execution and if necessary, new topics of the factual environment or stakeholders are identified, these are analysed and the existing measures are evaluated and if necessary, new measures are derived. In other words: Steps 1 to 3 are to be repeated in every controlling cycle.

The following presents the essential methods for stakeholder management.

In reference to the management of the factual environment (► Sect. 2.5), the following parameters are used to describe a stakeholder:

- Name of the stakeholder,
- Attitude towards the project,
- Influence on the project,
- Interests and needs,
- Possible behaviour,
- Measures,
- Responsibility,
- Deadline.

Thus, the parameters of the factual environment and the stakeholders are not completely identical.

Stakeholder Table

A typical stakeholder table looks as shown in ◘ Fig. 2.9.

Stakeholder Matrix

Using the stakeholder matrix (◘ Fig. 2.10), it can be clearly demonstrated which individuals and groups of people pose a threat to the project or from whom support can be expected.

To get a quick overview of the stakeholders and to categorise them, a so-called stakeholder matrix *(stakeholder portfolio, force field diagram)* is suitable. The stakeholder matrix is derived from the stakeholder table and is ultimately the graphical representation of the parameters stakeholder, attitude and influence. With the help of the stakeholder matrix, it is very quickly apparent who is a supporter and who is an opponent of the project and how high the corresponding influence is.

From the findings of the stakeholder analysis, suitable measures are derived to prevent possible conflicts and to be

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Stake-holder	Attitude	Influence	Need	Behavior	Measure	Responsibility	Date

Fig. 2.9 Stakeholder table

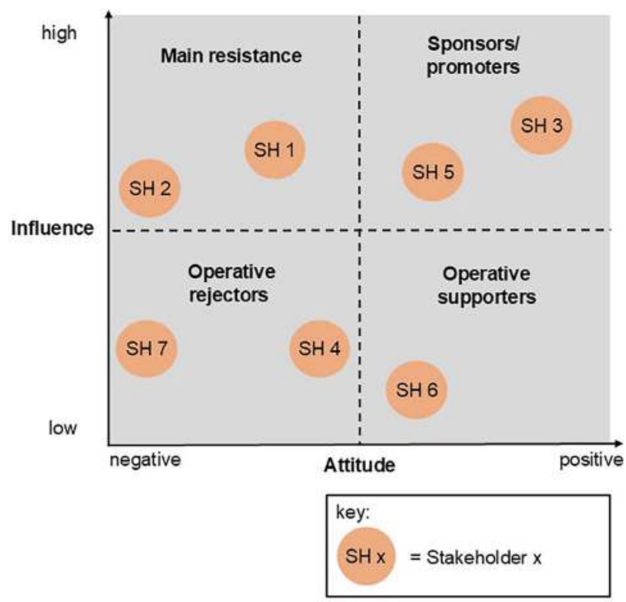


Fig. 2.10 Stakeholder matrix

able to use favourable constellations for the project. The planned measures are continued in the stakeholder table (Fig. 2.9). It also shows who is responsible for which measures and by when they should be implemented.

Practical tip

Stakeholder management

- Stakeholder management should be carried out together in the project team and not solely by the project manager.
- All steps of stakeholder management should be considered, including planning and implementing measures as well as controlling, which are often neglected in practice.
- Stakeholder management should be established and thus lived in a project organisation. However, it should not be presented as a dogma.
- The project organisation should be sensitised to the needs and interests of the stakeholders.
- The internal stakeholders, i.e. the own project organisation, should also be taken into account.
- Contact should be maintained with important stakeholders.
- If stakeholders are groups, it should be checked whether the group is homogeneous. Often, the categorisation of all employees of an organisation is of little use.
- The stakeholder analysis helps to understand and analyse the needs and interests of the stakeholders more concretely.

Ei-Ti AG Christmas party—Stakeholder list/table/register
After some discussion with her client Paul Perso, Laura Leiter and her team create the following stakeholder table. For the sake of completeness, she also includes herself and her client in the table:

2

Stakeholder	**Attitude**	**Influence**	**Measures**	Responsibility	By when
Laura Leiter (Project Manager)	Positive	Medium	*Will be filled in during the planning phase*		
Paul Perso (Head of HR)	Positive	High			
Gerd Genau (Managing Director)	Positive	High			
Frank Findus (CFO)	Neutral	High			
Martina Mark (Head of Marketing)	Negative	High			
Volker Verse (Head of Sales)	Neutral	High			
Sabine Schein (Project Team Member)	Neutral	Low			
Ina Itti (IT Manager)	Negative	High			
Sven Soft (Software Developer)	Positive	Medium			
Agile Development Team	Positive	Low			
Catering Manager	Neutral	Medium			
DJ Dodo	Positive	Medium			
Janitor Hans Hauser	Negative	Low			
Facility Manager Tommi Tekkus	Neutral	Medium			
Employees in Berlin	Neutral	Medium			
Employees in Dresden	Neutral	Medium			
Employees Abroad	Negative	Low			
Emil Expert	Positive	Medium			

Laura Leiter discusses the table with Paul Perso, to include the perspective of senior management. She met Emil Expert at a meeting as an expert in project management. Emil Expert offered to support her with any questions about project management in general and specifically at Ei-Ti AG.

Laura Leiter, like with the table of the factual environment, wants to fill out the rest of the table only after official approval of the project.

2.7 Project Charter

The project charter is ultimately the documented result of the initiation phase. The basis is provided by the Project Canvas or the boundary and context analysis. The results can be briefly and concisely recorded on one page (◘ Fig. 2.11).

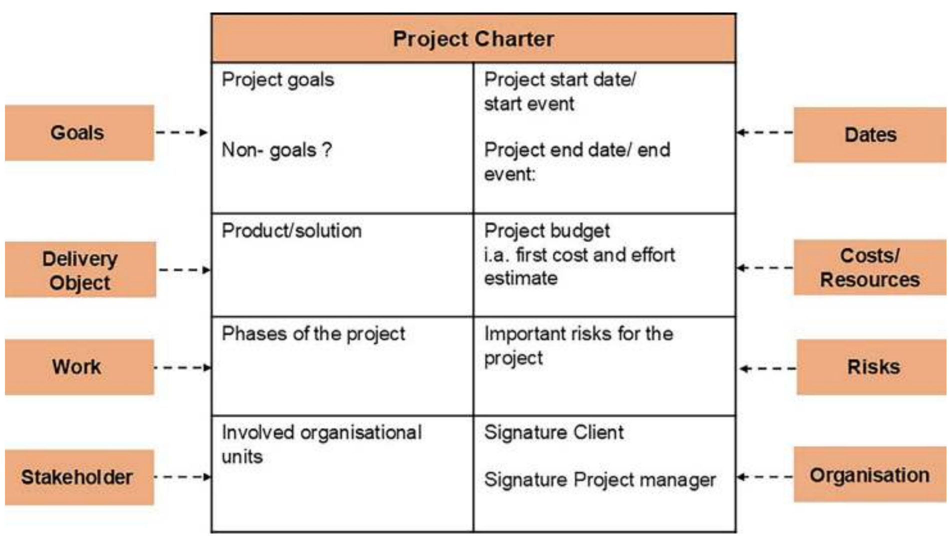
The project charter authorises the project with the signatures of the project client and project manager. Projects are usually approved by a management team based on the charter. Due to the limited budget for internal projects, an organisation must determine which projects are approved. Against this background, it is important to create a solid project charter with reliable information.

Ei-Ti AG Christmas Party—Project Charter

During her project management studies, Laura Leiter learned that many companies have developed a series of templates for important project management documents. She first asks her boss and client Paul Perso for a corresponding template for a project order. He tells her that all project management templates can be downloaded from the intranet under the category *Project Management Templates*.

Laura Leiter transfers the results of the boundary and context analysis and further discussions with the client Paul Perso into the Ei-Ti AG's project order template. The project order for the Christmas party looks like this:

Project Charter for the Ei-Ti AG Christmas Party



◘ **Fig. 2.11** Project charter with corresponding management elements

Project Order	
Project Name/No.: Ei-Ti AG Christmas Party/Project No. 4711	**Distribution:** CFO Frank Finance; see Stakeholders
Date: 15.03. this year	**Version:** 2.1
Project start: 01.08 this year	**Project end:** upon completion of the evaluation, at the latest 31.12. this year
Purpose: – Employee retention – Enhancement of team spirit – Strengthening of the IT culture – Thank you to the employees – Preservation of traditions – Company information	**Project goals:** – Organisation of a Christmas party with IT employees – Development of an employee app for evaluation and as an internal communication and information platform – Increase in employee satisfaction **Non-project goals:** – Communication strategy for the restructuring project
Deliverable(s): – Christmas party – Employee app	**Main tasks:** – Project management – Conceptualisation – Preparation – Implementation
Milestones – Project start: 01.08. this year – Entertainment programme commissioned: 01.10. this year – Project end: 21.12. this year	**Effort/Cost/Budget:** – Effort: 110 project-days (PD) – Budget: €55,000 for Christmas party and €20,000 for development of the employee app
Risks – Boredom among the guests – Feedback is not given – Employees do not participate – Poor planning and organisation	**Organisational units to be involved** – Human Resources (HR) – Marketing – IT development – Facility Management
Other agreements: – Company management must participate – Development of the employee app with Scrum	
Client's signature *Paul Perso*	**Project manager's signature** *Laura Leiter*

Paul Perso now submits this application to the executive board and asks for approval.

2.8 Excursion: Methods and Tools for Daily Project Work

At this point, some essential methods and tools are explained, which are important for daily project work. Here the term *project work* was deliberately used, as these methods and tools are not only of interest for project management and thus the

project manager with his management team, but for all those who are involved in projects in the broadest sense or have tasks to be completed, where something creative needs to be developed, analysed, structured, organised, evaluated and documented. Against this background, the methods and tools are divided into the following areas:
- Creativity,
- Survey methods,
- Structuring, analysis and presentation,
- Evaluation and decision.

2.8.1 Creativity

Creativity is becoming an increasingly important competence these days. Especially in project management, which is constantly confronted with new and often complex situations and problems, creative solutions are important.

The following basic rules should be observed with all creativity techniques to ensure that good ideas are not sorted out right from the start:
- All ideas and suggestions should be recorded and not discarded before the evaluation is completed.
- No evaluation or judgement of ideas in advance.
- Everyone should be able to express their opinion freely.
- You can build on the ideas of others.
- No “killer arguments” *(We’ve always done it this way)*.
- The more creative, the better.
- Especially during creativity sessions, ensure sufficient breaks and rest.
- Create a positive environment (room, climate, light, etc.).

The following creativity techniques are widespread:
- Brainstorming and brainwriting (card query),
- 6-3-5 method,
- 6 hats.

Brainstorming and brainwriting (card query)
1. Write down and present the task/question/problem at the beginning for everyone to see.
2. A) Brainstorming: Collection of ideas and thoughts to solve the task by shouting out (unstructured) or in turn. The suggestions are written down for everyone to see on the flipchart or similar.

3. B) Brainwriting: The suggestions are written by the participants on cards and then pinned by the moderator to a metaplan wall.
4. Clustering of results and removal of duplicates.
5. Make evaluation and selection (possibly also with scoring table ► Sect. 2.8.4, see also Andler, 2015, p. 133 ff.)

An alternative to brainwriting is the 6-3-5 method, which derives its name from the procedure. Six participants should each write three suggestions in 5 min on a sheet of paper. The method is particularly suitable for building on the ideas of other participants. The number of participants, the duration of the proposal finding as well as the number of proposals can of course be adjusted.

6-3-5 method

1. Write down and present the task/question/problem at the beginning for everyone to see.
2. Each participant writes three suggestions within 5 min on a sheet of paper.
3. The paper is passed to the next participant after the time has elapsed, so that each participant has the sheet of his neighbour has. Another round of suggestions is collected, with the suggestions of the neighbour should serve as a stimulus. As many rounds are carried out as participants participate in the method. In the original 6-3-5 method thus six rounds. It should be noted that in practice the duration can be reduced after a few rounds, as in most cases the number of ideas decreases with the number of rounds.
4. Make evaluation and selection (possibly also with scoring table ► Sect. 2.8.4, see also Andler, 2015, p. 137 ff.)

Another method that consciously promotes different perspectives on a task is the 6-hats method, which can also be used in other applications (e.g. feedback method). This method is not so much about generating as many suggestions as possible, but rather about ensuring a structured process in creativity finding. The following "hat phases" should be run through.

6-Hats

All participants go through the six phases of idea search one after the other. Participants go through within a predefined time frame:

1. White Hat: Collecting information in the context of the task.
2. Red Hat: Describing emotions related to the task.
3. Black Hat: Collecting objections.
4. Yellow Hat: Identifying positive aspects of the task.
5. Green Hat: Collecting solution proposals.
6. Blue Hat: Linking, sorting, evaluating and selecting ideas (Andler, 2015, p. 151).

2.8.2 Data Collection Methods

Especially in project business, it is always important to collect and compile data. The reasons for this are manifold, such as surveying the mood in the project team, collecting processes in a restructuring project, collecting perspectives in concept development, searching for weaknesses in project management.

The following data collection methods are available.

- **Reading**

Document Analysis

The simplest form of data collection is reading and analysing documents. This data collection method is also called document analysis.

- **Asking**

Questioning Techniques

The questioning technique is one of the most common forms of data collection. There are several ways of asking questions. A distinction is made between individual and group surveys. In individual surveys, only one person is interviewed. In group surveys, several people are interviewed at the same time. Another distinction is made in the choice of tools. Surveys can be conducted using a questionnaire or without any tools as an interview. The medium of the survey can also differ. Questions can be asked in person by the interviewer, by telephone over long distances, or online based on a questionnaire. The questionnaire itself can differ in the type of questions. As a rule, a distinction can be made between closed questions, which contain a predefined answer, and open questions, which do not contain a predefined answer. The choice of the most sensible questioning technique depends on the goal, the size of the group of respondents, the spatial distance and the effort of the survey.

2

Observing

■ **Observing**

Observing should be a core competency of the project manager. Especially to ascertain the moods in the team, observing is a useful method. This usually happens on the side. However, the observation methodology can also be the main activity in meetings or at the workplace when certain behaviours need to be recorded. However, one should proceed sensitively here and inform the group or person to be observed in advance and obtain their permission. Consultants and coaches often work with this data collection method.

Self-Recording

■ **Self-Recording**

In self-recording, selected employees are asked to write down their behaviour, feelings, thoughts, perspectives, results or their self-assessed performance as part of their work. Self-recording can be structured in the form of templates or unstructured. This form of data collection requires little effort in execution for the collector, but it is also subjective and susceptible to manipulation.

Working Out

■ **Working Out**

Results in surveys can also be worked out in groups or individually, e.g. weaknesses in project management can be identified together in the team in the form of workshops.

The choice of data collection method depends, among other things, on the goal, the data situation, the accuracy of the desired results, the group size, the spatial distribution of the participants, the effort to be made and the time available.

2.8.3 Structuring, Analysis and Presentation

The following methods and tools are particularly suitable for structuring, analysing and presenting ideas or topics:

- Mindmap,
- Ishikawa diagram,
- 5-W method,
- ABC analysis.

Mindmap

■ **Mindmap**

A mind map is a visualisation and structuring method. This was developed by Tony Buzan. Essentially, a mind map is a graphical tool that visualises thoughts and ideas (■ Fig. 2.12).

With the mind map, the central theme is written in the middle on a piece of paper, on a flip or whiteboard. Sub-themes then branch off from this theme (second level). The subthemes can be further branched (third and more levels). Mind

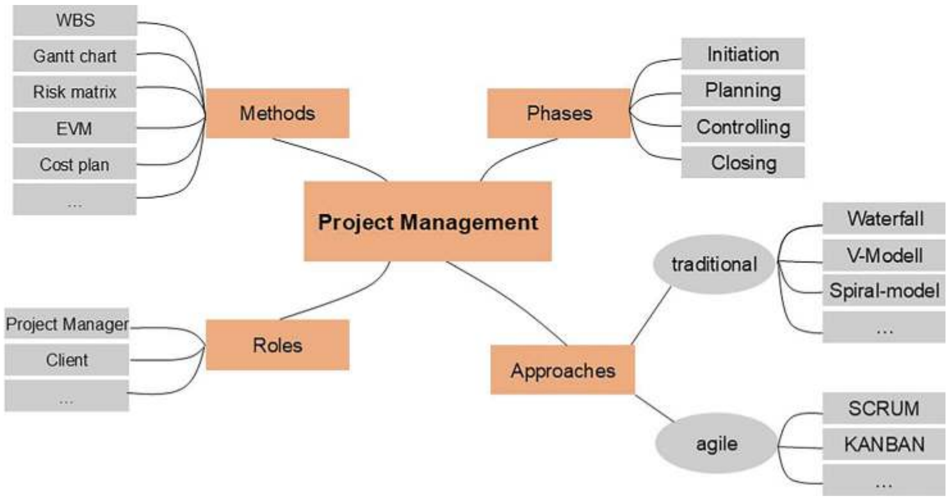


Fig. 2.12 Example mind map

maps can contain not only terms but also images. Essentially, there are no limits to the design of a mind map from a graphical point of view. The method itself ultimately thrives on this creativity.

Although the mind map methodology represents a creativity technique, it brings order to the thought process. Due to its methodology, it appeals to both creative, artistic as well as logical and structuring areas of the brain.

■ Ishikawa diagram

Ishikawa diagram

A similar approach to the mind map is provided by the so-called Ishikawa diagram, named after its inventor Kaoru Ishikawa. Alternative terms are *cause—effect—diagram* or *fishbone—diagram* (due to its structure). The method originally comes from quality management, but can also be applied in other areas (Fig. 2.13).

This method is used for structured cause research or problem solving. That is, possible causes or solutions are discussed, explored and then documented using the structure from the six areas of machine, man, environment, method, material and measurement for a problem or a general topic. As with the mind map, there can be branches to a topic in sub-topics. Since the six investigation areas all start with *M*, one must expand the terminology somewhat. Thus, the machine area stands for everything that is processed mechanically or electronically, including IT including software. The environment is the entire surroundings, i.e. in project management everything outside the project organisation. The material area should also be expanded to include the *electronic material,* i.e. the data. The

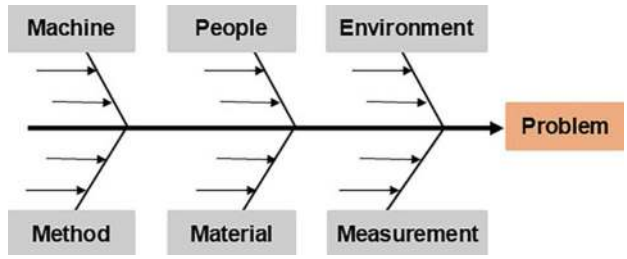


Fig. 2.13 Ishikawa diagram

aim is to subsume all possible causes for a problem or solutions for a topic under these six areas.

■ **5-W method**

5-W method

The 5-W method is also an analysis method to determine the reasons for a problem. In this case, the why question is asked five times to determine a cause. In practice, it does not have to be exactly five times, it may be that the cause has already been mentioned before—if necessary, the why question must be asked more than five times.

Ei-Ti AG Christmas party—5-W method

Laura Leiter wants to find out the reasons for the poorly received Christmas party last year. She asks Sabine Schein the following questions and receives the following answers:

1. Iteration
   - Laura Leiter: "Why was the Christmas party not well received last year?"
   - Sabine Schein: "Because the employees didn't have fun."

2. Iteration
   - Laura Leiter: "Why didn't the employees have fun?"
   - Sabine Schein: "Because the speeches were perceived as boring and took too long."

3. Iteration
   - Laura Leiter: "Why were the speeches perceived as boring and took too long?"
   - Sabine Schein: "Because the management talked almost only about the new has spoken about the foreign strategy and the planned speaking time was extended from one hour to two hours."

4. Iteration
    - Laura Leiter: “Why did management only talk about the new foreign strategy and extend the speaking time to two hours?”
    - Sabine Schein: “Because management considered the topic very important and there was no prior opinion poll. The time was exceeded because there was no moderator.”

After the fourth iteration, Laura Leiter stops asking questions, as it has become clear to her what could have caused the poor evaluation of last year’s Christmas party.

■ ABC Analysis

The ABC analysis is a method for determining priorities. Elements are divided into three categories according to their relative importance. This tool comes from business administration and originally divides customers, products or resources according to their value in connection with another parameter such as quantity. However, it can also be used more generally to classify elements according to qualitative or quantitative aspects.

ABC Analysis

- A—the most important elements. These elements have a very high importance and represent approximately 80% of the value.
- B—these elements represent approximately 15% of the value.
- C—these elements have the least importance and represent approximately 5% of the value.

In project management, for example, the importance of stakeholders can also be clustered using an ABC analysis.

2.8.4 Evaluation and Decision

Utility Analysis and Scoring Table

Often ideas, approaches, tasks, requirements etc. need not only be analysed and structured, but also evaluated and prioritised, and a selection made. For a quantitative evaluation of alternatives, the so-called utility analysis (method) is suitable, which is implemented using a so-called scoring table (instrument).

A utility analysis is carried out in several steps.

1. Goal description: First, it should be noted for which goal or task the utility analysis is used.
2. Listing and description of alternatives.

3. Selection of criteria for evaluation.
4. Optional: Weighting of criteria.
5. Operationalisation of criteria (evaluation scale, metrics).
6. Evaluation and calculation.

The steps are exemplified using the example "Selection of a location for the Christmas party".

2.9 Summary

■ **Initiation**

The initiation phase is carried out in the following steps, which do not necessarily have to be carried out one after the other:

- Project worthiness analysis.
- Project evaluation in terms of type, economic and strategic benefit (cost-benefit analysis) and, if necessary, technical feasibility (feasibility analysis).
- Determination and presentation of the essential project management elements, such as goals, deliverables, start-end date and budget, project phases, essential internal and external stakeholders, but at least the client and the project manager, important environmental influences.
- Defining a goal system is of particular importance in the initiation phase.
- A useful method for analysis and structuring is the delimitation and context analysis or/and a Project Canvas.
- The project order contains the essential results of the initiation phase and serves as a basis for decision-making as well as an official and binding start document for a project.

Ei-Ti AG Christmas Party—Utility Analysis for Location Selection

To select the location for their Christmas party, Laura Leiter and Sabine Schein apply the utility analysis:

1. Goal description: Selection of the standard for the Christmas party at Ei-Ti AG.
2. Listing and description of alternatives: Three alternatives: Berlin (headquarters), Berlin Festhalle, Budapest company headquarters.
3. Selection of criteria for evaluation: Cost, Christmas atmosphere, employee travel time, employee satisfaction.
4. Optional: Weighting of criteria (see table below).
5. Operationalisation of criteria (evaluation scale, metrics, see table below).
6. Evaluation and calculation (see table below).

Scoring table

Criterion	Weighting (%)	Berlin Headquarters		Berlin Festival Hall		Budapest	
		Value	Weighted Value	Value	Weighted Value	Value	Weighted Value
Cost	40	3	1.2	2	0.8	1	0.4
Atmosphere	30	1	0.3	2	0.6	3	0.9
Travel Time	30	3	0.9	3	0.9	1	0.3
Total	**100**	**7**	**2.4**	**7**	**2.3**	**5**	**1.6**

Operationalisation of criteria:
Cost: 3: <£20,000; 2: £20,000 < x < £30,000; 1: > £30,000
Atmosphere: 3: very good—good; 2: average (nothing special); 1: sufficient
Travel Time: 3: <1 h on average; 2: between 1 h and 3 h on average; 1: >3 h on average

Based on this overview, the choice for the Christmas party fell on the headquarters in Berlin.

This example clearly shows how essential the selection of criteria and the weighting factors ultimately are. Because if employee satisfaction had been chosen as a criterion instead of travel time, and the atmosphere had been rated higher, the result would be different.

■ Further Methods

Further methods for organisation and time planning are described in ► Sect. 6.1.4.

2.10 Review Questions

1. What is the purpose of the initiation phase and what are the main results of this phase? (*Solution* Chap. 2)
2. In what form can a feasibility study be conducted? (*Solution* ► Sect. 2.2.4)
3. What is the aim of a Project Canvas or a delimitation and context analysis and who carries it out? (*Solution* ► Sect. 2.1)
4. How are Project Canvas or delimitation and context analysis and project order related? (*Solution* ► Sects. 2.1 and 2.7)
5. What is the significance of the project order and why should it be in writing? (*Solution* ► Sect. 2.7)
6. Why should overarching goals be further broken down? (*Solution* ► Sect. 2.4)
7. Which project management elements are of interest in the initiation phase and in what form should these be present? (*Solution* Chap. 2)

Traditional Project Management

Contents

A. Dechange, *Project Management*, https://doi.org/10.1007/978-3-662-71462-1_3

3

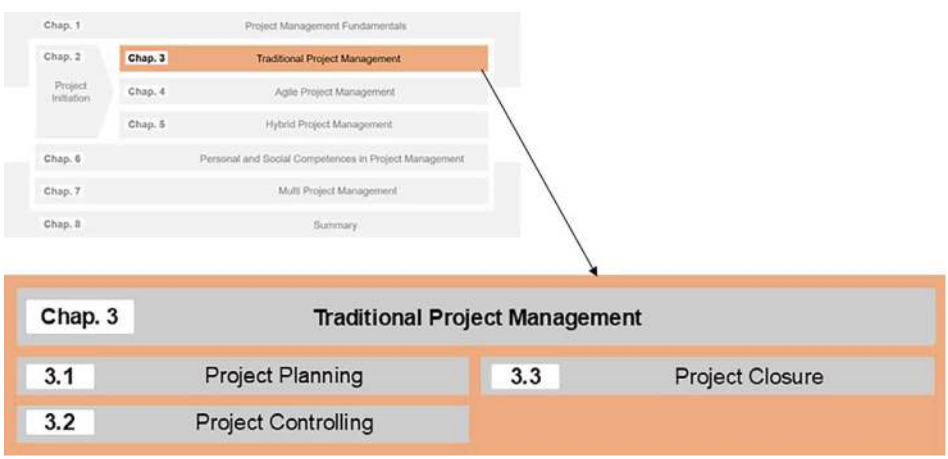
Learning objectives of this chapter

After reading this chapter ...

- you can describe the project management elements with their most important features.
- you know the different activities of the individual project management elements within the planning and controlling phase.
- you know the different methods and tools of the project management elements and can apply them.
- you understand the relationships between goal/result planning, work planning, time planning, cost and resource planning and can plan changes.
- you can create a project plan.
- you know the importance and tasks of project controlling.
- you can explain the relationship between project planning and project controlling.
- you are aware of the special importance of progress measurement, milestone trend analysis, earned value management as well as social controlling and can apply these methods.
- you are able to create a status report.
- you know the importance and process of Change Requests Management.
- you know the importance and tasks of project closure.

The third chapter has the structure shown in ◘ Fig. 3.1.

As already presented in ► Sect. 1.2, traditional project management includes the phases of planning, controlling and



◘ **Fig. 3.1** Structure Chap. 3

closure. These three phases are presented and explained in this chapter.

3.1 Project Planning

Planning in general refers to the systematic and future-oriented thinking through and setting of goals and measures for achieving these goals (based on Dillerup & Stoi, 2016).

The project management phase *Planning* aims at a holistic plan on the basis of which the project can be carried out. This phase thus includes all processes, activities, methods and tools to plan the various project management elements in such a way that they can be executed and controlled.

The structure of project planning is based on the functional perspective and thus aligned with the project management elements.

3.1.1 Project Goal/Deliverable

During the initiation phase, the project goal and the deliverable are described in such a way that an assessment of the future project is possible. In the planning phase, the goals and the deliverable should be described in such a way that the project can be planned with all its project management elements. This means that a more detailed knowledge of goals and deliverables is necessary in the planning phase.

Distinction: Planning at project management level and at project level

In the project management phase *Planning*, the deliverable is to be described in such a way that the work, effort, deadlines, project organisation, required resources, costs and risks for the creation of the deliverable can be estimated. However, it is not necessary to plan the entire deliverable in this project management phase. Therefore, this is referred to as *project planning*.

The detailed planning of the deliverable in terms of value creation, i.e. as preparation for creation, takes place at project level in a separate project phase or work package. Depending on the type of project, this is then referred to as conception, design, specification or, in the construction sector, planning. Here one can speak of *deliverable planning* or *result planning*.

Planning Project Goal

The planning of the project goals has already been described in detail in ► Sect. 2.4. As part of the project planning, the goals can be revised and/or refined as needed.

Planning Deliverable

The planning of the deliverable at project management level is usually based on a delivery object plan. This plan can be presented in the form of an object breakdown structure, a requirement catalogue or a specification sheet.

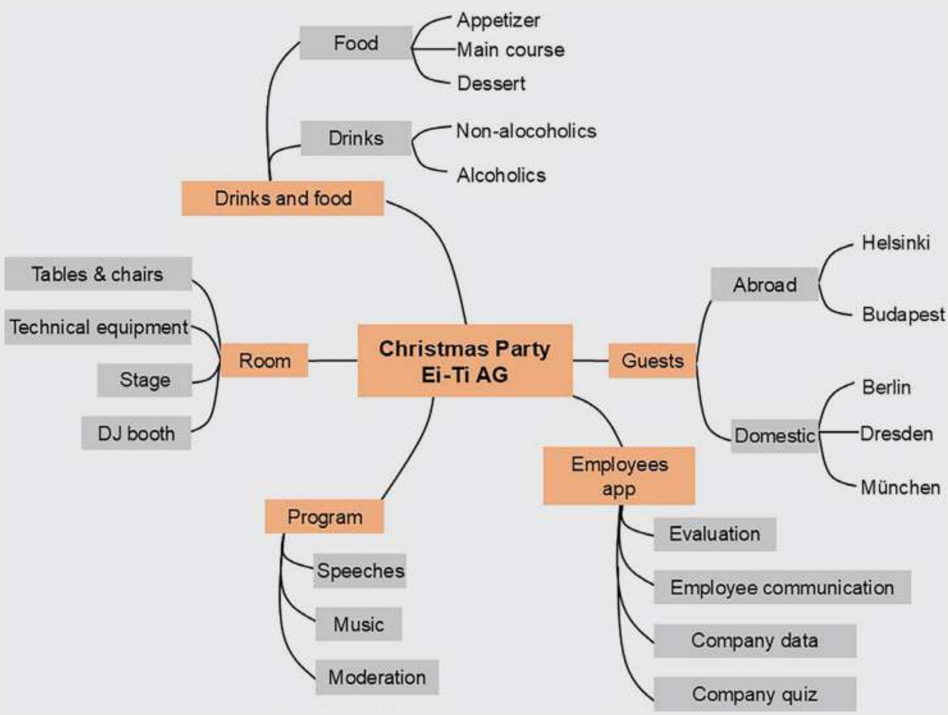
Delivery object plan

The formulation, management and controlling of requirements is called requirement management (engl. Requirements Engineering) (cf. Timinger, 2015, p. 95 ff.). A specification sheet is the detailed description of the requirements for a deliverable and goes beyond a requirement catalogue.

The consideration and structuring of the deliverable into its components (objects) can be done with different tools. Tree structures (as in the work breakdown structure in ◘ Fig. 3.3), tables or mind maps are often used.

Ei-Ti AG Christmas Party—Delivery object plan and Object breakdown structure

Laura Leiter is considering which method and tool she can best use to structure and represent the deliverable (the Christmas party) with its components. A simple representation of the object structure of the Christmas party is a mind map, which is sufficient for this deliverable. Since Sabine Schein from her project team has more experience in planning and conducting Christmas parties, Laura Leiter creates the following object breakdown structure in the form of a mind map together with her.



◘ Object breakdown structure of the Christmas party at Ei-Ti AG

For innovative projects, it is sometimes useful to develop the deliverable using creativity techniques (► Sect. 2.8.1).

The deliverable planning should be done depending on the type and complexity of the deliverable with the appropriate method or tool (e.g. requirement catalogue, specification sheet, object breakdown structure).

The exact design of the deliverable (detailed planning) can take different forms depending on the type of project, e.g. in the form of a specification sheet (IT), a construction plan (construction), a design drawing (plant construction), a concept (strategy, organisation, personnel) or a description (process management). The design is part of the project implementation and does not belong to the project management processes or activities. Against this background, it is not further deepened in this book.

There are types of projects, especially software development projects, where the requirements only emerge during the course of the project. Therefore, the in ► Sect. 1.3.2 described agile project management methods are so successful because they involve an incremental and iterative approach.

3.1.2 Quality

First, the terms *quality* and *quality management* are defined and then related to project management.

In accordance with DIN EN ISO 9000, quality and quality management are defined as follows (ISO, 2000).

Quality

Quality is the degree of conformity of elements (objects, products, services, procedural models, processes) with the requirements.

In project business, the requirements are set by the customers (stakeholder group). The customers can be internal customers of an organisation or external customers (outside the organisation).

Quality management

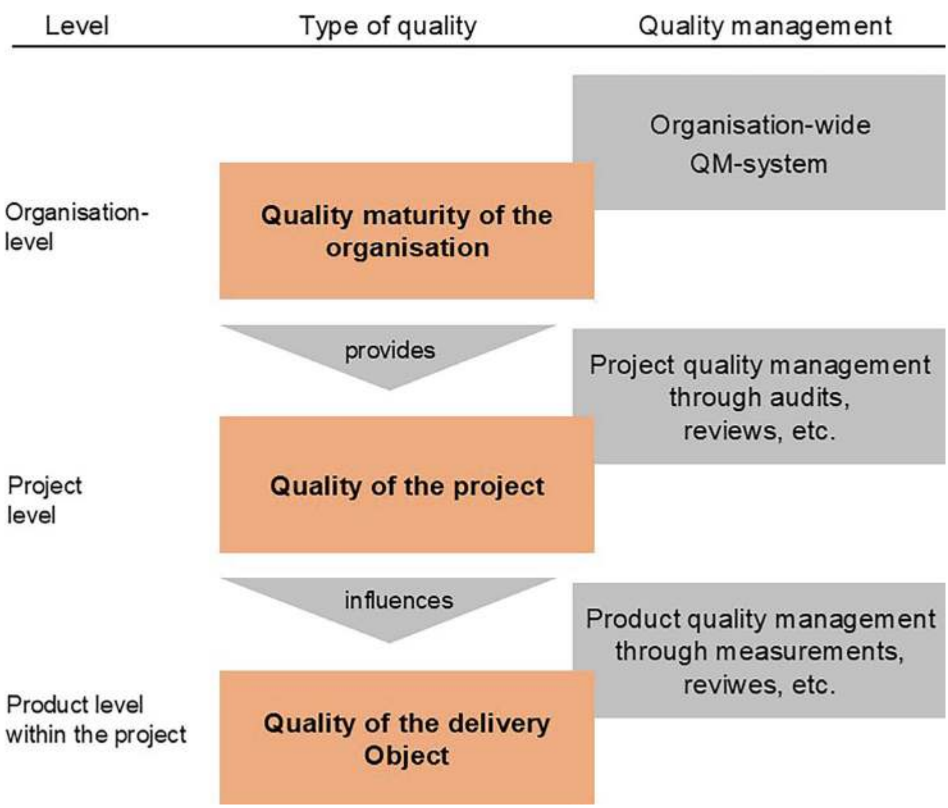
Quality management includes the quality strategy, the planning, control, assurance and continuous improvement of the quality.

Product quality and project quality

The quality in projects can be divided into a product quality (delivery object quality) and a project quality (process quality). The product quality refers exclusively to the quality of the delivery object and compares the specification of the delivery object (actual values) with the requirements (target values). The project quality refers to the creation process of the delivery object and includes the essential project management elements such as work, organisation/communication, time, resources, costs etc. and is thus a measure of project management success. The project quality has a major influence on the product quality.

Basically, every project and every delivery object has a quality. That is, every project has requirements for the delivery object and the project approach model that must be met.

The intensity with which quality management (◘ Fig. 3.2) is operated depends on the types of projects and the project size. In particular, the delivery object quality has a special significance in some types of projects. When building a bridge or a power plant, the product quality is so important that it takes on the greatest importance.



◘ **Fig. 3.2** Quality management in projects

Within the framework of a project's quality management, there are some approaches and methods that should be considered as a basis and taken into account in projects.

Quality management can be divided into four processes: quality planning, -control, -assurance and -improvement (cf. Bea et al., 2018, 330 ff.).

- **Quality planning**

Quality planning includes all activities for planning and designing quality management in the project. This primarily involves:

- Selection, classification and weighting of quality characteristics,
- Determination of the quality requirements for both the delivery object and the process quality,
- Design of project control, i.e. determination of the processes, methods and instruments, roles for measuring and evaluating the quality in the project,
- Design of quality assurance, i.e. determination of the processes, methods and instruments, roles for ensuring the quality in the project,
- Design of quality improvement, i.e. determination of the processes, methods and instruments, roles for measuring and evaluating the quality in the project.

- **Quality control**

As part of quality control, the planned quality and the quality management are implemented and monitored. This primarily involves the following activities:

- Measurement of product quality and project quality,
- Analysis of the planned-actual values,
- Derivation of measures for controlling the product and project quality in case of deviations.

- **Quality assurance**

The aim of quality assurance is to actively meet the quality requirements through targeted and structured methods, instruments and measures. to ensure. The following activities can be mentioned in the context of quality assurance:

- Measurement of product quality and project quality,
- Definition of measures to control product quality and project quality.

- **Quality improvement**

The improvement of the quality level or the quality maturity in projects is the goal of this process within the framework of quality management in projects.

In particular, through lessons-learned workshops or other survey methods (► Sect. 2.8.2) ideas, approaches and measures can be identified and developed to increase the quality maturity in the current project or also in later projects.

Since quality management, unlike the other project management elements, is an independent management area, further literature is referred to at this point for deepening (such as Schmitt & Pfeifer, 2015). The description of special methods and tools within the framework of project management can be found, for example, in the PMBOK (Project Management Institute, 2021).

3.1.3 Work

Once the goals of a project have been agreed and the deliverable with its components and requirements planned, the planning of the work necessary to create the deliverable begins.

The work that needs to be done to realise the deliverable must be identified and structured. The top-down approach or the bottom-up approach is suitable for identifying the work.

Top-down approach

With the top-down approach, the process goes from the general to the specific. This means, for example, based on the roughly planned phases from the delimitation and context analysis, the work in the individual phases is further broken down. The smallest sensible unit of work in the structuring of project work is called a work package. This approach is suitable for projects for which there is already experience regarding the essential project tasks. Because only in this case can the completeness important for project structuring be guaranteed at the phase level.

Bottom-up approach

For novel projects, for which there is little or no experience, the tasks of the project must first be identified. Under these conditions, it makes sense to first identify and collect the tasks to be done and then structure them upwards (bottom-up). Here, creativity techniques, as described in ► Sect. 2.8.1, are suitable. In this way, a project structure is gradually created.

3.1.3.1 Project Structure and Work Breakdown Structure

In small projects, checklists are usually sufficient to plan the work and control it. These checklists can be "ticked off" during project execution. If the project scope or the number of tasks and activities to be done reach a certain size, it is necessary to structure them sensibly. This structure is the basis for planning the further management elements and project management processes as well as the later control of a project. Also, the distribution of responsibilities for certain activities is facilitated by a suitable structuring of the project.

Since there are a number of terms within the project management element Work, these should first be clarified and defined here.

Task

A task describes a work order. A task can be a single activity, a work package, a project or a programme, depending on the goal or hierarchy of goals. The task is usually carried out under defined conditions, using various resources and taking into account the SMART rule (► Sect. 2.4.3).

Work

Work is a bundle of activities that must be carried out to create a deliverable, to complete a task or a work package.

Project structure

The project structure reflects the sequence and/or structure of a project in terms of the tasks to be done. The tasks can be divided hierarchically and/or phase-oriented into phases, sub-projects and work packages.

Work Breakdown Structure

The work breakdown structure documents the project structure. It is usually presented as a tree structure or list and contains the work packages at the lowest level.

Deliverable

The deliverable is a thing (material or immaterial) that is created during the project (project result). In the case of sub-projects or work packages, we speak of partial deliverables.

3

Phase

A phase is an overarching time-limited section that has a clear beginning and a clear end. A phase usually contains several work packages (project phases) or processes (project management phases).

The structuring is done using a work breakdown structure (WBS). The WBS is divided into different levels. The overall task of the project (creation of the deliverable) is broken down on the different levels from the general to the specific. ◘ Figure 3.3 shows the general structure of a work breakdown structure.

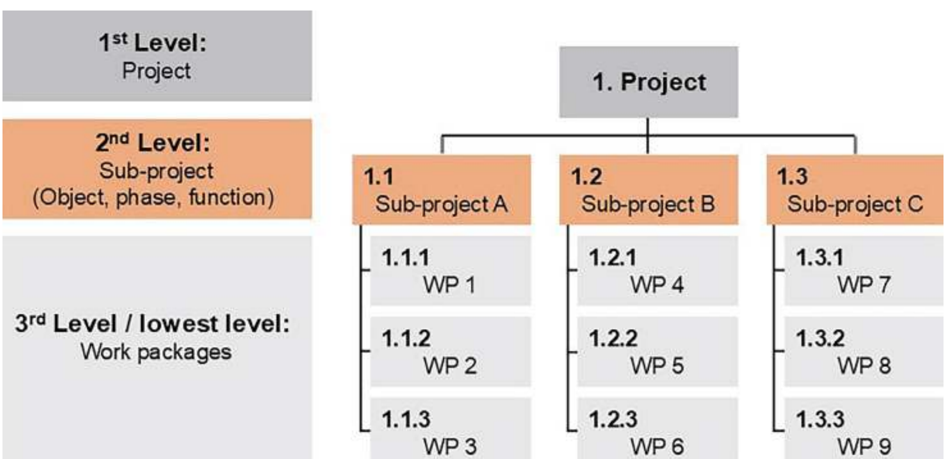
On the first level of a work breakdown structure, the overall task is named, i.e. usually the project name. In practice, it is often just a noun, such as Airport North, App 4711, Mobile 4812. However, the overall task should already be named here, such as construction of the North Airport, development of an App 4711, development of a mobile prototype 4812.

Subproject

The second level represents the subprojects, which can be structured according to different aspects, such as phases, objects, functions (► Sect. 3.1.3.1).

Subproject

A subproject divides the overall task of the project into clearly delineated subtasks, which can be structured according to various criteria, such as phases, objects, functions.



◘ **Fig. 3.3** Work breakdown structure

Work Package

At the lowest level, the work packages are defined. Depending on the project size or complexity, additional levels above the work packages can be added. Here you often find levels that are called *subtask, subphase* or *main work package*. The names of the different levels vary in practice from organisation to organisation. The work package level is always the lowest level in the project structuring, regardless of how many levels the project is divided into. However, there can be a different number of levels for each subproject.

Work Package

A work package is a self-contained task with a clear partial deliverable (work package deliverable).

For each work package, there must be a work package manager. It is recommended that there is exactly one person responsible. Because if there is no one responsible or there are several, this can lead to conflicts or non-completion of tasks of the work package.

Since project management is also an important subtask within a project, which is associated with effort, it is recommended to also mention this in the work breakdown structure. That is, here often the first *subproject* on the left side is the project management, which can then be divided into the work packages *planning, controlling* and *closure*. The actual project management phases are thus represented in the work breakdown structure as work packages. It is also possible to assign project management specifically to individual subprojects, especially if this is necessary due to special project management tasks, such as the creation of project brochures, in the context of project marketing. This project management task can and should certainly be assigned to a subproject.

The structure of a work breakdown structure can be done according to various structuring types. The structuring is primarily based on the subprojects. At the lowest level there are always the work packages. Theoretically, they are even always the same work packages, which are just structured or sorted differently. The following work breakdown structures are important:

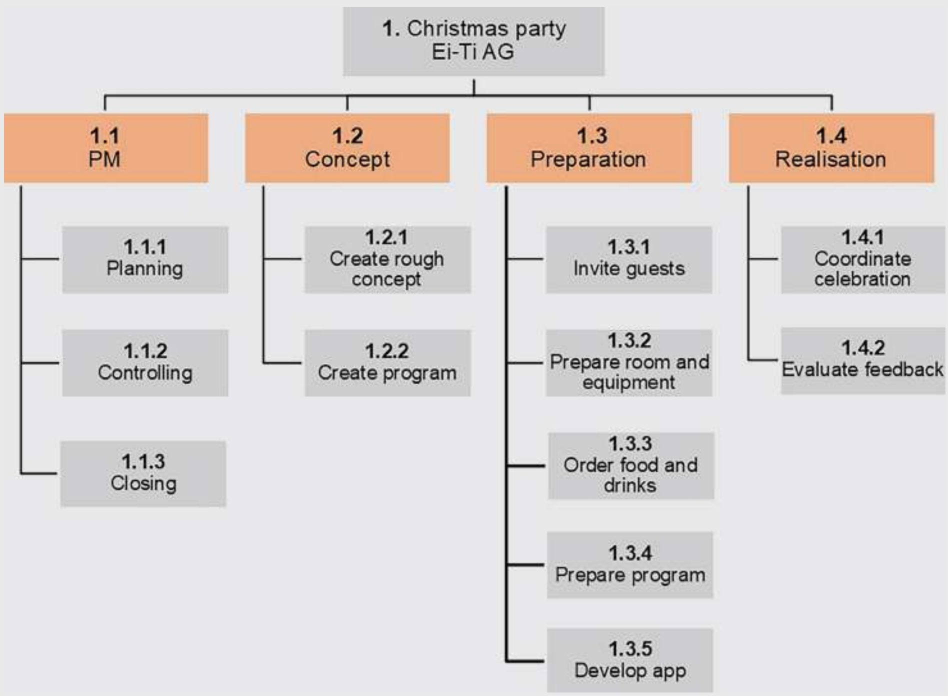
- phase-oriented work breakdown structure,
- object-oriented work breakdown structure,
- function-oriented work breakdown structure,
- mixed-oriented work breakdown structure.

The following sections present the different work breakdown structures. An example of a Christmas party is given for each type of work breakdown structure, to illustrate the differences.

Phase-Oriented Work Breakdown Structure

The phase-oriented structuring is a logical structuring, i.e. the tasks of the project are roughly divided into phases. Ultimately, the phase-oriented work breakdown structure corresponds to the project phases on the second level of structuring (► Sect. 1.1.4). These phases are then divided down to the work package level.

Ei-Ti AG Christmas Party—Phase-oriented Work breakdown structure



Object-Oriented Work Breakdown Structure

Instead of a phase-oriented structuring, an object-oriented structure can also be used.

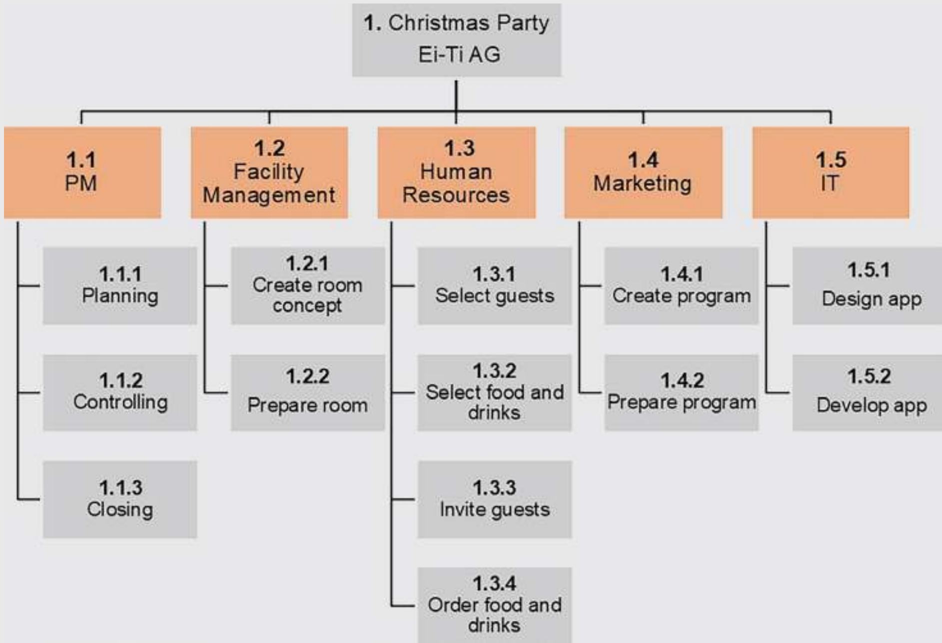
In the object-oriented structuring, the main components of the deliverable are represented on the second level of the work breakdown structure. That is, the project is initially structured based on the deliverable itself (e.g. main components, components, subcomponents, assemblies, individual parts). On the lowest level the assignment of the work packages then takes place again. Otherwise it would be a result plan. Ultimately, the work packages have only been structured in an object-oriented manner.

Ei-Ti AG Christmas Party—Object-oriented Work breakdown structure

Function-Oriented Work Breakdown Structure

In the function-oriented work breakdown structure, the work packages are structured according to functions, i.e. activity-oriented.

Ei-Ti AG Christmas Party—Function-oriented Work breakdown structure



Mixed-Oriented Work Breakdown Structure

In practice, mixed-oriented structures occur, e.g. the combination of phase and object orientation. The mix can be both on different levels (e.g. second level phase-oriented and then function-oriented within a phase) as well as on one level.

With the mixed-oriented structure within the same level there may be a risk of forgetting work packages or planning them multiple times, as the mix of structuring principles tends to hinder the transparency of the completeness of the work.

There are other structuring principles, such as the location-related structuring, where the location of the execution of work packages shapes the structuring. However, this structuring principle plays a subordinate role in practice.

The work breakdown structure is the *basic plan* of the project, on which all other sub-plans (schedule, resource plan, cost plan etc.) are based.

The decision for the type of structuring (phase-oriented, object-oriented, function-oriented) primarily depends on the inclinations of the project team and the deliverable itself. In the end, what counts is the completeness of the work packages.

The two most important requirements in the creation of the work breakdown structure are acceptance and completeness. To ensure these requirements, the following should be considered when developing the work breakdown structure:

Practical tip

When **creating a work breakdown structure** the following points should be considered:

- The work breakdown structure should be created jointly by the core project team to ensure a shared understanding and willingness.
- The defined work packages are intended to create the deliverable and thus achieve the goals. To this end, the components of the result plan can be adopted, for example, within the framework of an object-oriented work breakdown structure.
- For each sub-project, all work packages that are necessary to achieve it should be identified.
- Completeness is the most important quality criterion of the work breakdown structure and must be ensured by the project team.
- The work packages are clearly and comprehensibly described.
- The persons responsible for the work packages can already be determined during this planning process. There should be exactly one person responsible for each work package.
- The work package managers are members of the project organisation.
- The subtask of *project management* must be taken into account. Even if it is not explicitly listed in the work breakdown structure, it must not be forgotten under any circumstances.
- Redundant work packages and activities are to be identified and avoided.
- Also “unusual”, but necessary work packages, such as permits, patents, licenses, documentations, etc., must be identified and planned.
- The project structure is jointly “carried” by the team.
- For recurring projects, such as the Christmas party or product development projects, there are so-called generic work breakdown structures, which can be created once and then adapted for each project.

3

3.1.3.2 Work Package Description

The work package is the smallest element of a work breakdown structure and is located at its lowest level. A work package can be characterised by the following properties:

- The work package contains a unique deliverable (work package deliverable).
- The work package can be clearly delimited. (What is the goal/task and not-goal/not-task of the work package?)
- A single person can be defined as responsible for the work package.
- The duration and effort of the work package can be estimated.
- The interfaces to other work packages and areas of responsibility are transparent.

Work Package Description

Work packages can be considered as mini-projects and described with the typical parameters of a project. The description of a work package can be done using a so-called work package description (Work Package Card, Work Package Profile, Work Package Specification) (■ Fig. 3.4).

<table>
<tr><th colspan="4">Work package description</th></tr>
<tr><td>WBS Code</td><td colspan="2">Name</td><td>Version</td></tr>
<tr><td colspan="2">Result(s)

Non-Result(s)</td><td colspan="2">Tasks</td></tr>
<tr><td colspan="2">Dependency with other work packages
Predecessor
Succesor</td><td colspan="2">Time
– Start
– Finish
– Duration</td></tr>
<tr><td colspan="2">Person responsible for work package</td><td colspan="2">Effort
– Internal effort per qualification
– External effort per qualification</td></tr>
<tr><td colspan="2">Team</td><td colspan="2">Other resources (material, etc.)</td></tr>
<tr><td colspan="2">Progress measurement</td><td colspan="2">Documentations and templates</td></tr>
</table>

■ **Fig. 3.4** Work package description

Ei-Ti AG Christmas Party—Work Package Description for Selected Work Packages

Laura Leiter goes through the work packages with her team and considers for which work packages a detailed description in the form of a work package description should be made. As Sabine Schein's experience shows that the work packages for the actual Christmas party are clear, the team decides to only create a description for the new work package *Develop App*. Laura Leiter asks Martina Mark to make a short description. Two days later, Laura Leiter receives an email with the following work package description.

<table>
<tr><th colspan="4">Work package description</th></tr>
<tr><td>WBS Code: 1.3.5</td><td colspan="2">Name: Develop app</td><td>Version 1.1</td></tr>
<tr><td colspan="2">Result(s)
Released app that fulfills the requirements

Non-Result(s)
Introduction and training of the app</td><td colspan="2">Tasks
Due to the Scrum method, the development team will define the task for this work package later</td></tr>
<tr><td colspan="2">Dependency with other work packages
Predecesseor 1.2.1
Succesor none</td><td colspan="2">Time
– Start: calendar week 36
– Finish: calendar week 47
– Duration: 12 weeks</td></tr>
<tr><td colspan="2">Person responsible for work package
Product Owner Martina Mark</td><td colspan="2">Effort
– Internal effort: 72 person days
– External effort: --
– Costs: 20.000 Euro for a nwe development environment</td></tr>
<tr><td colspan="2">Team
Scrum team</td><td colspan="2">Other resources (material, etc.)
New software</td></tr>
<tr><td colspan="2">Progress measurement
Burn-down chart</td><td colspan="2">Documentations and templates
Scrum templates (artifacts)</td></tr>
</table>

3.1.4 Organisation and Communication

Following the planning of the project structure, the project organisation should be determined. However, the selection of project participants (project organisation) should ideally begin earlier.

In the planning of the organisation and communication, the project structure, the various roles in the project, the regular communication and the collaboration in the project are determined.

◘ Figure 3.5 presents the various methods and tools that can be used in this planning process and are described in this section.

3.1.4.1 Organigram

The organigram represents the structural organisation of a project and was already introduced in ► Sect. 1.7.

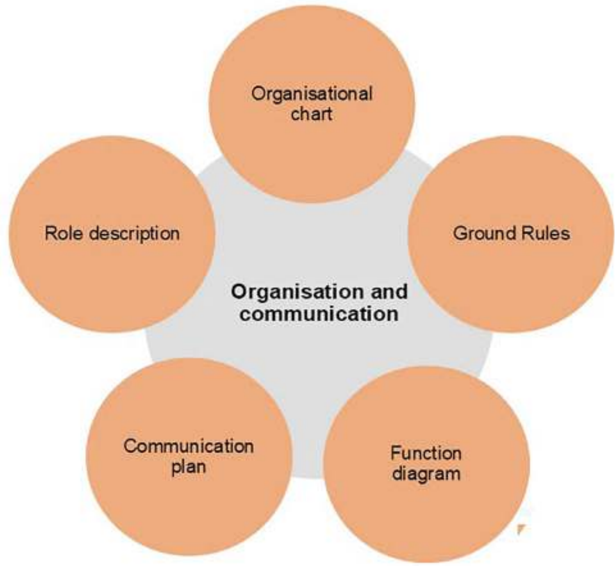
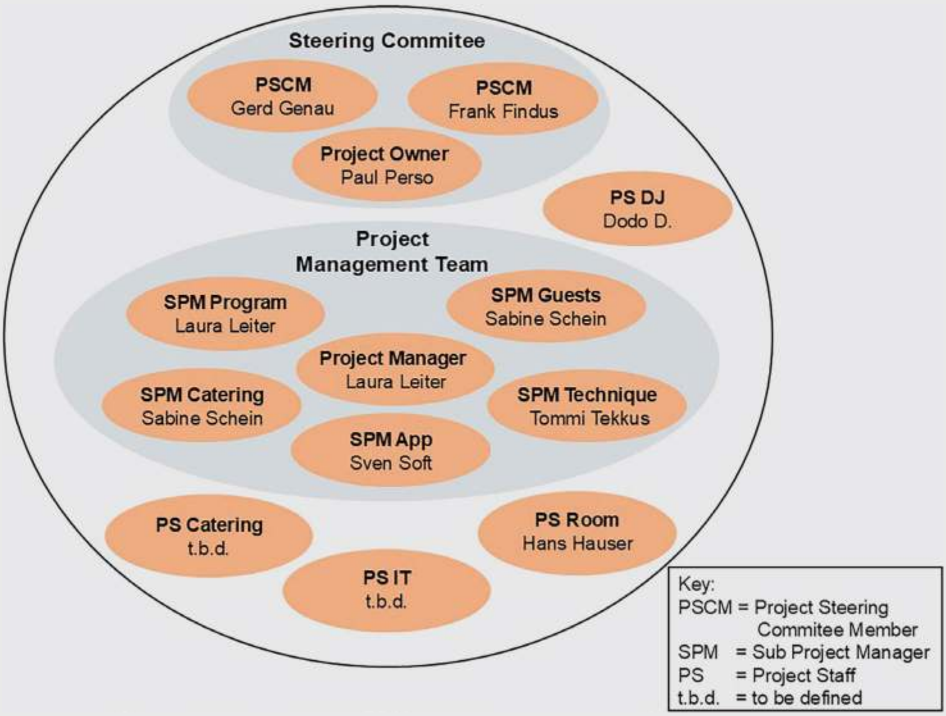


Fig. 3.5 Tools of organisation and communication

In practice, the organigram shows not only the roles that need to be filled within the project, but also the corresponding names for the project.

Ei-Ti AG Christmas Party—Organigram
Laura Leiter has already brought some of the project participants on board for her project. She takes another look at the project assignment and the delimitation and context analysis. Already identified as project clients are Paul Perso, and in the core team for catering she was able to win over Sabine Schein. For the technology, she brought Tommi Tekkus into the team as a sub-project leader. The app development was not so easy. Here she went the official way via the IT manager Ina Itti and asked her if she could have Sven Soft in the team. Since Ina Itti knows that the managing director Gerd Genau absolutely wants to establish the topic of agile project management and Scrum at Ei-Ti AG, she reluctantly made her best developer, who has first experience with Scrum, available for the project. This completes Laura Leiter's project management team. For the steering committee, Paul Perso suggests including the managing director Gerd Genau and the CFO Frank Findus. Laura Leiter has a strange feeling about Frank Findus, but trusts her client and his experience in dealing with difficult personalities. Moreover, it is certainly difficult in her role and especially as a newcomer at Ei-Ti AG to have any influence here.



▣ Project Organigram of the Christmas Party at Ei-Ti AG

3.1.4.2 Role Description

In projects, there are various roles, which were already described for the generic project management roles in ► Sect. 1.7.

Role Description according to the TAR Principle

However, since every project is unique, there are additional roles or generic roles, such as the project team member, which need to be adapted for a specific project. Furthermore, the generic roles can have different characteristics in a project. For example, project team member 1 may have a different signing authority (also competence or rights) (e.g. authorised to sign up to 10,000 EUR) than project team member 2, who may have no signing authority at all. These role-specific peculiarities are best represented by a role description according to the TAR principle.

3

TAR stands for:

Tasks	These are the tasks that the role holder has to complete.
Authority	Authorities are the rights that the holder of a role has.
Responsibility	In contrast to the rights, these are the duties that a role holder has to fulfil.

For role descriptions for individuals (e.g. project manager), the qualification that is needed to perform these roles can be added.

The role descriptions for committees (project steering committee) should be supplemented by the minimum selection of members (participating areas and hierarchical level), e.g. for major projects, at least two members of the first management level should participate in the steering committee. Furthermore, the parameter Organisational (frequency and organisational responsibility) is important for the committees, e.g. for projects with a duration of more than 1 year, the steering committee meets once a month.

In practice, the role description is often found on a DIN A4 page.

Christmas party Ei-Ti AG—Role description

Laura Leiter has found some standard descriptions for the project management of IT projects on the intranet. She adapts these to her project and discusses them at the next opportunity with her core team and her client. Small changes are made, then the role descriptions for her project are finalised.

Role description: Project manager

Tasks	Authority	Responsibility
Those to be processed within the project	*Rights and powers to carry out the tasks/ activities incl. decision-making powers and value limits*	*Duties of the role (e.g. delivery results of documents)*

Tasks	Authority	Responsibility
– Clarification of the project order with the clients – Determination of the project structure – Conducting a schedule, capacity and cost planning – Definition of the project organisation and communication in coordination with the line organisation – Involvement and agreements with stakeholders – Control of the project goals – Risk management and escalation into the decision-making body – Ensuring a regular flow of information to all project participants (team and committees) – Preparation, coordination, implementation and follow-up regular project team and steering committee meetings	– Specification of project goals to team members according to project order – Convening of project team meetings – Prioritisation of project-specific topics – Evaluation of the project status – Demand for the promised capacities – Escalation into a higher decision-making body – Assignment of tasks – Evaluation of the work results – Demand for information about absence of team members – Demand for the defined numbers, data, facts for each work package	– Implementation of the projects according to project order and project plan – Ensuring the project goals – Scheduling of the work packages – Accountability to the clients and the project steering committee – Availability of the project status – Timely escalation in case of deviations – Implementation and communication of lessons learned – Evaluation of change requests – Coordination of reporting and documentation

Role description: Client

Tasks	Authority	Responsibility
Those to be processed within the project	*Rights and powers to carry out the tasks/activities incl. decision-making powers and value limits*	*Duties of the role (e.g. delivery results of documents)*

3

Tasks	Authority	Responsibility
– Representation of the interests of the management of Ei-Ti AG – Definition of the project, setting of goals – Selection of a project manager – Commissioning of a project – Coordination of the composition of the core team with the project manager – Decision on the further handling of change requests	– Appointment of the project manager – Assignment of the project – Approval of the project plan – Overall entrepreneurial assessment of project progress including all initiative measures to ensure the project success – Regular review of project progress	– Coordination of project planning with the project manager – Responsibility of the business plan (benefit generation) – Support of the project manager, e.g. in resource conflicts with line managers – Information of the management in case of major changes to the project – Relief of the project manager and the project team after project completion

Role description: Project team member

Tasks	Authority	Responsibility
To be processed within the scope of the project	*Rights and powers to carry out the tasks/ activities incl. decision-making powers and value limits*	*Duties of the role (e.g. B. delivery results of documents)*
– Clarification of work package tasks with the project manager – Determination of activities within a work package – Execution of a schedule, capacity and cost planning for the work package – Involvement and agreements with relevant interfaces (permanent organisation) – Control of the work package goal – Ensuring a regular flow of information to the project manager	– Specification of work package goals to employees – Evaluation of the work package status – Requesting the promised capacities from the project manager – Assignment of tasks to employees – Assessment of work results	– Execution of tasks according to work package – Ensuring the work package goals – Scheduling of work packages – Accountability to the project manager – Determination of a work package status – Timely escalation in case of deviations

Role description: Project employee		
Tasks	**Authority**	**Responsibility**
To be processed within the scope of the project	*Rights and powers to carry out the tasks/ activities incl. decision-making powers and value limits*	*Duties of the role (e.g. B. delivery results of documents)*
– Substantive processing of the work package taking into account time and effort	– Regular review of project progress – Escalation in case of problems	– Quality, schedule and effort appropriate creation of partial delivery results

Role description: Steering committee		
Tasks	**Authority**	**Responsibility**
To be processed within the scope of the project	*Rights and powers to carry out the tasks/ activities including decision-making powers and value limits*	*Duties of the role (e.g. delivery results of documents)*
– Representation of the interests of the management of Ei-Ti AG – Definition of the project, setting of goals – Selection of a project manager – Commissioning of a project – Coordination of the composition of the core team with the project manager – Decision on change requests	– Appointment of the project manager – Assignment of the project – Approval of the project plan – Overall entrepreneurial assessment of project progress, including measures to ensure project success	– Coordination of project planning with the project manager – Responsibility of the business plan – Support of the project manager, e.g. in resource conflicts with line managers – Provision of budget and resources as needed and after approval of the steering committee – Relief of the project manager and the project team after project completion

3

3.1.4.3 Responsibilty Assignment Matrix (Function Diagram)

Another method to coordinate the various project roles is the function diagram, which represents different functions for the project roles or the named project participants for each work package.

The four functions of *responsible, accountable, consulted/ collaborate* and *(is) informed* are often used. The initial letters form the word RACI, as this method is also called.

A responsibility assignment matrix is schematically represented in ◘ Table 3.1.

The functions mean in detail:

Responsible	The corresponding role has responsibility for the work package. This is the only function that must be assigned in any case.
Accountable	The role decides on the outcome of the work package. It is a kind of acceptance of the work package.
Consulted/ Collaborated	This role consulted and/or collaborates in the work package, i.e. this is the role of the project collaborator.
Informed	The role is informed about the work package, especially about the outcome.

◘ **Table 3.1** Schematic representation of a responsibiltiy assignment matrix/RACI matrix

	Project Owner	**Project Manager**	**Project Team Member 1**	**Project Team Member 2**	**Project Staff 1**	**etc.**
Work Package A	A	I	R		C	
Work Package B	I	A	R			
Work Package C		A	I	R	C	
Work Package D			R			
etc.						

R—Responsible, *A*—Accountable, *M*—consulted/collaborated, *I*—(is) informed

The responsibility assignment matrix can be created both at the role level (◘ Table 3.1) as well as at the name level. When creating at the name level, it must be taken into account that a person can take on several roles within a project and thus also gets assigned several functions (letters), as can be seen in the following example *Christmas party at Ei-Ti AG*.

Ei-Ti AG Christmas party—Responsibility assignment matrix based on the RACI matrix
Laura Leiter heard about the responsibility assignment matrix during her studies and is now looking forward to finally trying out this method. She has now understood that she should do this together with the team.

For reasons of clarity, only an excerpt with few roles and work packages is shown below.

	PO (P. Perso)	**PM (L. Leiter)**	**SPM Guests (S. Schein)**	**SPM Progr. (L. Leiter)**	**PS Progr. (S. Schein)**	**PS Guests (L. Leiter)**	**…**
Project management	E	V	M	M	I	I	
1.2.1 Create rough concept	I	I	I	V	M		
1.2.2 Create programme	E	I		V	M		
…							
1.3.1. Invite guests		i	V			M	
…							
1.3.4 Prepare Programme		I		V	M		
…							

V—Responsible, *A*—Accountable, *C*—Consulted/Collaboration, *I*—(is) informed, *PO*—Project owner, *PM*—Project manager, *SPM*—Subproject manager, *PS*—Project Staff

3.1.4.4 Ground Rules

In projects, people from different organisational units work together with different working methods for a specific period of time. Due to the time pressure in projects, the team must work together very quickly and efficiently. However, conflicts can never be completely ruled out. Therefore, ground rules can be another method to improve cooperation in the project.

Examples of ground rules are:

- The project team should act entrepreneurially. In case of conflicts between project goals and the line, decisions should be made based on arguments. The highest decision-making body is the project steering committee.
- The project team decides on the use of the planned and agreed project budget with the steering committee.
- A good project leader/project staff member is proactive, asks competent contacts in the company and talks about problems in the project before they escalate.
- The steering committee is the first escalation level in case of conflicts between the project and the line or with the customer.
- If an agreement cannot be reached in the steering committee, the management has to make a decision (second escalation level).
- Project staff can only be planned to a maximum of 100% of their capacity.
- Project team members must be named during the project planning phase.
- For each work package, there is a named person responsible with authorities. The resources are clearly assigned.
- In case of conflicts of goals between line management and project management, a sustainable compromise should always be sought.
- The project leader or his deputy participate in every negotiation with the customer regarding the scope of the order, price or changes.
- The holiday and travel planning for project staff is coordinated with the project leader.

Ground rules can come from the areas of communication, behaviour, task distribution, organisation, agenda and team meetings, teamwork, social competence etc.

Ei-Ti AG Christmas Party—Ground Rules
Laura Leiter first collects the existing ground rules of the Ei-Ti AG for her project. Since she received the additional task from Gerd Genau to collect, check and possibly create all existing methods, tools and documents in her project, Laura Leiter has listed the following suggestions for generic ground rules for projects. These can then be adapted project-specifically. Paul Perso likes the idea very much, as he knows from experience how differently various departments with different people and working methods deal with each other. And especially in projects, where different people with different working methods and views on a topic have to work together quickly and successfully, ground rules are a good method to avoid conflicts. Paul Perso also contributes a few important ground rules. Thus, the following ground rules are proposed and adopted.

Category	Ground Rules
Communication	– We pay attention to the selection of the most sensible Communication medium (personal, telephone, email) – Where possible, we prefer personal communication – Emails providing team-relevant data are sent to the entire team
Organisation	– We respect the role distribution in the team, especially when the permanent organisation has a different superior and subordinate relationship – The role descriptions with the tasks, competences and responsibilities are binding for all internal stakeholders
Behaviour	– We practice respectful interaction with each other – Conflicts are not carried out behind the backs of those affected – The rules of the game are also a dynamic part of project planning and control and can be adapted to the circumstances. Changes should be discussed and agreed upon in the project team – Anyone who does not adhere to the rules must pay a pound into a piggy bank, which will be spent together at the end of the project as part of an event

Category	Ground Rules
Task distribution	– We help each other – If someone finishes earlier than planned, this is openly communicated
Agenda and team meetings	– Regular appointments are jointly determined during the planning phase – The project team meeting is primarily a coordination meeting and less of a working meeting – If an agreement is not possible, the escalation rules apply – We arrive on time for meetings

Paul Perso explains to Laura Leiter once again how important it is to develop the rules of the game together.

3.1.4.5 Communication Plan

The main activity of a good project manager is communication.

Communication should be understood here as the exchange of information between several people.

In the context of planning communication, the kick-off, the start workshop, and the communication table as a method are particularly worth mentioning. They are part of the communication plan.

Kick-Off and Start Workshop

In addition to the regular meetings shown in ◘ Table 3.2, there are two important types of meetings at the beginning of the planning phase, the kick-off date and the start workshop.

In the first step of the planning process, the key stakeholders involved in the project should be informed as part of a kick-off. This appointment is usually a presentation in which the project assignment is presented by the project client and/or the project manager. In addition to the purpose of informing a large group of participants about the upcoming project, the kick-off has the character of a starting signal and is intended to create a mood of departure.

The second important meeting at the beginning of a planning phase is the start workshop, which primarily aims to develop a project plan. That is, unlike the kick-off, the focus

Table 3.2 Communication table

Designation	Content	Participants	Time (frequency and duration)	Location
Steering committee meeting	– Status and progress – Risks; measures – Problems – Decisions – Further procedure	– Project sponsor – Steering committee – Project manager	– Monthly – 20 min	– Room 4711
Project team meeting	– Status and progress – Risks; measures – Problems – Decisions – Further procedure	– Project manager – Subproject manager – Work package responsible	– Monthly (before the steering committee meeting) – 2 h	– Room 4712
Working meeting	– Coordination of the subteam – Content topics	– Work package responsible – Work package employee	– As needed – Duration depending on the topic	– Depending on the meetings
etc.				

here is not on informing the key stakeholders of the project, but on creating project planning results.

The following topics are typical for a start workshop and are therefore on the agenda:
- Project name, date, location, participants,
- Welcome, introduction, goals and process, round of introductions,
- Status of the project,
- Project goals and deliverable using object breakdown structure,
- Environment analysis and stakeholder analysis,
- Draft/supplement of the work breakdown structure,
- Revision of project organisation chart and communication structures,
- Determination of work package responsibles and work package specifications,

- Schedule planning: Milestone definition,
- Dependencies and duration of the work packages,
- Resource planning,
- Cost planning,
- Further procedure including to-do list,
- Summary and conclusion.

Depending on the project size and the project context, these two types of meetings have different characteristics. In small projects, the kick-off and the start workshop can be held together or within one appointment in two parts. Here, the duration is rather 1–2 h. Whereas in large projects, the start workshop can cover several days or several parts. In practice, there are often several appointments during the planning phase, at which the project team comes together and plans the project management elements.

Communication Table

For the planning and control of communication, a communication table has established itself in practice, which answers the following relevant question:

- Who communicates with whom? (Participants)
- About what? (Content)
- When? (Time)
- Where? (Location)

◘ Table 3.2 shows a communication table, in which three relevant meetings are exemplarily represented. To achieve the highest possible efficiency, the participants are limited to certain roles.

> **Ei-Ti AG Christmas party—Communication plan**
> Laura Leiter now knows how busy each employee of Ei-Ti AG is. Against this background, she creates the following communication plan together with Paul Perso and Sabine Schein, which should ensure efficient communication in the project.

Designation	Content	Participants	Time (Frequency & Duration)	Location
Steering Committee Meeting	– Status and Progress – Risks; Measures – Problems – Decision – Further Procedure	Steering Committee (Gerd Genau, Frank Findus and Paul Perso (PO))	1st Monday of the month at 10 o'clock for 10 min as part of the management meeting	Room 4123 Berlin (Dial-in coordinates for telephone conference available from Flora Fleißig)
Project Team Meeting	– Status and Progress – Risks; Measures – Problems – Decisions – Further Procedure	PM (Laura Leiter) SPL (Sabine Schein, Sven Soft, Tommi Tekkus)	Monthly on Thursdays before the steering committee meeting 60 min	Room 2007
Subproject Leader Meetings	– Coordination of the Subteam – Content-related Topics	Depending on the subprojects	Depending on the content	t.b.d.

PO—Project Owner, *PM*—Project Manager, *SPM*—Subproject Manager, *t.b.d.*—to be defined

Laura Leiter is glad that she has a relatively small project team for her first project, to which she can personally go. Thus, the stumbling blocks of difficult communication through distributed project teams at different locations are not given.

3.1.4.6 Information Management

Information management includes the collection, processing, storage and distribution of information, including reporting and document management. Information management answers the following questions:

- Who needs to be informed about what and when?
- Who delivers which information when?
- How much information is absolutely necessary?
- In what form should information be prepared?
- Where and how should the information be stored?

The timely provision of information is crucial for the preparation and making of project-relevant decisions.

3.1.4.7 Essential Documents for Project Management

Periodic and event-oriented reports

Documents can be distinguished between periodic (time-oriented) and event-oriented documents. Periodic documents are created in a certain time cycle (e.g. monthly status report), whereas event-oriented documents are created depending on an event (e.g. final report at the end of a project).

The most important periodic document that should be regularly available is the project status report. Event-oriented documents are the project order (► Sect. 2.7), the project plan, acceptance protocols for partial delivery objects or work packages, change requests and the final report.

▪ **Project Plan**

The project plan is defined and interpreted differently in different sources and especially in practice. Many understand this to mean exclusively the schedule or a combination of schedule and resource plan. According to the standards, such as DIN 69900, PMBOK, PRINCE2, the project plan includes all sub-plans that are necessary for managing a project (Project Management Institute, 2021; AXELOS, 2017; DIN, 2009a). These include:

- Goal Plan,
- Result Plan,
- Work breakdown structure,
- Schedule,
- Resource plan,
- Cost plan,
- Risk plan,
- Organisation and communication plan,
- if necessary, procurement plan.

Ultimately, all results from the individual project management elements are summarised in the project plan. In addition, a project plan includes the project management approach (e.g. agile approach, use of various methods and tools, consideration of standards).

Of particular importance is the interdependence of the various sub-plans, which describe the management of the individual project constraints (► Sect. 1.1.3). For this reason, a change in one sub-plan (e.g. the schedule) can have effects on the other sub-plans (e.g. cost, risk, communication plan). Therefore, with every sub-plan change, i.e. a change in a project constraint, the effects on the other project constraints must be checked. The procedure for this is described in ► Sect. 3.2.

■ **Table 3.3** Structure of document plan

Document plan				
Document	**Creator**	**Recipient**	**Contents**	**Frequency/by when**
Status report	Project leader	Client, decision-making body	Current status of the project (schedule, costs, performance)	By the last working day of the month
Work package report	Work package responsible	Project leader	Current status of the work package	Every 2 weeks
Immediate report	Project leader	Client, decision-making body	Specific need for action due to deviations	In exceptional situations
Change requests	Depending on the request	Client, decision-making body	Change including reason and impact	As needed

■ **Status report**

The project status report is used in the context of project controlling, but is already designed in the planning phase or is given as a standard within the organisation. The status report is described in ► Sect. 3.2.3.1.

■ **Change request**

The change request is also a document used in project controlling in the context of change request management *(change management)* (► Sect. 3.2.4). It is also designed in the context of reporting or used as a standard.

■ **Document plan**

Analogous to the communication table, the joint development of a document plan (■ Table 3.3) has proven its worth in project work, which provides an overview of all documents to be created in the project and contains essential information about the individual documents, such as creator, recipient, contents, frequency etc.

To answer the above questions and thus achieve the goals of information management in the project, the project leader must fulfil the following tasks in coordination with the relevant stakeholders:

- Selection of project-relevant information,
- Determination of which information, at which times or frequencies, is distributed to which stakeholders,
- Determination of the responsibility for information procurement, processing and dissemination,

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- Determination of the processing method of the relevant information (medium, degree of compression, currency etc.),
- Determination of the templates to be used,
- Distribution of access rights for digital storage or programs.

The project manager is responsible for the information management in the project. He must ensure that the information needs of the internal and external stakeholders are effectively and efficiently met. This means that a balance must be struck between the need for information and the effort required to process and provide information.

A decision also needs to be made regarding the type of communication in terms of verbal and/or written communication (i.e. documentation).

In addition to direct, primarily verbal information exchange in the context of team meetings, status meetings, phone calls etc., written documentation of project-relevant information is important. The templates and forms should be as "user-friendly" and as need-oriented, readable and understandable as possible for the recipient.

The degree of compression plays a significant role in the provision of information at different hierarchical levels, because the higher the hierarchical level, the more compressed the information must be.

This means that the project manager and his project team must have the highest level of detail, while management is provided with a rough overview of the project data in order to correctly assess the project and possibly take measures.

3.1.4.8 Escalation Management

An important topic in the context of project management is the issue of escalation. Especially against the background of the different integration of a project into the permanent organisation, conflicts often arise that cannot be resolved within the project and therefore need to be escalated to a higher authority.

Escalation can generally be summarised as the forwarding of a decision or a problem to a higher hierarchical level if the decision or the problem cannot be solved at the current hierarchical level.

Escalation

Escalation management includes the processes, roles, and templates that should be applied in the event of escalations. The escalation processes reflect pre-structured paths within an organisation that must be followed in the event of an escalation.

In principle, the project team should make all decisions within the agreed project goals themselves. The project manager and the project team are given responsibility and certain authorities (powers) for the project. This approach enables the delegation of tasks from “top to bottom” (► Sect. 6.3.2, Management by Delegation). Escalation should only occur in exceptional cases. Escalation is the antonym of delegation.

The transfer of responsibility and granting of authorities should be in balance. Escalation corresponds within the management principles to the *Management by exception* (► Sect. 6.3.2). For example, a budget increase or a project deadline extension is essentially an escalation, as the project manager must ask the steering committee or the client for a decision. In practice, companies with a medium to high level of project management maturity have an established escalation management.

3.1.5 Time

Time planning is closely linked to performance planning (goals/deliverable, quality and work) as well as resource and cost planning (► Sect. 1.1.3, Magic Triangle).

Sequence planning

Schedule planning

Time planning is divided into sequence planning and a schedule planning. In sequence planning, the logical sequence of the project or the work packages is planned. Subsequently, as part of the schedule planning, the work packages are assigned start and end dates, so that at the end of the time planning a coherent schedule is in place. The dates agreed in the project order (usually start and end dates, possibly further milestones) must be taken into account.

The larger the project, the more complicated it is to create a coherent schedule. In the context of time planning, there are some methods and tools, such as the milestone plan, the task list or the network and bar chart, which can be applied depending on the project size and requirements for time planning.

3.1.5.1 Milestone

In the context of project initiation, the two most important key dates of a project are already set: the start and end date of the project.

In order to better plan the project in terms of time and to be able to check during the project implementation how the project is “on the way”, further *anchor points* are set between these two key dates, so-called milestones. The start and end dates are also milestones.

Milestone

A milestone is a “key event of special significance” (DIN, 2009b).

Thus, a milestone is a special point in time in the project at which something important for the further course of the project happens. *Receiving approval for a loan,* is an example of a milestone. A distinction can be made between fixed and dynamic milestones.

Time-fixed milestones

Fixed milestones have a set date (e.g. the loan approval must be available by 31.1., otherwise the project cannot be carried out).

Dynamic milestones

Dynamic milestones do not have a specific date, but depend on the event itself (e.g. it may also be that the approval of the loan only depends on the end of the work package *Apply for loan*, but does not contain a date specification).

Milestones have the following important characteristics:

- Guidance for stakeholders,
- *Stage goals* for the project organisation, at which, among other things, the progress of the project can be recognised,
- Control instrument for the project manager and the project team (work package managers),
- Motivation tool for the project team and the project staff to focus energies,
- Status report for management, at which the project *is balanced*,
- Decision points for the client and the management of the project.

Whenever important decisions need to be made in the project (technical, financial, organisational or regarding risks), at which important coordination points between the sub-projects or to other projects need to be reached or directional results need to be available, milestones should be set.

There should be at least one milestone per phase as an anchor point (◼ Fig. 3.6).

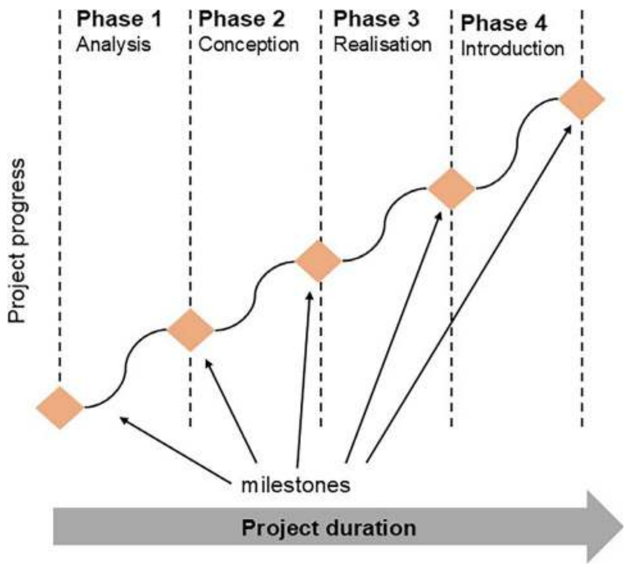

Fig. 3.6 Milestones as anchor points of the project

Effort

Effort is understood as the time required for resources (means of deployment) for the complete processing of a task (cf. Bea et al., 2018, p. 142 f.). The effort represents the sum of the net working time of the individual persons for the resource person.

Duration

The duration indicates the period between the start and end of a work package or process. It is the time needed to achieve a planned result (e.g. deliverable, partial deliverable).

According to the definition, the measurement and representation of the duration is a unit of time. Depending on the total duration of the project, the duration of the individual work packages or processes is indicated as follows:
- in days (abbreviation: *d* for *day*),
- in weeks (abbreviation: *w* for *week*),
- in months (abbreviation: *m* for *month*),
- in quarters (abbreviation: *q* for *Quartal*).

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Table 3.4 Difference between duration and effort

	Duration	**Effort**
Definition and characteristics	Lead time; time span from start to end including all waiting and downtimes	Net work to be provided in a work package/phase
Unit	Unit: time, e.g. months (m), days (d), hours (h)	Unit: time, e.g. (project-) months (m), (project-) days (d), (project-)hours (h)
Project management element	Goes into time planning	Goes into cost planning
Dependency	Variable size regarding a work package; dependent on the number of resources and the effort	Fixed size regarding a work package; independent of the number of resources and the duration Dependency on the task or the work package

Difference between duration and effort

Although duration and effort have the same unit of measurement (time), they differ in essential characteristics. Table 3.4 provides an overview of the two important quantities effort and time.

Project-days

A project-day *(person day)* is a unit of measurement for the effort of work to be done. A project-day corresponds to the work effort of one person on a working day.

Working day

Days on which work is done in an organisation, i.e. usually from Monday to Friday. A working day includes a varying number of working hours depending on the contract situation (working hours per day).

Project-days, working days and calendar days should not be confused. The duration of a work package is measured in calendar days (private) or working days (business). The project-days represent the effort.

Table 3.5 Difference between working days, calendar days and project-days

Working days	Weekdays	Calendar days	Project-days
Unit of duration in the business environment		Unit of duration in the private environment	Unit of effort based on working days
5	From Mon to Fri in the same week	5	For one person: 5 project-days For two people: 10 project-days
5	From Wed to Tue of the next week	7 (including Sat and Sun, which are not working days)	For one person: 5 project-days For two people: 10 project-days

Table 3.5 shows the difference between the three terms using an example of five working days.

The duration of a work package is five working days. If the work package is processed from Monday to Friday, the duration is five calendar days. If it starts on a Wednesday and ends on the following Tuesday, the duration is seven calendar days, as no work is done at the weekend. Saturday and Sunday are counted as calendar days, but not as working days.

In project management, one usually calculates with working days. When a duration of 20 working days is mentioned, this corresponds to a duration of approximately 1 month, as the calendar days are taken into account in the monthly view.

3.1.5.2 Approach to Scheduling

In order to create a detailed schedule, the work breakdown structure (WBS) with defined work packages and a rough schedule in the form of a milestone/phase plan (usually from the project order) must be available:

The detailed schedule represents the logical dependencies and the temporal sequence of the individual work packages or possibly even more detailed in the form of tasks among each other.

Task

According to DIN 69900, a task is "a process element for describing a specific event with a defined beginning and end" (DIN, 2009c).

A task is a process element in the context of scheduling, representing a closed task and serving as a subdivision of a work package. In the context of scheduling, it may be useful for some work packages to be further divided into tasks in order to better plan waiting times within the work packages or dependencies in the middle of the process of a work package.

A task is an element of time management (question: When?), while the work package is an element of work (question: How?). A work package can represent a task or be divided into several tasks.

The division of a work package into several tasks is done for reasons of more sensible or efficient planning. For example, the work package *Hiring staff* can be divided into the tasks *Creating job advertisement, conducting interviews, selecting candidates and negotiating contract*. These subtasks or tasks each represent a self-contained task, between which waiting times can also occur. This representation would not be taken into account in the temporal planning at the work package level. This means that planning at the task level allows for detailed scheduling, but also leads to more planning and controlling effort in project management.

Practical tip

More detailed scheduling on a task basis

The planning responsible (usually the project manager with his team) should always consider during the entire planning that detailed planning also leads to more controlling effort. If the detailed schedule at the task level cannot be *controlled,* i.e. monitored and managed, this plan has little benefit and the work for it should better be put into other important project management elements that are often neglected in practice (e.g. organisation and communication, ► Sect. 3.1.4).

Based on the terminology of DIN 69900, only tasks are spoken of in the context of scheduling. This means that work packages are either completely transformed into tasks or further broken down into tasks. In practice, work packages are often still spoken of within the scheduling. For the sake of consistency and simplicity and to clarify the importance of the work packages, this book continues to speak of work packages when they are not further divided into tasks.

The schedule serves the project manager and the work package managers as an important control instrument for schedule monitoring. The work package managers recognise from the schedule which results must be available when in order to start their own tasks. They recognise at which point they must deliver results for subsequent activities (▶ Sect. 3.1.5).

Various stakeholders (e.g. clients, customers, management) expect a binding statement on the timing and the expected end date of the project. In addition, the schedule with its calculated end date is an important basis for the decision to carry out the project.

To create a meaningful and understandable schedule at the work package or task level, the measures described in ◘ Table 3.6 are necessary.

Practical tip

Scheduling

The following points should be considered in the context of scheduling:

- Choose an appropriate scheduling tool (schedule list, Gantt chart, milestone plan (see below),
- the schedule should be developed in the team (e.g. in the context of the start workshop),
- schedules from similar past projects should be used as a template,
- let experts and work package managers define dependencies and duration,
- plan on several detail levels for larger projects,
- when converting time lengths (days, weeks, months) into specific dates, non-working days (weekends, holidays, vacation etc.) must be taken into account,
- the availability of resources should be checked,
- realistically estimate milestones for external deliveries,
- only create the schedule as detailed as you can monitor and control it,
- use planning tools that are generally accessible and available,
- milestones agreed in the initiation phase must be adhered to,
- determine responsibility(ies) for maintaining the schedule.

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Table 3.6 Procedure for creating a schedule

Steps	Measures
1. Method and instrument selection	Selection of alternative methods for scheduling depending on the project size – Milestone plan – Schedule/task list – Gantt chart (networked; not networked) – Network diagram Selection of possible tools (software) depending on the methodology and availability (software licenses) in the organisation – Standard spreadsheet or graphics programs – Standard scheduling software – Proprietary company software etc.
2. Estimation of the duration of work packages/ tasks	– Experts estimate the duration of their individual work packages from the work breakdown structure – If necessary, work packages are broken down into tasks – If necessary, derive/calculate the duration from the effort (formula ► Sect. 3.1.5) – If necessary, add waiting times and temporal risks; waiting times can arise for deliveries, approvals, need for coordination, decisions etc.
3. Determination of dependencies between the work packages/ tasks	– Review and determine dependencies, i.e. which results from work packages must be available to start the next one (predecessor and input) or which work packages must be processed directly afterwards (successor)? – Identify serial and parallel processing, i.e. which work packages must be processed one after the other, which can be processed in parallel?
4. Calculation of the project duration	– Calculation of the earliest possible start times for each task, starting from the project start (forward calculation) – Convert the earliest possible and latest possible start times of each task into calendar dates
5. Validation and optimisation	– Identification of scheduling risks (critical path, long waiting times, special dependencies, long decision-making processes etc.) – Resource balancing (► Sect. 3.1.6) – Optimisation of the schedule

3.1.5.3 Estimates

The work breakdown structure makes the tasks and work packages necessary for the creation of the deliverable visible. The size of a project only becomes transparent when effort, costs and duration are estimated.

This section first describes general procedures for estimating. These also apply to the cost estimates in ► Sect. 3.1.7. Since effort also plays a role in scheduling, this section covers both effort and duration estimates. The description of cost estimates is given in ► Sect. 3.1.7. The expert estimate, the experience estimate (based on historical data) and the parametric estimate are common estimation methods (see Bea et al., 2018, p. 142 ff.; cf. Timinger, 2015, p. 140 ff.).

3.1.5.4 Estimation Methods

■ Expert Estimation

Expert Estimation

One of the most common estimation methods used in practice is the expert estimation. This involves accessing the knowledge of experts who have expertise on the project content using different methods and tools.

There are several methods and tools within the framework of expert estimation:
- Individual estimation,
- Group estimation,
- Delphi method,
- Estimation conference.

In individual estimation, an expert is asked to make an estimate. Thus, the estimate is based on a single view.

In group estimation, several experts are asked independently of each other. Thus, it involves multiple perspectives.

The Delphi method is a structured approach involving several experts who are also asked multiple times. The results of the estimation are averaged and outliers should be justified. The results of the averages and possibly the reasons for the deviations are made available to all participating experts and a second round of estimation is carried out, and more if necessary.

In the estimation conference, several experts participate again. This time the experts exchange ideas together in a meeting (conference) and there should be a joint estimate at the end.

■ Experience Estimation

Experience Estimation

Another frequently used and relatively simple estimate is the experience estimate, which is based on past experience or historical data. Here, the efforts, duration or costs from past comparable projects, sub-projects, work packages or processes are used and for the current project to be estimated, sub-project, work package or process adopted or adjusted accordingly. A special form of experience estimation is the estimation by standardisation. This represents a quantitative method in which the effort can be standardised to a base value based on experience. This base value can then be calculated accordingly for the current project, sub-project, work package or process. This special case works for tasks that produce a quantifiable amount of results, such as 100 m^2 roofing, writing 50 test routines, plastering 50 m^2 masonry.

▶ Standardised Experience Estimation

If an event company knows from experience that the effort for seating a room is approx. 1 h per 50 seats, the effort for the entire party with 500 seats can be easily calculated: 500 seats * 1 h/50 seats = 10 h effort = 1.25 days effort (conversion from hours to days considering an 8 h working day).

If the hall is to be seated in one working day (8 h), you need 1.25 people. ◀

- **Parametric Estimation**

Parametric Estimation

In parametric estimation methods, the sizes of effort, duration or costs are calculated using formulas and various parameters. The values of the parameters are again estimated.

The best-known parametric methods are:

- **COCOMO**

This method comes from software development and is based like the standardised experience estimation on a standardised value from past comparable projects. Unlike other estimation methods, COCOMO (COnstructive COst MOdel) only calculates the effort. The calculation is as follows:

$$PM = m^{*}KSLOC^{n}$$

The individual terms have the following meanings:

- PM—Effort in person-months
- m—Complexity factor (including productivity)
- n—Scale effects, e.g. degree of innovation, development flexibility
- KSLOC—KILO-Source-Lines-Of-Code: gives the expected value for lines of programming code in 1000.

All three input values (m, n and KSLOC) are again based on experience or expert knowledge.

- **Three-point estimation**

The three-point estimate is based on the following formula:

$$\text{Estimated value} = \frac{OV + 4RV + PV}{6}$$

Explanation:
- OV—optimistic estimated value
- PV—pessimistic estimated value
- RV—realistic estimated value

Here too, the individual estimates are again based on experience or expert knowledge.

- **Mixed methods**

In practice, the methods are sometimes used together. For example, expert interviews or experience estimates are used to determine the parameters of the parametric estimation methods.

Mixed methods

Effort Estimates

As already mentioned, the effort in practice usually refers to human resources (project team members, project staff, external experts, etc.).

When estimating the effort for a work package or a process, often only the technical processing is taken into account, from which visible results emerge. This leads to the effort being underestimated. To estimate the total effort of a work package, the following effort-relevant components must be included in the estimate in addition to the actual processing time:
- Effort for familiarisation,
- Effort for planning and/or organisation,
- Effort for coordination and leadership,
- Effort for documentation/reporting incl. obtaining signatures.

This results in the total effort for a work package from the sum of the efforts of processing time and possibly efforts of the above additional components. By adding the estimate of the work package efforts, the effort of individual phases, subprojects or the total effort of the project can be calculated.

Duration Estimate

Estimating the duration of the individual work packages or processes is one of the prerequisites for the project's schedule planning. This estimate is made by experts and the person responsible for the work package. The duration of a work package/process can also be calculated from the estimated effort (if this is already available). In addition to the effort, the time factors listed in ◘ Table 3.7 must be known or estimated.

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Table 3.7 Factors for calculating the duration

Factor	Description	Examples
Duration	Period for the creation of the results of the work package/process	
Effort	Net processing time	An effort of 40 person-hours was estimated for work package 1.2.3 and 10 test hours
Number of resources	Quantity of available resources (people or tools)	A maximum of three database developers and two test environments are available in a work package
Availability	Proportions of time in %, during which a certain resource is available. The formula gives the average availability	For the work package, 2 people are available 50% and one person 80% over the entire work package duration. The average availability is then 60% ((50% +50% +80%)/3). The test environments are available 100%
Waiting times	Waiting times arise from delivery times, decisions, obtaining signatures. During the waiting times, there is usually no effort	From experience, the report to be created at the end still requires an average of 2 working days (16 working hours), as it has to be signed by several people. When creating a foundation for a house, the Waiting time from the drying of the concrete
Risk buffer	Times for risks arise from experience or risk analysis	An additional 10% of the work package duration is added as a time buffer

The duration is calculated as follows:

Duration

$$\text{Duration} = \frac{\text{Effort}}{\text{Number of resources}^{*}\text{Availability}} + \text{Waiting times} + \text{Risk buffer} \tag{3.1}$$

The duration is calculated separately for each type of resource. If the resource types can be used in parallel, the max. duration of the resources is used.

In practice, resources often refer to employees or technical aids (e.g. crane in construction, test environments in IT), which are limited. For this reason, the availability for each individual resource must be determined. Thus, the term *Number of resources * availability* represents an average size.

The duration for the example mentioned in ◘ Table 3.7 is calculated as follows:

Duration for the resource *Personnel:*

$$\text{Duration} = \frac{40}{3^{*}60\%} = 22.2\ \text{h}$$

Duration for the resource *Test environment:*

$$\text{Duration} = \frac{10}{2^{*}100\%} = 5\ \text{h}$$

Thus, the duration of this work package without waiting times and buffers is 22.2 h, which represents the maximum value of 22.2 h and 5 h. Taking into account the waiting time (16 h) and the buffer (10% of 22.2 h and 16 h= 3.8 h) from ◘ Table 3.7, the duration of the work package results:

$$\text{Duration incl. waiting times and buffer} = \\ 22.2\ \text{h} + 16\ \text{h} + 3.8\ \text{h} = 42\ \text{h}$$

With an 8-h working day, the work package then lasts 5 days and 2 h.

Limitation of Estimates

Law of diminishing marginal utility

Law of diminishing marginal utility

A phenomenon or a law that must be taken into account in project management is the law of diminishing marginal utility. Simply explained, this means that an increase in resources does not result in a proportional reduction in duration, as employees need to be coordinated and led and some time is required for coordination among each other. If you want to cover a roof with two roofers, for example, and the effort is 40 days, the duration is 20 days. In this example, waiting times and risk buffers are to be neglected and availability is assumed to be 100%.

$$\text{Duration} = \frac{\text{effort}}{\text{number of resources}} \tag{3.2}$$

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Taking into account an availability of 100% and neglecting the waiting time and the risk buffer, results:

$$\text{Duration} = \frac{40}{2} = 20$$

The duration can be halved purely mathematically by doubling the number of roofers (so four roofers), i.e. 10 days duration. If you now plan to reduce the duration to 1 day, this corresponds to a number of roofers of 40 people, because:

$$\text{Number of resources} = \frac{\text{effort}}{\text{duration}} = \frac{40}{1} = 40$$

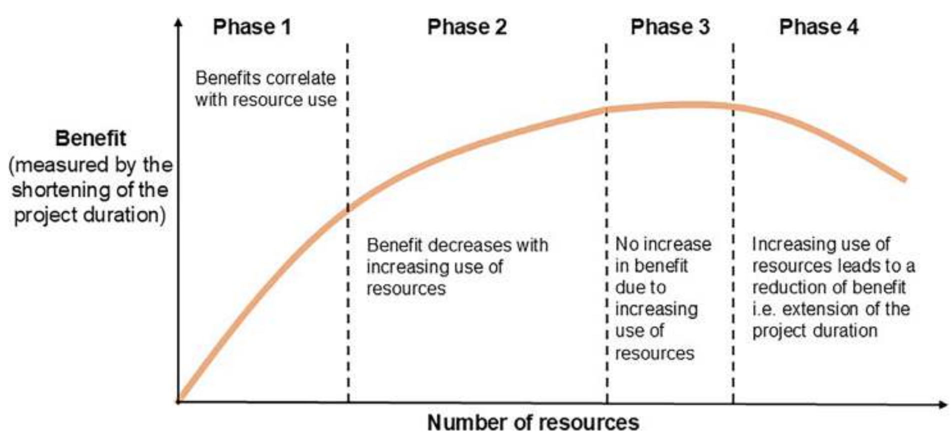
Purely mathematically this is correct. However, if you imagine 40 roofers on one roof, it is easy to understand that the duration cannot be 1 day.

In practice, the increasing number of resources leads to a reduced increase in benefits (in this case the reduction of duration) up to no benefit. This can be vividly illustrated by the roofer example, if you imagine 100 roofers on the roof of a single-family house. In the worst case, it can even be counterproductive, by mistakes happening or the roofers falling off the roof because it is too full.

The law of diminishing returns (◘ Fig. 3.7) applies to all project types, as the increased number of resources results in increased coordination and management effort.

▪ Parkinson's Law and Student Syndrome

There are two more phenomena in estimates that have more of a psychological character.



◘ **Fig. 3.7** Law of diminishing returns

Parkinson's Law

According to the so-called Parkinson's Law, the processing time expands to the extent that time is available for this task. This law is not based on scientific investigations, but is now cited in management literature and accepted in practice.

Student Syndrome

The student syndrome is a procrastination behaviour, which is not only observed in students. However, a distinction must be made between postponing due to lack of time, aversion, lack of interest, other priorities, which neither leads to performance losses nor to subjective suffering, and pathological procrastination behaviour (procrastination, see also ► Sect. 6.1.4).

3.1.5.5 Methods and Instruments of Time Planning

In the context of time planning, there are several instruments that are used depending on the type and size of the project. The most common instruments are

- Milestone plan,
- Schedule list,
- Network plan,
- Bar chart.

These four methods and instruments will be presented in the following.

Milestone Plan

Milestone Plan

A milestone plan is the simplest form of scheduling. Here the milestones of a project are entered in table form.

For small and medium-sized projects that are not too complex, i.e. do not have too many dependencies of the work packages, a milestone plan as the sole planning and controlling instrument regarding the dates is often sufficient.

When creating a milestone plan in table form, the base value, the planned value and the actual value should be specified as parameters for each milestone. The base value is the date that was set in the original milestone plan. The planned value corresponds to the base value in the planning phase, but can change during the controlling phase. By taking into account planned values and actual values, the milestone plan is also a controlling instrument. This fact is described in ► Sect. 3.2.2.

The code is either the WBS code, in which the milestones are integrated into the sequence logic of the work packages. Or the milestones are simply numbered through, as applied in the milestone plan in ◘ Table 3.8.

When using IT tools in the context of milestone planning or scheduling, the WBS code is used for coding the milestones

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Table 3.8 Milestone plan

No.	Code	Milestone Name	Base	Plan	Actual
1	MS1	Project Started	01.04.	01.04.	
2	MS2	Approval Granted	15.05.	15.05.	
3	MS3	Goods Received	20.06.	20.06.	
4	MS4	Partial Object Accepted	20.07.	20.07.	
5	MS5	Project Completed	30.08.	30.08.	

(e.g. *1.2.4.*). In doing so, the already created coding of work packages/tasks is changed by inserting milestones.

Every project has at least two milestones, the start and the end milestone.

Ei-Ti AG Christmas Party—Milestone Plan

Laura Leiter discusses with her project client Paul Perso about the most important milestones in the project. Both have identified the following milestones.

The milestones *MS1—Project started, MS4—App approved* and *MS5—Project completed* are so-called fixed milestones, which are assigned to a fixed date. They thus form temporal anchor points in the project. The other two milestones *MS2—Concept created and MS3—Programme approved* are dynamic milestones and depend on the end date of the work package in terms of timing.

No.	Code	Milestone Name	Basis	Plan	Actual
1	MS1	Project started	06.08.		
2	MS2	Concept created	t.b.d.		
3	MS3	Programme approved	t.b.d		
4	MS4	App approved	26.11.		
5	MS4	Project completed	21.12.		

Schedule List

After identifying milestones, which can be found in every project, further information is needed to create a schedule. The starting point is the work packages and possibly tasks that have been derived from the work packages as part of detailed scheduling. The work packages can be read from the work breakdown structure (► Sect. 3.1.3). The people responsible for each work package have also been determined using the project organisation chart (► Sect. 3.1.4) or the responsibility assignment matrix (► Sect. 3.1.4) and are responsible for determining the further information. An important piece of information is the duration of the work package or a task. This should be estimated or calculated from the effort. In addition, dependencies (ordering relationships: predecessor–successor) are of particular importance for network diagrams and linked bar charts. The information can be entered into a list or table. This list is called a task list or schedule list (◘ Table 3.9).

The indication of the person responsible is optional, as it has no influence on the creation of the schedule, but is helpful. This way, you don't always have to look into the organisational planning, e.g. into the RACI matrix or the organigram, for each work package or process.

Also optional is the indication of the effort, which is only mandatory in the resource and cost planning. However, the duration can be calculated from the effort. And since the estimation of the effort is needed in the next step, it can of course already be estimated at this point.

The indication of the predecessor refers to the work packages, processes or milestones that should have taken place before the element under consideration (work packages, processes or milestones). That is, the element under consideration builds on it. Start and end are the dates when the element should start or end. Milestones have a duration of 0. That is, the start and end dates coincide.

3

Practical tip

Project management software

For smaller projects (less than 20 elements, i.e. processes, work packages and milestones) project management software for creating a network and/or bar plan is not absolutely necessary. Here, the process list as a planning and control instrument is often sufficient.

For medium or large projects with more than 20 elements, the use of software makes sense for efficiency reasons.

Table 3.9 Schedule list

Code	Element Type	Name	Responsible	Effort (PD)	Duration (D)	Predecessor	Start	End
Unique Code	*Milestone, Process or Workpackage*	*Name of the Element*		*Opt. Indication of effort*	*Estimation or Calculation from Effort*	*Predecessor of this Element*	*Is calculated*	*Is calculated*
A								
B								
C								

Ei-Ti AG Christmas Party—Schedule

Based on the work packages from the work breakdown structure, Laura Leiter and her team consider whether the work packages need to be detailed into processes first to ensure better schedule planning. The team doesn't see a need for this at the moment.

Laura Leiter prefers to ask Emil Expert, who just happens to be passing by her office. Emil Expert confirms her decision and explains to her that a very detailed schedule often leads to difficulties in implementation. In addition, this must also be monitored and adjusted accordingly, which represents a relatively high project management effort. From his experience, he knows that the effort for detailing often hardly corresponds to the benefit stands. Emil Expert advises her to keep the plan as simple as possible—taking into account controllability and optimal project duration. And besides, the work package managers can still decide if they want to plan more precisely within the packages. The project team then creates the following schedule:

Code	Element type	Name	Responsible	Duration (D)	Predecessor	Start	End
MS1	MSt	Project started	L. Leader	0		06.08.	06.08.
1.1.1	WP	Planning	L. Leader	10	MS1	6.08.	17.08.
1.1.2	WP	Controlling	L. Leader	100	MS1	6.08.	21.12.
1.1.3	WP	Completion	L. Leader	5	1.4.2	17.12	21.12.
MS5	MSt	Project completed		0	1.1.3	21.12.	
1.2.1	WP	Create rough concept	L. Leader	10	1.1.1	20.08.	31.08.
1.2.2	WP	Create program	L. Leader	10	1.2.1	03.09.	14.09.
MS2	MSt	Concept created		0	1.2.2	17.9.	17.9.
1.3.1	WP	Invite guests	S. Schein	30	1.2.2	17.9.	26.10.
1.3.2	WP	Prepare room and technology	T. Tekkus	10	1.3.4	26.11.	07.12.
1.3.3	WP	Order food and drinks	S. Schein	20	1.3.1	29.10.	23.11.
1.3.4	WP	Prepare programme	L. Leader	50	1.2.2	17.09.	23.11.
MS3	MSt	Programme approved		0	1.3.4	26.11.	26.11.
1.3.5	WP	Develop app	S. Soft	60	1.2.1	03.09.	23.11
MS4	MSt	App accepted			1.3.5	26.11.	26.11.
1.4.1	WP	Coordinate celebration	L. Leader	1	1.3.2	7.12	8.12
1.4.2	WP	Evaluate feedback	S. Soft	5	1.4.1	10.12.	14.12

The following notes regarding the schedule:
- The code for the milestones is MSt, where the milestones are numbered in order of their chronological sequence.
- The duration is given in days, with 5 days (working days) corresponding to one calendar week.
- The start and end are given as dates, with milestones having the same start and end date and thus a duration of 0 days.

Network Plan

Creating a schedule as a table without further graphical aids requires some experience. The dependencies in the form of predecessor relationships in table form are difficult to grasp as a whole. Here, the network plan is a suitable tool for planning and clarifying the dependencies of work packages or tasks. After successful representation of the dependencies of the individual work packages or tasks and taking into account the duration of the individual work packages or tasks, the network plan provides information about the total duration of the project. It also shows the order in which the work packages/tasks are processed and thus the start and end of individual work packages, the critical path and the buffer of the project.

The dependencies of the work packages can be differentiated between the types shown in ◘ Fig. 3.8:

In practice, the normal sequence is most common. In addition, there are various types of dependencies for some relationships of work packages/tasks.

In the dependencies, a delay or an acceleration or overlap can be planned between the work packages/tasks. will occur. A delay usually refers to planned buffer times or waiting times. For example, after the work package *Pouring the foundation* a few days must be waited before the work package *Building walls* can start. This planned buffer or waiting time is represented in a network diagram by a positive time value on the relationship arrow (e.g. *+3d* for 3 days delay between the work packages/tasks). In the case of an overlap, a negative time value (e.g. *–5h* for 5 h overlap in the work packages/tasks) is noted. Graphic examples of this can be found in ◘ Fig. 3.12.

Delay and acceleration

A network diagram represents the work packages/tasks and milestones with their relationship. Depending on these elements, which are primarily represented in the network diagram (work packages/tasks, milestones and the relationships), there are several types of network diagrams. In practice, the activity node network diagram is common in German-

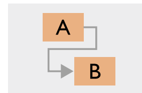
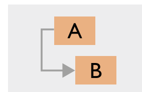
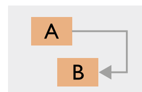
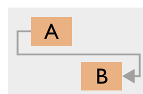
Designa-tion	Type of Dependence	Description	Example	Schematic Depiction
Normal Sequence	Finish – Start	Work package/process A must be finished so that Work package/ process B may start	Walls can only be built (B) once the foundation is laid (A)	
Start Sequence	Start – Start	Work package/process A must be started so that work package/ process B can be started. The starts of both work packages/processes depend on each other	Parallel processes: *mix concrete (A)*, must be started along with the process *pour base plate (B)*.	
Finish Sequence	Finish – Finish	Work package/process A must be finished so that work package/ process B can be finished. The finishes of both work packages/processes depend on each other	Parallel processes: *move (A)* must be finished so that *clear out old apartment (B)* can be finished	
Jump Sequence	Start – Finish	Work package/process B can only be finished once work package/process A has been started	*Decommission IT-system (A)* can only be started once *put new IT into operation (B)* is finished	

Fig. 3.8 Types of dependencies. [a]This example also shows the division of the work package *Create foundation* into the two tasks *Mix concrete* and *Pour floor slab*

speaking countries. The activity node network diagram represents the work packages/tasks as nodes or rectangles and the relationships as arrows. The work packages/tasks contain the information shown in Fig. 3.9.

The network diagram graphically represents the work packages/tasks and their relationships. The time buffers (buffer times), possible bottlenecks and the critical path can be calculated and displayed. The critical path is the path in the network diagram on which work packages or tasks are arranged so that the total buffer time is 0.

Figure 3.10 shows an example of a network diagram.

Creation of a network diagram

Basically, a network diagram is created as follows:

1. The work packages of the work breakdown structure are broken down into tasks if necessary.
2. The work packages/tasks are estimated in terms of duration.
3. If not already done, further milestones are identified and their dependency on the work packages is shown.

3

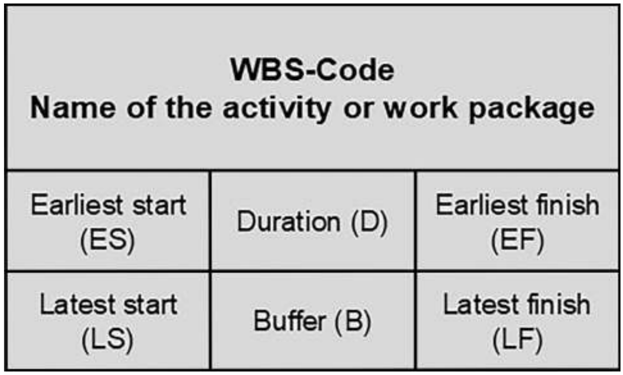


Fig. 3.9 Structure and content of a work package/task within a network diagram

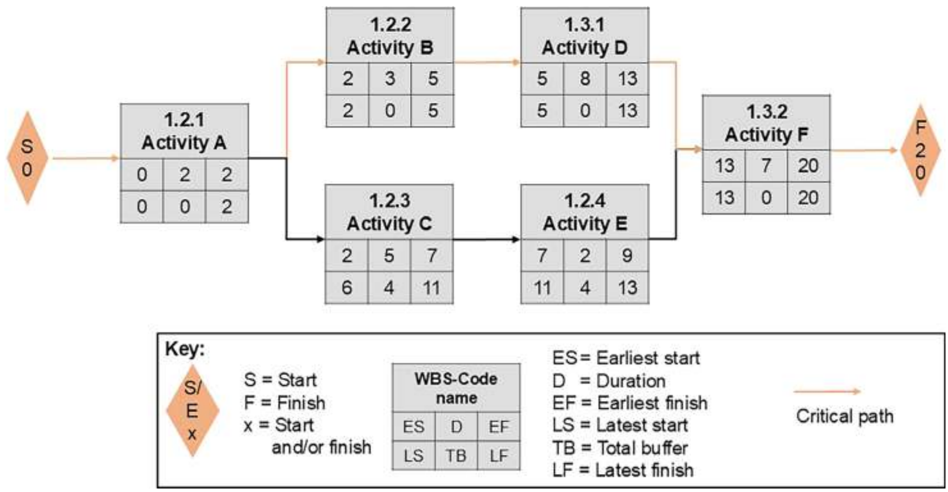


Fig. 3.10 Example network diagram

4. The dependencies of the work packages/tasks are determined and graphically represented (representation of the logical sequence of work packages, tasks and milestones).
5. Forward scheduling

To determine the duration of the project, a so-called forward scheduling is carried out, in which the earliest start and the earliest end are calculated. The following rules apply to the normal sequence:

- The start milestone (MSt_{Start}) begins at 0. It corresponds to the earliest start (ES) of the first work package/task or the first work packages/tasks:

$$ES_{Start} = MSt_{Start} = 0 \tag{3.3}$$

- The calculation of the earliest finish EF of a work package/task results from the addition of the FA and the duration:

$$EF_n = ES_n + D_n \tag{3.4}$$

- The earliest start (ES) of a work package/task corresponds to the earliest end (EF) of the predecessor,[1] i.e.

$$ES_n = EF_{n-1} \tag{3.5}$$

If there are several predecessors, the largest value of the latest EF is taken:

$$ES_n = \max\ EF_{(\text{all predecessors of } n)} \tag{3.6}$$

► Example Network Diagram

In the example from ◘ Fig. 3.10, it starts from the start milestone “S” at time 0 and thus process A also starts at 0 (ES = 0). Since the duration of process A is 2, the ES of process B and process C is also 2. The ES of process F is 13, as both process D and process E are the predecessors and here the maximum ES value of the two predecessors is adopted (ES of process D = 13). The total project duration is 20, which corresponds to the ES of process F.

6. Backward Scheduling

The calculation of the buffer times of the individual work packages/processes and the critical path of a project is done using a so-called backward scheduling. The latest end (LF) and the latest start (LS) of the individual work packages/processes are calculated from the end milestone, so to speak backwards. The following rules apply:

The EF of the project, which corresponds to the total duration, is the LF of the predecessor(s) of the end milestone:

$$MSt_{finish} = LF_{finish} \tag{3.7}$$

The calculation of the LS of a work package/process results from the subtraction of the LF and the duration:

$$LS_n = LF_n - D_n \tag{3.8}$$

The LF of a work package/process corresponds to the LS of the successor, i.e.

$$LF_n = LS_{n+1} \tag{3.9}$$

1 Note: The terms *process* and *predecessor* may sound similar, but they have different meanings. A *process* is a sequence element, a *predecessor* is the arrangement relationship of processes (opposite of *successor*).

If there are several successors, the smallest LS value of the corresponding work packages/processes is taken:

$$LF_n = \min\ LS_{(\text{all successors of n})} \tag{3.10}$$

◄

► Example Network Diagram

In the backward scheduling in the example from ◘ Fig. 3.10, it starts from the end milestone E with a duration of 20. The predecessor of milestone E is process F, which therefore also receives the LF value of 20. The LS of process F is 13 (20–7 = 13). The LS of process F is the LF of the two predecessors D and E of process F. One subtracts the duration from the LF values in processes D and E and gets for process D an LS value of 5 (13–8 = 5) and for process E an LS value of 11 (13–2 = 11). When determining the LF of process A, the smallest value of process B and C is transferred, as these two are successors of process A. In this example, the LF value of process A is 2 (LS of process B is 2). The LS value of process A results in 0. The LS value of the first process must correspond to the ES. Otherwise, there is a calculation error.

7. Calculation of Buffer Times
   The formation of the difference of the LF and EF or LS and ES results in the so-called total buffer of a work package/process n:

$$\text{Total buffer } (TB) = LF_n - EF_n = LS_n - ES_n \tag{3.11}$$

◄

Total Buffer

The total buffer is the time span by which a work package/process can start later or be extended without endangering the project end (cf. Patzak & Rattay, 2017, p. 260).

The total buffer indicates by how much a work package/process can be shifted without moving the successor, if it is in its latest position, i.e. the successor starts at LS.

The total buffer is the buffer that has an impact on the entire project. That is, if this buffer = 0, a delay or shift of the corresponding work package/process would have a direct influence on the end date of the project.

► Example Network Diagram

The total buffer of process C in the example from ◘ Fig. 3.10 is 4 (11–7 = 6–2 = 4) and of process E also 4 (13–9 = 11–7 = 4). A delay of process C by 2 time units would reduce the buffer of process C itself by 2 time units, but it would also let process E start 2 time units later (ES = 9 and EF = 11), which implies a reduction of the buffer of E also by 2 time units. If the total buffer of C is exhausted i.e. equals 0, any further delay would immediately shift the project end and thus the total duration of the project from 20. Increase time units. ◄

Furthermore, there is a buffer that, unlike the total buffer, does not immediately lead to the reduction of the buffers of consecutive or subsequent work packages/operations.

Free Buffer

The free buffer is the time span by which a work package/operation can be moved without endangering the EF of the other work packages/operations (in accordance with DIN, 2009a).

The free buffer (FB) is calculated as follows:

$$\text{Free Buffer } (FB)_n = \min.ES_n - EF_n \quad (3.12)$$

► Example Network Plan

In the example from ◘ Fig. 3.10, a free buffer of 4 results for operation E. Operation E can be moved a maximum of 4 time units without affecting the subsequent operation F. The calculation is made by subtracting the ES of operation F (13) from the EF of operation E (9). In this example, the total buffer and the free buffer of operation E are identical. ◄

The difference between total buffer and free buffer is graphically illustrated in ◘ Fig. 3.11.

8. Calculation of the critical path

Critical Path

The critical path is the path of consecutive work packages/operations that cannot be moved or extended without affecting the overall duration of the project. The work packages/operations on the critical path have no buffer.

3

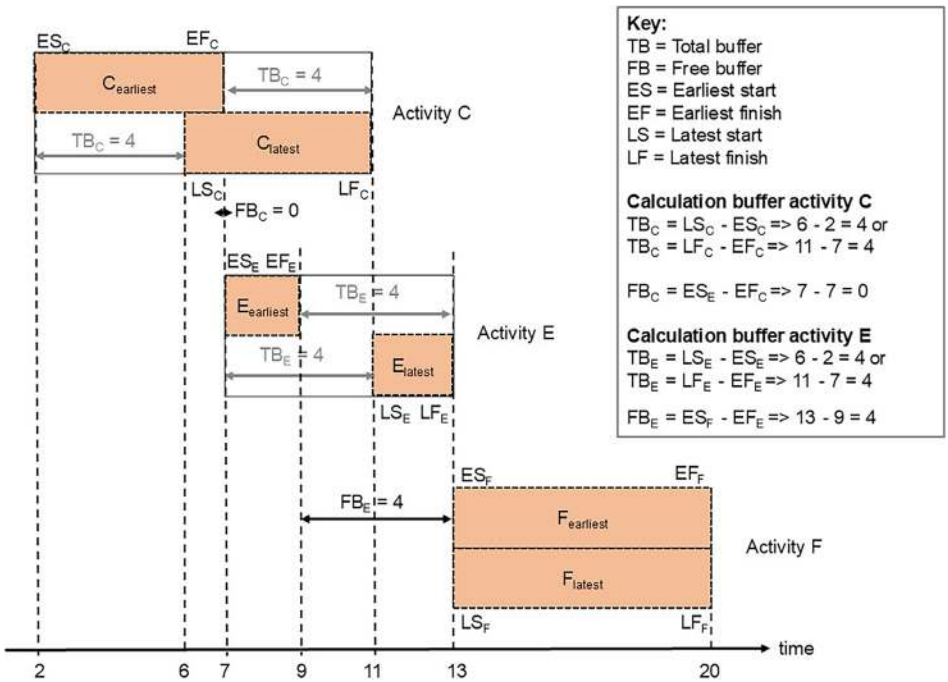


Fig. 3.11 Difference between total buffer and free buffer

Thus, all work packages/operations on the critical path, whose total buffer is 0, are located.

The critical path in a project is always continuous, i.e. it starts at the start milestone and runs through the network plan to the end milestone without interruption. However, there can be more than one critical path in the project.

► Example Network Plan

In the example from Fig. 3.10, the operations A, B, D and F form the critical path, as these each have a total buffer of 0. ◄

Computational vs. planned buffers

The total buffer and the free buffer are computational buffers that result from the arrangement relationships and the duration of the work packages/operations. However, there are also the planned buffers described above.

Planned buffers within a work package/operation

On the one hand, these can be planned when estimating or calculating the duration of a process/work package (formula 3.1). The buffer is added via the waiting time and/or the risk buffer.

Planned buffers between work packages/operations

On the other hand, the buffer can also be planned between two work packages/operations (delay).

In addition, accelerations, i.e. parallelisation, can also be planned. The scheduling of buffer times or accelerations is common in practice.

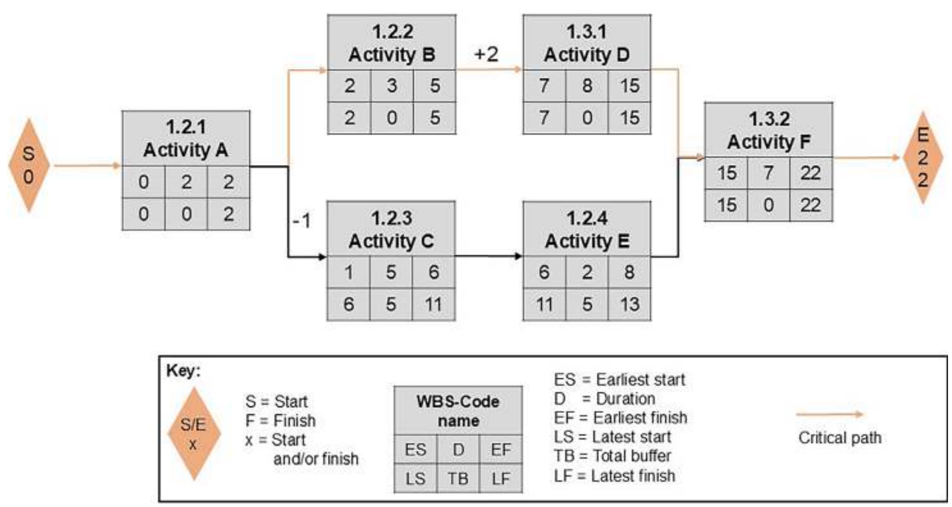
► Example Network Plan

The example from ◘ Fig. 3.10 is supplemented here by a buffer of 2 between operation B and operation D. Planned buffers between two work packages/operations are represented by the corresponding positive duration on the arrow. The acceleration is represented by the neg. duration. In our example −1 between operation A and operation C. Operation C thus starts 1 day before the end of operation A. By taking into account planned delays (waiting times, buffers) and accelerations (parallelisation) between work packages/operations, the values such as duration, start and end times of the work packages/operations change accordingly (◘ Fig. 3.12). ◄

As project size increases, a network plan quickly becomes confusing. Therefore, bar charts are often used in practice.

Bar Chart

The bar chart is also a scheduling tool and provides high transparency for a large number of work packages. In addition to the information on the duration of individual work packages, the bar chart also provides the start and end dates, i.e., a specific date. This information is not directly apparent in a network plan.



◘ **Fig. 3.12** Example network plan with planned delays and acceleration

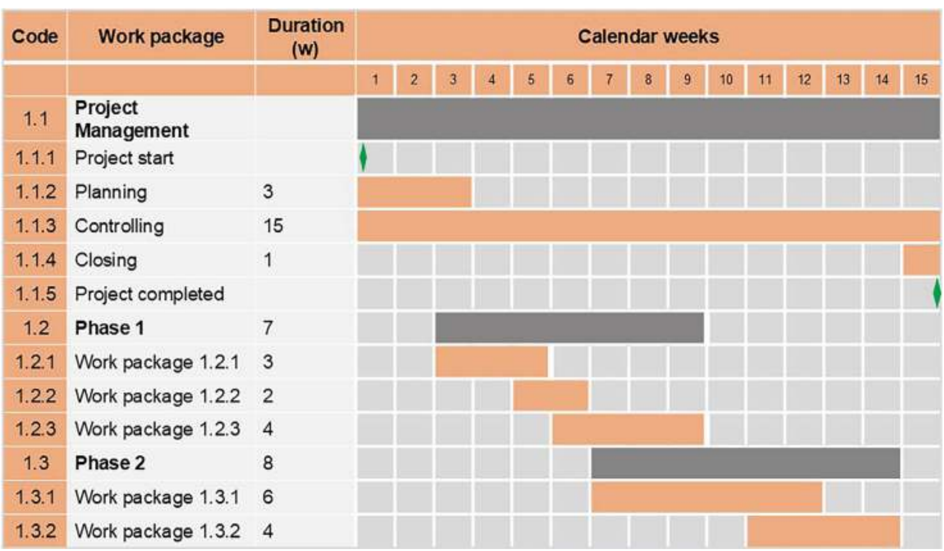
The bar chart visualises the duration of individual work packages (processes) on a timeline depending on the time unit, e.g., days, weeks, months. The longer a bar is, the longer the duration of a work package. Dependencies can also be made visible through an arrow. The planned total duration and the expected end date of the project are easy to read on a bar chart. Milestones can also be depicted.

With the help of the bar chart, it is easy to see which work packages or processes are processed simultaneously (in parallel), delayed or sequentially. Work packages or processes can be grouped into phases or phases can be broken down into work packages or processes. The phases of the phase-oriented work breakdown structure (► Sect. 3.1.3) correspond to the phases in the bar chart. In theory, phases run sequentially. In practice, as shown in ◘ Fig. 3.13, phases can also overlap and thus be processed partially in parallel.

The bar chart is not just a planning tool. It also serves

- as a communication tool for the temporal sequence of the project within the project team,
- as a reporting medium, e.g., for decision-making bodies and clients,
- as a basis for project status reports,
- for the presentation of all temporal aspects of a project.

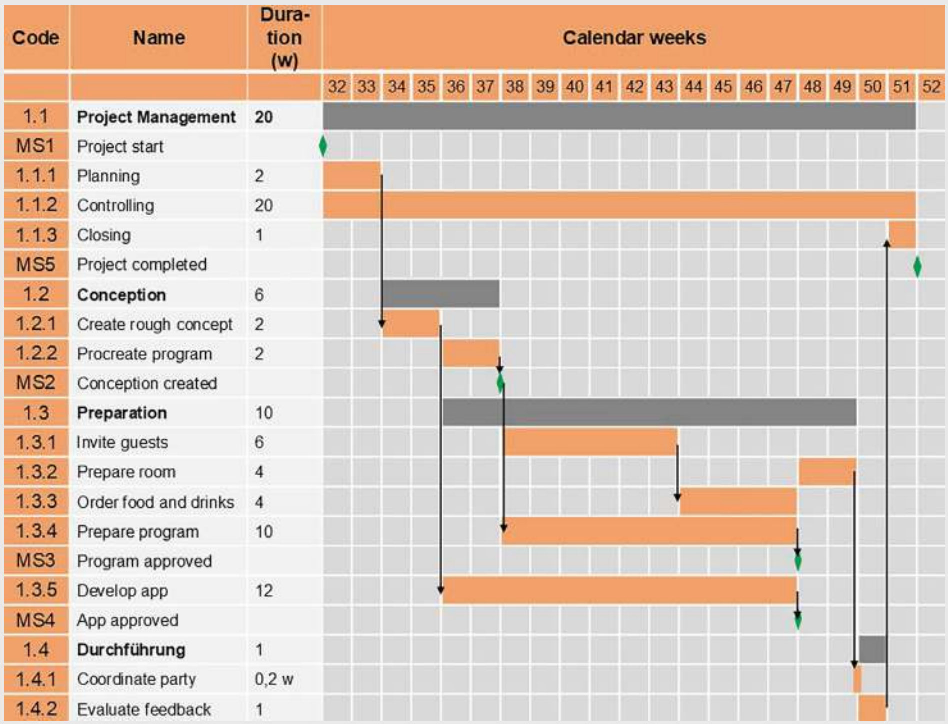
The creation of a bar chart is already generally explained in ◘ Table 3.6.



◘ **Fig. 3.13** Example bar chart

Ei-Ti AG Christmas Party—Bar Chart

Laura Leiter has found out that suitable software for creating a network and bar chart is available at Ei-Ti AG. Now she is annoyed that she had to calculate everything manually, as in her studies. However, she soon learns from her colleague that there are only a few licenses at Ei-Ti AG and they are all already assigned. Since she now knows how long it can take to get a license, her annoyance quickly fades and she starts creating a bar chart, which she easily derives from the schedule.



In summary, the four scheduling methods are once again compared (◘ Table 3.10).

3.1.6 Resources

Resources are of great importance for all organisations in general and for projects in particular, as they are always limited.

Resources

Resources refer to the means relevant for a project (staff, materials, tools), i.e. the means required for the implementation of the project.

In contrast to the general definition of resources in business administration, which also includes time and finances under

3

Table 3.10 Overview and comparison of scheduling methods

Method	**Characteristics**	**Advantages and Derived Areas of Application**
Milestone Plan	– tabular overview of the milestones	– easy to create – ideal for small to medium-sized projects with few work packages and dependencies
Schedule	– tabular overview of work packages/processes and milestones – Mention of duration, start and end dates as well as order relationships if necessary – no graphical overview – usually the basis for the bar chart	– all information is available as a value – recommended as the sole planning tool for small to medium-sized projects – suitable as additional information for all types of projects and sizes
Network diagram	– graphical representation of work packages/tasks with their dependencies on each other (predecessors and successors) – various parameters are displayed per work package/task (start, end, duration, buffer etc.)	– calculation of impacts in case of shifts – used when detailed planning is required and in projects where the dependencies of the work packages/tasks are central, such as construction projects
Gantt chart	– graphical representation of work packages on a timeline – corresponds to the network diagram + *timeline*	– start and end dates of the work packages/tasks are easy to identify particularly suitable for many work packages – suitable for all types of projects

resources, in the context of project management only the resources (personnel and material resources[2]) within resource management are considered, as time and finances (costs, budget) are considered separately due to their importance and different methods and tools.

Achieving the project's time specifications (milestones incl. end date) can only succeed if the necessary personnel and material resources are available. When, who and what is needed in the project is determined by the project manager or the project team based on the work breakdown structure and the schedule. Through the temporal assignment of the work packages and the work to be done, the resource requirement (personnel and material resources) can be determined. Furthermore, resource bottlenecks can be identified by comparing them with the available resources. This can lead to an adjustment of the schedule.

2 Resources = Materials and aids. Aids do not enter into the final product and are, for example, machines, PCs, rooms, test facilities, drawing devices, tools.

Depending on the size and complexity of a project, different methods for planning resources are suitable. The following presents the resource plan and the resource histogram.

3.1.6.1 Resource plan

The resource plan is usually presented as a table and provides an overview of the demand and supply of resources for a project. It also provides information about the utilisation of resources. It is created for the duration of the project. The resource plan can be created per work package, phase or even per time unit (e.g. weekly).

Table 3.11 shows an example of a resource plan for a small project with three phases. The resources are exclusively related to people.

For all three phases 1.1, 1.2. and 1.3, the need for project-days (equivalent to the effort) is estimated for the required roles.

The effort is added up per role and displayed for each role (line *Total Effort*). Subsequently, the gross availability, i.e. the capacity with which a group of people with the corresponding competence is available for the project, can be determined per phase or work package and written into the line *Gross Offer*. To determine the availability per work package or phase, the start and end dates of the work packages or phases from the schedule must be known. The gross availability is adjusted for planned absences, such as holiday and training days. The result, the so-called net availability, is written in the corre-

Table 3.11 Example structure of a resource plan

Work packages or phases	Effort	Roles (competency requirements)				
WBS-Code	In PD	PM	PTM 1	PTM 2	PS 1 (HR)	PS 2 (SW Developer)
1.1	5	3	1	1	–	–
1.2	10	–	1	–	7	2
1.3	40	–	–	2	3	35
Total Effort	**55**	**3**	**2**	**3**	**10**	**37**
Gross Availability		10	20	3	30	25
Planned Absence		–	3	2	–	–
Net Availability for the Project		**10**	**17**	**1**	**30**	**25**
Over-/Undercoverage		**+7**	**+15**	**–2**	**+20**	**–12**

WBS—Work breakdown structure, *PD*—Project-days, *SW*—Software, *PM*—Project Manager, *PTM*—Project Team Member, *PS*—Project Staff sponding column. The data on availability comes from the department that provides the staff. The over- or undercoverage results from subtracting the required work performance (total effort) from the net availability and is shown in the line *Over- / Undercoverage*.

Christmas Party Ei-Ti AG—Resource Plan

Laura Leiter and her core team take another look at the work packages and the bar plan for their project and decide to carry out the resource planning at phase level, as the work packages are not too large in terms of effort and a phase view is therefore sufficient. For phase 1.3, they decide to view it at work package level, as the development of the app should be shown separately here.

Work Packages/ Phases	**Effort**	**Roles (Competency Requirements)**										
WBS-Code	**In PD**	**PM**	**SPM Progr.**	**PS Progr.**	**SPM Cater-ing**	**PS Cater-ing**	**SPM Guests**	**PS Guests**	**SPM App**	**PS App**	**SPM Tech**	**PS Tech**
1.1	10	5	1		1		1		1		1	
1.2	10	5	1		1		1		1		1	
1.3	99	2	3	5	1	3	1	2	2	70	2	8
1.3.1	3						1	2				
1.3.2	10										2	8
1.3.3	4				1	3						
1.3.4	10	2	3	5								
1.3.5	72								2	70		
1.4	5	1	1	3								
Total Effort	**124**	**13**	**6**	**8**	**3**	**3**	**3**	**3**	**4**	**70**	**4**	**8**
Gross Avail-ability		20	20	5	5	5	3	2	5	48	5	10
Planned Absence		–	2	2	–	–	–	–	2	8	–	–
Net Avail-ability for the Project		**20**	**18**	**3**	**5**	**5**	**3**	**2**	**3**	**40**	**5**	**10**
Over-/ Under-coverage		**+7**	**+12**	**–5**	**+2**	**+3**	**0**	**–1**	**–1**	**–30**	**+1**	**+2**

PM—Project Manager, *SPM*—Subproject Manager, *PS*—Project Staff, *Progr.*—Programme, *WBS*—Work breakdown structure, *PD*—Project-days

From the resource plan, it is immediately clear that the development cannot be carried out in terms of personnel if additional staff is not made available or the work package is reduced in terms of scope (sub-delivery object and thus reduced work and less effort).

The assignment of roles is also already clear, so that a name assignment can be made at this point.

Already assigned to roles are:

- PM—Laura Leiter,
- SPM Programme—Laura Leiter,
- SPM Guests—Sabine Schein,
- SPM Catering—Sabine Schein,
- SPM App—Sven Soft,
- SPM Technology—Tommi Tekkus.

Furthermore, the following staff has been determined for the project staff together with the superiors from the line:

- PS Programme—Sabine Schein,
- PS Guests—Intern Paula Prima,
- PS Catering—Sabine Schein,
- PS App—four developers of Ei-Ti AG,
- PS Technology—two people from an external service provider.

Laura Leiter discusses the consideration of further resources with her core team. The team identifies the entire catering and the room equipment (especially tables, chairs, stage) for the Christmas party. Since these resources are procured externally, the team decides not to consider them further in the resource planning, as they are not a critical good in the sense of limitation in their own company. However, these resources must definitely be taken into account in the cost planning.

3.1.6.2 Resource Histogram

A resource histogram shows the over- and under-coverage of the resources (usually personnel) of the project along a timeline displayed. Since the presentation is on a timeline, the table cannot simply be graphically plotted, as these were determined at the phase or work package level.

The following steps lead to a resource plan based on time units, which is shown in ◘ Fig. 3.14:

1. Based on the schedule (schedule list, bar chart or network diagram) the required resources per time unit for each work package determined (capacity requirement). The dis-

Gantt chart Project 4711										
Work package (WP)	Ressource demand (Project Days - PD) incl. distribution per WP	weeks								
		1	2	3	4	5	6	7	8	9
WP 1	4 PD (50% / 50%)	2	2							
WP 2	20 PD (equally distributed)			4	4	4	4	4		
WP 3	15 PD (10 PD in cw4, 5 PD in cw6)				10	0	5			
WP 4	10 PD (4 PT in cw5 & cw6, 2 PT in cw7)					4	4	2		
WP 5	6 PD (equally distributed)							2	2	2
	Demand (PD)	2	2	4	14	8	13	8	2	2
	Availability (PD)	4	4	4	4	4	4	4	4	4
	Result (PD)	2	2	0	-10	-4	-9	-4	2	2

Fig. 3.14 Resource plan based on time units

tribution of the resource requirement per time unit is of great importance. There can be an equal distribution of resources, i.e. the same number of resources is available per time unit (example in Fig. 3.14 for the work package 1, 2 and 5). But there can also be a different resource requirement for each time unit (example for work package 3 and 4). The resource distribution results from the upcoming work during the work package and can be estimated by the experts.

2. Ask or check the availability of the individual employees. The availability of resources per time unit is reported via the corresponding department.
3. By comparing the demand and availability per time unit (in the example in weeks) identify over- or under-coverage.

The representation of the table using a bar chart is called resource histogram (Fig. 3.15).

The grey columns represent the resource requirement per week. The thick line with a value of four project-days corresponds to the resource availability per week.

Thus, a resource histogram is the graphical representation of a resource plan based on time units.

If there are shortfalls, the options in Table 3.12 should be examined. The compensation of resource shortfalls is called resource levelling.

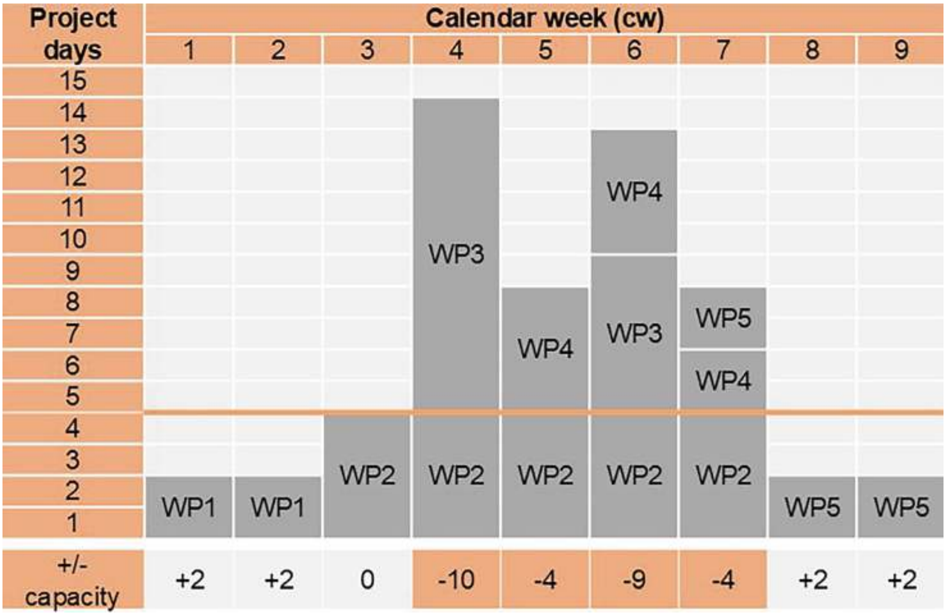


Fig. 3.15 Resource histogram

Table 3.12 Options for resource levelling in a project

Option	Prerequisite	Impact on the PM elements
Shifting of work packages/tasks	Resources are available for the new dates	None
Extending/Stretching of work packages/tasks	Sufficient resources available during the extension	If the work package/task is not on the critical path, it can be extended until the buffer is exhausted. If the work package is on the critical path, the extension of the overall project duration must be approved by the steering committee
Compression of tasks	More capacity (number of resources or availability) is needed	Possibly shorter project duration for work packages/tasks on the critical path; can be artificially extended by buffer times if necessary
Breaking down work packages into tasks with the aim of better scheduling the shorter tasks	Waiting times in tasks that can be used to shorten or tasks that can then be processed in parallel	Possibly shorter project duration for work packages/tasks on the critical path; can be artificially extended by buffer times if necessary

(continued)

3

Table 3.12 (continued)

Option	Prerequisite	Impact on the PM elements
Purchase of external resources	Consideration of the law of diminishing marginal utility; temporal availability	Increase in project costs and thus approval of the steering committee
Reduction of performance (corresponding partial deliverable and its work)	Partial deliverable can be reduced	Reduction of the project deliverable and thus approval of the steering committee
Overtime	In agreement with working time law and possibly works council	Additional costs for overtime compensation (for tariff employees)
Outsourcing of the corresponding work package/task	No time delay; the work package must be completed at least in the same time (duration) and at the planned time	Likely higher costs
Increase in productivity	There must be “more productive” resources (for people: people with more experience) available	None
Escalation	None	Not known at this time

Ei-Ti AG Christmas party—Resource histogram table

From the resource plan and the bar chart, Laura Leiter and her team determine the over- or under-coverage of personnel for this project. In distributing the personnel over weeks, the team assumed an even distribution. They receive a table as a basis for the resource histogram:

Code	Duration	Calendar weeks																				
	w	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1.1.	20	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	
1.1.1.	2																					
1.1.2.	20																					
1.1.3.	1																					
1.2.	4			2,5	2,5	2,5	2,5															
1.2.1.	2																					
1.2.2.	2																					
1.3.	14																					
1.3.1.	6							0,5	0,5	0,5	0,5	0,5	0,5									
1.3.2.	2																	5	5			
1.3.3.	4													1	1	1	1					
1.3.4.	10							1	1	1	1	1	1	1	1	1	1					
1.3.5.	12					6	6	6	6	6	6	6	6	6	6	6	6					
1.4.	1																			5		
1.4.1.	0,2																					
1.4.2.	1																					
Demand		0,5	0,5	3	3	9	9	8	8	8	8	8	8	8,5	8,5	8,5	8,5	5,5	5,5	5,5	0,5	
Availability		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
Total		3,5	3,5	1	1	-5	-5	-4	-4	-4	-4	-4	-4	-4,5	-4,5	-4,5	-4,5	-1,5	-1,5	-1,5	3,5	

3.1.7 Costs

One of the most important project sizes and project management elements for organisations are the costs of a project. As an element of the “triple constraints”, project costs are an important criterion for measuring project success. Project costs are determined over the entire duration of a project. It is important to note that costs are incurred during the project planning phase as well as at the end of the project. After the project is completed, no further costs are incurred within the project. Costs incurred after the project is completed, such as product maintenance, training (if not already carried out during the project period), are borne by other sources.

Type of cost

By breaking down the costs incurred into different types of costs, it is clear what money is being spent on in the project. Project costs can include the following types of costs:

- **Personnel costs**

Personnel costs usually include wages or salaries, social costs and other costs directly attributable to a person, such as training or IT (laptop, mobile phone, etc.). Personnel costs are determined by multiplying effort and daily rate. The effort was already estimated in the resource planning (▶ Sect. 3.1.6). The daily rate includes the costs that a person costs the organisation per day. The daily rate is usually determined as a full cost rate, i.e. in addition to the directly attributable personnel cost components already mentioned (salaries, social costs etc.), all overhead costs of the organisation are calculated proportionally to employee groups. The overhead costs then include room rents, total IT costs, levies for management, human resources etc. Thus, the daily rate corresponds to the costs that a person costs the organisation with all care efforts etc. The daily rates are either determined on average for all persons of an organisation or on average for individual areas/departments. The daily rate is not calculated for individual persons.

Example: A software developer needs 15 project days for the project and costs 500 EUR per day (daily rate). This results in project costs of 7500 EUR for the software developer.

- **Material costs**

Material costs can be divided into the following sub-cost types:

- Material costs—Material costs are often given in *unit costs * number of material units*.
- Operating costs—Operating costs are incurred for auxiliary and operating resources, such as rooms, tools, IT (hardware and software) including licence costs, energy, postage, documentation etc. Licence costs are usually

incurred for software licences and either depend on the number of users or are shown as a fixed price for an unlimited number of users.
- External services for external project participants. The external services can be shown on a cost basis, like the internal personnel *(effort * external daily rate)*, or as a fixed price. The difference results from the contract design (► Sect. 5.7.2).
- Travel costs—Travel costs are costs incurred in the course of a business trip for the project. They include, among other things, travel costs, accommodation costs, parking fees etc.

In practice, the breakdown of material costs depends on the controlling system available in the organisation. Against this background, the material costs should be structured accordingly.

Example: For the project, five PCs at 1000 EUR each are charged with a one-time software licence fee of 500 EUR per workstation. This results in material costs of 5000 EUR and 2500 EUR licence costs. In addition, a potential supplier abroad must be visited. This involves costs for the flight, the taxi from the airport to the supplier, parking fees at the home airport and the mileage allowance to and from the home airport to the place of work, which amount to a total of 1500 EUR.

The material costs for this work package are therefore 9000 EUR (5000 EUR + 2500 EUR + 1500 EUR).

- **Other costs**

Other costs include capital costs, insurance, depreciation, risk costs, etc.

3.1.7.1 Cost Estimation

The estimation methods have already been described in ► Sect. 3.1.7.1 and apply analogously to cost estimation.

3.1.7.2 Cost Plan

The basis for creating a cost plan is also the work breakdown structure or the work packages and the resource plan. The estimation of project costs is usually done in a bottom-up planning manner, i.e. the costs are determined at work package level and added up until the total costs of the project have been determined. This sum corresponds to the total budget to be planned for the project. This value is compared with the project budget, which is usually determined top-down, in the project application.

The following procedure is common in the context of cost planning in projects:

1. Determination of the different types of costs per work package or phase,
2. Determination or procurement of the daily rates relevant to the project for the project participants (an average daily rate for all or separated by organisational units or functions),
3. Calculation of the material costs per work package (materials, external services, travel expenses etc.),
4. Summary of the total costs per work package,
5. Addition of the total costs per work package (project costs).

In reference to the resource plan exemplarily created in ◘ Table 3.11, a corresponding cost plan has the structure shown in ◘ Fig. 3.16.

When creating the ◘ Fig. 3.16, the following should be considered:

1. First, the types of costs for the three phases should be clarified i.e. which types of costs (personnel costs, travel costs, external services costs or operating resources costs) are incurred per phase. This information is located in the second column *Cost type*.
2. Then, in the next column *Resource type* for the personnel, the different competencies (here: PM, HR or SW-Dev.), for the external services the different competencies (SW-Dev.) and for the operating resources the different goods (here: HW-PC and SW-License) are named.
3. The quantity for the respective resource is estimated. It should be noted here that the persons are estimated in PD (project days) and the operating resources in the quantity. So, for example, in phase 1.3 the resource *PM* at the cost type *Personnel* has an effort of 2 PD. As part of the operating resources costs, for example, 5 PCs must be purchased.
4. For the personnel, the daily rate and for the operating resources the unit costs are added. For example, the PM resource under step 3 has a daily rate of 700 EUR and a PC costs 2000 EUR.
5. The sums for the different resource types result from the multiplication of effort times daily rate for the personnel and of quantity times unit costs for the operating resources. For example, this results in costs of 1400 EUR for the PM resources in phase 1.3 and costs of 10,000 EUR for the 5 PCs.
6. The sum of the cost type results from the addition of the costs for the resources. For example, the costs for the per-

Phase / Work package	Cost type	Resource type	Quantity	Cost per unit	Total per cost- / reource type	Cost per work package / phase
WBS Code		Resources	Effort (PD) / amount	Daily rate / cost per unit / fix	Euro	Euro
1.1.	Personell	PM	5	700 €	3.500 €	3.500 €
		HR	-	600 €	0 €	
		SW-Dev.	-	500 €	0 €	
		Total	5		3.500 €	
1.2	Personell	PM	1	700 €	700 €	8.000 €
		HR	7	600 €	4.200 €	
		SW-Dev.	2	500 €	1.000 €	
		Total	10		5.900 €	
	Material: travel	Flight, hotel, taxi, parking			2.100 €	
1.3	Personell	PM	2	700 €	1.400 €	41.700 €
		HR	3	600 €	1.800 €	
		SW-Dev.	15	500 €	7.500 €	
		Total	20		10.700 €	
	Material: Third party	SW-Dev.	20	1.000 €	20.000 €	
	Material: Software	HW-PC	5	2.000 €	10.000 €	
		SW - Lizence	5	200 €	1.000 €	
		Total			11.000 €	
Total						**53.200 €**

Key:
PM – Project Manager
HR – Human Reources
SW-Dev. – Software Development
PD – Project Days

Fig. 3.16 Example structure of cost plan at phase level

sonnel are 10,700 EUR and for the operating resources 11,000 EUR.
7. The total costs per phase or work package are determined by adding the sum of the cost types. In our example for phase 1.3 this is 41,700 EUR.
8. The costs for the overall project result from the addition of the costs of the phases or work packages. In the example, the total costs are 53,200 EUR, which are calculated from the costs of phases 1–3.

3.1.7.3 Cost Trend and Cost Sum

Often in organisations, not only the total costs or the costs for a work package are needed, but the cost trend per observation period (e.g. per month) is required.

Analogous to resource planning, the costs can also be calculated per unit of time. In practice, this requirement is made by controlling. With the help of the schedule and the resource plan, the project costs can be assigned in time. This makes it transparent at which point in the project financial resources must be provided.

◘ Figure 3.17 shows how the costs per unit of time (here weeks) are calculated using the information from the schedule, the resource and cost planning.

The basis for the calculation of costs per unit of time are the efforts per week, which are drawn from the bar chart and

1. Effort per time unit from Gantt chart and resource plan

2. Daily rates and material costs from the cost plan

Gantt chart Project 4711												
Work package (WP)	Resource demand (Project Days - PD) incl. distribution per WP	weeks 1	2	3	4	5	6	7	8	9	Daily rates	Mate-rial
WP 1	4 PD (50% / 50%)	2	2								2 t€	3 t€
WP 2	20 PD (equally distributed)			4	4	4	4	4			1 t€	
WP 3	15 PD (10 PD in cw4, 5 PD in cw6)				10	0	5				0,5 t€	5 t€
WP 4	10 PD (4 PD in cw5 & 6, 2 PD in cw7)					4	4	2			1 t€	4 t€
WP 5	6 PD (equally distributed)							2	2	2	1,5 t€	
	Demand (PD)	2	2	4	14	8	13	8	2	2		
3. Multiplication of effort and daily rate per WP per week	Personell (t€)	4	4	4	9	8	10,5	9	3	3		
4. Addition of material costs at the end of each WP	Material (t€)		3				5	4				
5. Result (3. + 4.)	Total (t€)	4	7	4	9	8	15,5	13	3	3		

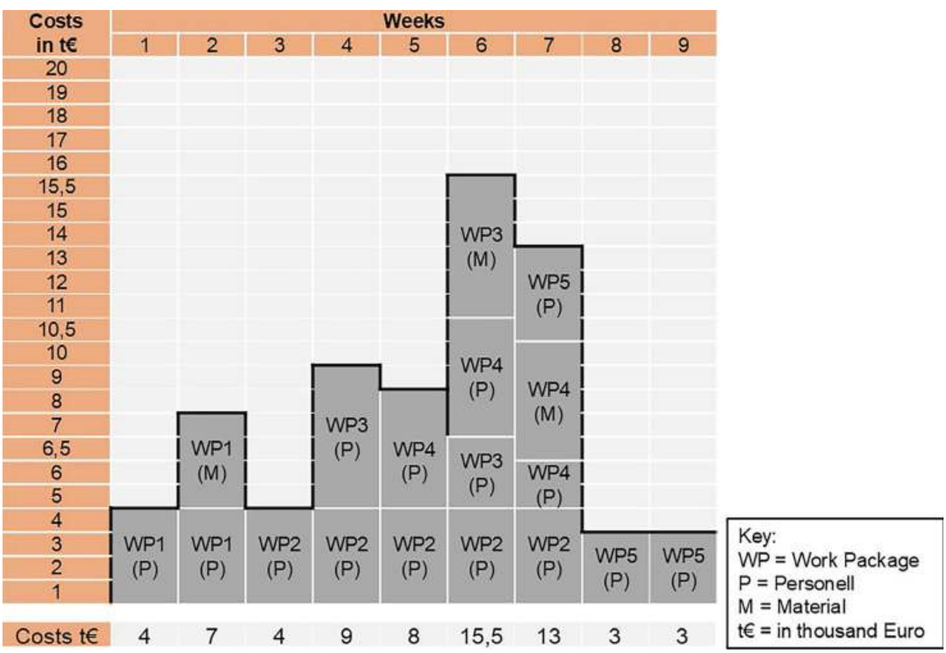
◘ **Fig. 3.17** Calculation of costs per week resource plan (Step 1). The costs for the corresponding resources per work package/phase can be taken from the cost plan (Step 2). Subsequently, the calculation of personnel costs per unit of time is made on the basis of the efforts multiplied by the corresponding daily rate (Step 3). In the fourth step, the calculation of material costs is made, taking into account that the material costs are only considered at the end of each work package/phase (Step 4). In practice, the calculation rule for when the material costs are incurred is specified by the controlling department and should therefore be clarified in advance. The addition of personnel and material costs results in the costs per unit of time (Step 5).

The graphical representation of the costs per week is called cost histogram (◘ Fig. 3.18).

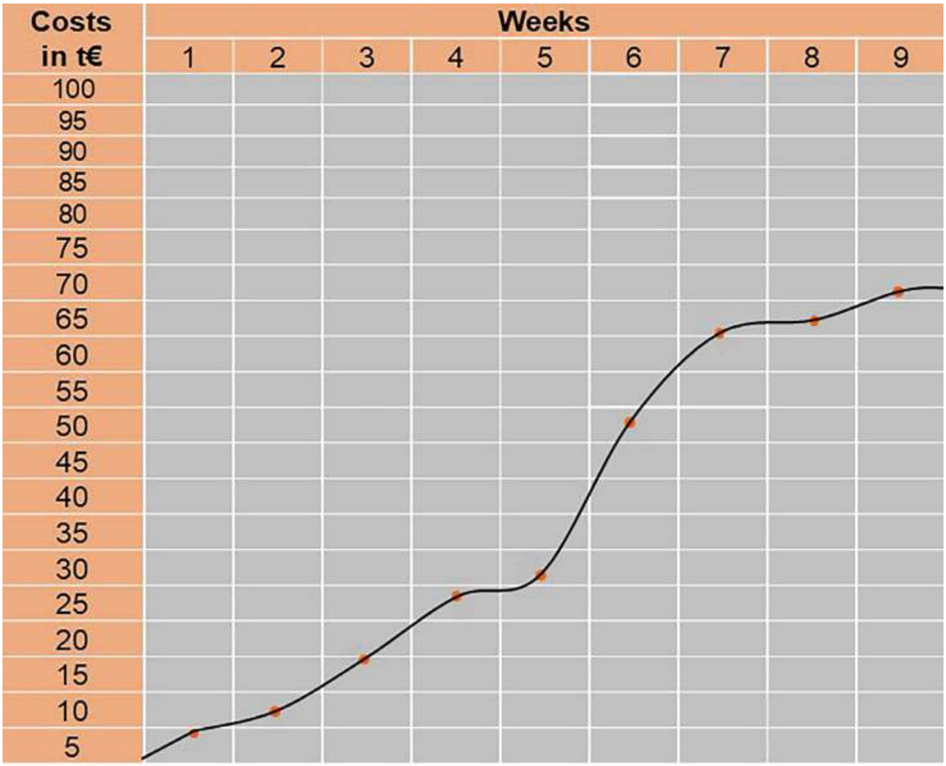
The cumulative representation of the costs per unit of time is called the cost sum line. The cost sum line shows the development of costs over the course of the project. It becomes visible at which point in time which costs will be incurred in the project according to the plan (◘ Fig. 3.19).

In summary, the following points are relevant in the context of cost planning:

- The individual cost types of the project are defined and possibly coordinated with the controlling department.



◘ **Fig. 3.18** Cost histogram



	1	2	3	4	5	6	7	8	9
costs t€	4	7	4	9	8	15,5	13	3	3
Costs accumulated t€	4	11	15	24	32	47,5	60,5	63,5	66,5

Fig. 3.19 Cost sum line

- The costs are planned at the work package level. That is, the costs incurred for each work package are estimated or calculated and the expected total costs per work package are calculated.
- The cost estimates are made by the work package managers, possibly with further experts.
- From the cost estimates for the work packages, the total costs of the project are determined (bottom-up approach).
- In connection with the schedule, the project manager determines when which costs will be incurred in the project (cost histogram and cost sum line).

3

Ei-Ti AG Christmas party—Table of cost histogram and cost sum line

From the efforts and corresponding daily rates per phase or work package, Laura Leiter determines the personnel costs. She has coordinated and determined the material costs with the corresponding sub-project managers. The booking time plays an important role for the temporal consideration. She has defined this information together with the controlling department. The following material costs result for the relevant phases or work packages with the booking times.

Code	Name	Material costs in k€	Description	Booking time
1.3.1.	Invite guests	20	Travel costs for 40 people (€500 per person)	End of project
1.3.2.	Prepare room	20	Rent for tables, chairs, stage and all technology as well as decoration	End of work package
1.3.3.	Order drinks and food	16	€40 drinks and food flat rate for 400 guests	End of phase 1.3
1.3.4.	Prepare programme	5.0	DJ and Artist	Phase End 1.3
1.3.5.	Develop App	20.0	IT Development Environment	Work Package Start
1.4.	Implementation	2.0	Trade Security	Phase End 1.4

Using the bar chart, personnel costs and material costs, Laura Leader determines the personnel costs and material costs per week. The total costs per week give the values for the cost trend. The cumulative costs per week give the values for the cost sum line. All values and information are shown in the following figure.

Code	D	Calendar Weeks																				E	DR	PC	MC	TC
	w	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	PD	t€	t€	t€	
1.1.	20	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	10	1,0	10,0		10,0
1.1.1.	2																									0,0
1.1.2.	20																									0,0
1.1.3.	1																									0,0
1.2.	4			2,5	2,5	2,5	2,5															10	0,7	7,0		7,0
1.2.1.	2																									0,0
1.2.2.	2																									0,0
1.3.	14																					99				0,0
1.3.1.	6							0,5	0,5	0,5	0,5	0,5	0,5									3	0,7	2,1	20.0	22,1
1.3.2.	2																	5	5			10	0,7	7,0	20.0	27.0
1.3.3.	4													1	1	1	1					4	0,7	2,8	16.0	18.8
1.3.4.	10							1	1	1	1	1	1	1	1	1	1					10	0,7	7,0	5,0	12,0
1.3.5.	12					6	6	6	6	6	6	6	6	6	6	6	6					72	0,8	57,6	20,0	77,6
1.4.	1																			5		5	0,7	3,5	2,0	5,5
1.4.1.	0,2																									0,0
1.4.2.	1																									0,0

Costs personell	0,5	0,5	2,3	2,3	7,1	7,1	6,4	6,4	6,4	6,4	6,4	6,4	6,7	6,7	6,7	6,7	4,0	4,0	4,0	0,5	97 €
Costs material	0,0	0,0	0,0	0,0	20,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	20,0	23,0	20,0	83 €
Costs p. week	0,5	0,5	2,3	2,3	27,1	7,1	6,4	6,4	6,4	6,4	6,4	6,4	6,7	6,7	6,7	6,7	4,0	24,0	27,0	20,5	180 €
Costs accumul.	0,5	1,0	3,3	5,5	32,6	39,6	46,0	52,3	58,7	65,0	71,4	77,7	84,4	91,1	97,8	105	109	133	160	180	180 €

Key:
D = Duration
w = weeks
E = Effort
PD = Project days
DR = Daily rate
PC = Costs Personell
MC = Costs Material
TC = Total Costs

Laura Leader has now also determined the total costs of the project amounting to 180,000 EUR. It should be noted that the personnel costs of 97,000 EUR represent internal services of the company's own staff and are therefore only calculative costs. That is, the company does not spend any additional money on personnel costs, as these costs are already covered by salaries etc. The material costs, on the other hand, have to be paid additionally, i.e. money flows out of the company (so-called cash-out). From the company's point of view, they represent the total costs for the project (see figure above).

3.1.8 Factual Environment

Depending on how detailed the factual environment was described in the initiation phase, a detailed examination can take place in the planning phase. In any case, the table including the measures, responsibilities and the deadline should be completed.

Ei-Ti AG Christmas Party—Finalisation of the action planning of the factual environment

Laura Leader, together with her team, completes the planning of the influences of the factual environment with regard to the three parameters measures, responsibility and deadline based on the table developed in the initiation phase (► Sect. 2.5).

Name	Influence	Measures	Responsibility	Deadline
Regulation of imputed income	influences the financial model	to be taxed	Paul Perso	until November
Restructuring Project Restruct	Employees feel insecure and, in some departments, have a negative attitude towards the Ei-TI AG	- Project marketing for a Christmas party project - Change management project for Restruct	Laura Leiter Laura Leiter Informs PL of Restruct	immediately immediately
Software development projects at Ei-TI AG	might cause resource shortfalls , if processed simultaneously	Escalation to steering group regarding prioritization of projects	Laura Leiter	Immediately
Guideline for handling personal data of Ei-TI AG	might stop the project or the function Employee Database , if not used correctly	Involvement of work council	Paul Perso	immediately

3.1.9 Stakeholder

The stakeholder management process is essentially similar to the management of the factual environment (► Sect. 2.5).

3

Ei-Ti AG Christmas Party—Finalisation of the action planning within the framework of stakeholder management

Laura Leader, together with her team, completes the stakeholder table (► Sect. 2.6). They check whether there are any additional stakeholders and identify measures for stakeholders who have a neutral or negative attitude, the responsibility for the measures and the completion date *(by when)*.

Stakeholder	Attitude	Influence	Measures	Responsibility	By when
Laura Leader (Project Leader)	Positive	Medium	None		
Paul Perso (Head of HR)	Positive	High	None		
Gerd Genau (Managing Director)	Positive	High	None		
Frank Findus (CFO)	Neutral	High	Status report and personal conversation	Paul Perso	Monthly
Martina Mark (Marketing Manager)	Negative	High	Inclusion in steering committee	Paul Perso	Immediately
Volker Verse (Sales Manager)	Neutral	High	Status report and personal conversation	Paul Perso	Monthly
Sabine Schein (Project Team Member)	Neutral	Low	Informal conversations as needed	Laura Leiter	Regularly
Ina Itti (Head of IT)	Negative	High	Inclusion in steering committee	Paul Perso	Immediately
Sven Soft (Software Developer)	Positive	Medium	None		
Agile Development Team	Positive	Low	None		
Catering Managing Director	Neutral	Medium	Regular information	Laura Leiter	Monthly

Stakeholder	Attitude	Influence	Measures	Responsibility	By when
DJ Dodo	Positive	Medium	None		
Caretaker Hans Hauser	Negative	Low	Info conversation with Laura Leiter	Laura Leiter	By the end of August
Facility Manager Tommi Tekkus	Neutral	Medium	Regular information	Laura Leiter	Monthly
Employees in Berlin	Neutral	Low	None		
Employees in Dresden	Neutral	Low	None		
Employees abroad	Negative	Low	Project marketing	Laura Leiter	Immediately
Emil Expert	High	Medium	None		

3.1.10 Risks and Chances

Goals of Risk Management

The risk management in projects, which considers both risks and chances, essentially pursues two goals. On the one hand, measures should be identified and initiated to avoid or at least reduce risks and support chances. On the other hand, within the framework of risk management, a monetary and temporal buffer can be determined, which should be added to the overall budget and the schedule.

Experience shows that not all risks can be avoided or eliminated. There is no project in which something unplanned and uncertain does not happen, which has an impact on the project's success.

Risk and Chances

Risks and chances are uncertain, possible events or situations that have negative (risks) or positive (chances) effects on the success of the project. They are characterised by the probability of occurrence and the impact on success.

3

Risk Management

Risk management includes all procedures, models, methods, tools and templates that serve to identify and assess risks and chances, plan measures and monitor and control both these risks and chances as well as the entire process related to them.[3]

Problem

A risk is distinguished from a problem by the probability[3] of occurrence and the temporal reference. That is, a risk always lies in the future and has a probability of occurrence between 1% and 99%. A problem is a present obstacle in the course of the project that requires a solution to avoid project damage.

Crisis

Thus, risk management is a procedural model in which measures are considered before a problem occurs. In the case of problems, that significantly endanger the success of the project, we speak of crises.

3.1.10.1 Risk Categorisation

Risks can be divided into different classes according to their origin:

- commercial risks (contract),
- technical risks,
- project management risks,
- risks regarding the organisation including processes,
- human risks,
- external risks, e.g. political and environmental risks, resistance by stakeholders outside the organisation,
- etc.

In addition, risks can also be divided according to their impact. The categories correspond to the project management elements:

- technical and performance risks, e.g. the deliverable is not accepted by the customer, the performance does not meet the intended quality standards,
- commercial and cost risks, e.g. the project becomes more expensive than expected due to additional costs,
- schedule risks, e.g. the project is completed later than expected,
- resource risks, e.g. resources are not available as planned in terms of quality or quantity,

3 In risk management, *both* risks and opportunities are considered.

- social risks, e.g. the project staff are demotivated and have a lower performance capability,
- etc.

Individual risks can influence each other, e.g. complement or exclude each other.

In risk management, a distinction is made between project and product risks. The project risk is distinguished from the product risk in terms of the project management elements, as with quality management. The product risk refers to the deliverable. The project risk primarily relates to the creation process of the deliverable and thus to the remaining project management elements. In development projects, the Product risk continues to apply to the product that is manufactured following the development project. Thus, product risk management extends temporally beyond project risk management. The demarcation between project and product risk is not always clear-cut. There are risks that can be assigned to both categories, such as the risk of demotivation, which can have an impact on the performance of project participants and thus have an effect on time (project risk), but at the same time can also have an effect on the quality of the deliverable and thus also represents a product risk.

Demarcation and overlap of project and product risk

In every organisation that operates professional project management, there should be a budget for risk management to implement measures. A risk budget can be provided for a project (individual project management) as well as across all projects of an organisation or an organisational unit (multi-project management level). At the individual project management level, each project has its own risk budget, from which preventive and corrective measures are paid for. At the multi-project management level (► Chap. 7), there is a budget for the projects considered, from which the projects can serve themselves after prior approval.

Risk management takes place in all project management phases. Obvious risks are already identified in the initiation phase. In the planning phase, further risks are identified and corresponding measures for avoidance or reduction are derived. In the controlling phase, the risks, the measures and their success are monitored and, if necessary, new risks are identified. Risk management thus begins in the initiation phase and is evaluated as a process in the closing phase.

3.1.10.2 Process Steps and Methods/Tools of Risk Management

The following process steps are repeatedly carried out in the context of risk management:

1. Risk identification → Identify risks,
2. Risk analysis → Evaluate and analyse risks,
3. Action planning → Plan preventive and corrective actions,
4. Controlling → Monitor and evaluate actions and status of risks/chances.

■ Risk identification

In the first process step of risk management, risks and chances of the project are identified. This step can already be carried out roughly, i.e. for the most important risks and possibly chances in the initiation phase, but should be carried out at the latest for all risks to be identified in the planning phase. Transparency about project goals, the deliverable, and the course of the project based on the work packages and the schedule, as well as the resource plan and project organisation, is important here. The project manager, the project team and possibly further experts should answer the following questions:

- What risks and chances can be specifically identified?
- What problems have already occurred in the past in one's own environment or in other organisations or organisational units?
- What else could occur?
- What risk categories exist in this project that help to identify further risks?

The Ishikawa diagram described in ► Sect. 2.8.3 can help to identify risks and chances. The two questions *What could prevent us from achieving the project goals? (Risks) and What could help us achieve the project goals? (Chances)* should be answered based on the original structure of the diagram (machine, human, environment, method, material, measurement). However, the six categories can also be replaced by the typical categories of project risks (such as contractual, technical, organisational, cross-cutting, other, ► Sect. 3.1.10.1).

Other working techniques, such as creativity techniques (brainstorming, mind map) or survey methods (document analysis, observations, workshops), which are described in ► Sect. 2.8, can be used in the identification of risks and chances.

When identifying risks and chances in the context of document analysis, the following existing project documents should be analysed:

- Requirement documents, such as e.g. specification sheet,
- Contracts,
- Project order,
- Work breakdown structure,
- Schedule,

- Resource plan,
- Organisational chart, role description, communication plan,
- etc.

Risk analysis

Risk analysis

The identified risks and chances are, if not already done, categorised and then evaluated according to their probability of occurrence and the extent of the impact. The estimate is based on empirical values, expert knowledge or concrete analyses. Specifically, the risk of diseases in an organisation can be analysed, for example, by averaging the percentage of sick leave in a certain period of the last few years, in the case of risk of frost in the context of construction projects, statistical weather data is consulted. The impact can also be simply analysed or determined in some cases. In construction projects, penalties[4] are often due. A penalty corresponds to the impact in case of delay.

The evaluation, analysis and presentation of risks and chances is usually done in table form. This is then referred to as a so-called risk register *(risk list, risk table)*.

Qualitative risk assessment

In addition to naming the risk, the reason for a possible occurrence should be identified and the impact briefly described. The determination of the risk reason is important for the derivation of actions. The description of the impact is important for the following column *impact evaluating* (◘ Table 3.13) of significance. When evaluating the impact, a distinction can be made between qualitative and quantitative evaluation. In the qualitative evaluation, an evaluation of the impact and the probability of occurrence is made in categories, e.g. *low, medium, high* or *1, 2, 3.* The categories form a sequence and thus enable prioritisation (ordinal scale). If both parameters (impact and probability of occurrence) are expressed in numerical sizes, these can be multiplied and the so-called risk priority (RPI) results. With the help of the risk priority number, the risks and chances can be put in order, i.e. prioritised.

$$\text{Risk priority index} = \text{impact}^{*}\text{probability} \tag{3.13}$$

4 Contractual penalty for non-fulfilment of the contract (e.g. in case of delay or inferior quality ► Sect. 5.7.2).

Table 3.13 Qualitative risk register

No.	Risk	Reason	Impact (descriptive)	Impact (evaluating)	Probability of occurrence	RPI
1	Supplier A delivers late	Poor order clarification	Project is delayed as AP is on the critical path	High (3)	Medium (2)	6
2	Employees are missing	Flu wave in Feb.	Project is delayed depending on the affected AP	Medium (2)	Medium (2)	4
3	Lack of PMgt. competence	PL still inexperienced	Conflicts in the team and delay	Medium (2)	Low (1)	2
4	Interface B does not work	Lack of experience	Delivery object is not completed	High (3)	Low (1)	3

WP—Work packages, *RPI*—Risk Priority Index, results from the multiplication of impact (rating) and the probability of occurrence, *PMgt.*—Project management, *WP*—Work package, *PM*—Project Manager

Quantitative Risk Assessment

In the quantitative assessment, an attempt is made to express the impact in monetary units (euro, dollar etc.) and in time units (days, weeks etc.). The probability of occurrence must be given in a percentage. The multiplication of the impact and the probability of occurrence results in a monetary and temporal expected value. This value is a calculated size, since a risk or an opportunity either occurs completely (probability of occurrence 100%) or not at all (probability of occurrence 0%). The addition of the expected values of the individual risks results in the monetary or temporal risk buffer, which is added to the costs calculated up to that point and the end date (Table 3.14).

Contingency Reserve

In the quantitative risk assessment, the impact can be assessed in monetary terms (money), in terms of effort (work) or in terms of time (duration). The expected value can thus have up to three dimensions. The sum of the individual expected values is called the Contingency Reserve and ultimately represents the buffer of the project.

Management Reserve

As there are, as shown in Fig. 3.21, also unknown risks, which cannot be estimated, a buffer can also be formed for this, the so-called Management Reserve.

Similar to the stakeholder matrix, the risks can also be graphically represented to get a simple overview. The graphic

Table 3.14 Quantitative risk register

No.	Risk	Reason	Impact (descriptive)	Impact (rating)	Probability of occurrence	Expected value
1	Supplier A delivers late	Poor order clarification	Project is delayed as WP is on the critical path	€10,000 2 weeks	30%	€3000 3 days
2	Staff shortage	Flu wave in Feb.	Project is delayed depending on the affected WP	€6000 1 week	20%	€1200 1 day
3	Lack of PMgt. competence	PL still inexperienced	Conflicts in the team and delay	€5000 –	10%	€500
4	Interface B does not work	Lack of experience	Delivery object is not completed	€30,000 4 weeks	10%	€3000 2 days
Risk buffer						**7700 €** **6 Days**

WP—Work packages, *PMgt.*—Project Management, *WP*—Work Package, *PM*—Project Manager

is called a risk matrix or risk portfolio and carries the risks on the two axes of impact and probability of occurrence (Fig. 3.20).

The risk matrix is thus the graphical representation of the risk register and can be used for simple prioritisation.

Action Planning

Risk Strategies

After the analysis and evaluation of risks and chances, the planning of actions for reducing and avoiding risks takes place.

In an intermediate step, one can consider on the basis of the risk priority number or the expected value, which basic risk strategy is most sensible for the individual risks. There are four risk strategies.

Avoid

In risk avoidance, the aim is to completely eliminate the risk. It should be noted that the avoidance of risks can also create new risks.

In particular, risks with high impact and high probability of occurrence should be avoided.

Example: When creating a company brochure, there is the risk that the print from the newly selected printer does not meet the quality standard of the company. As part of risk avoidance, work can be resumed with the “old” printer.

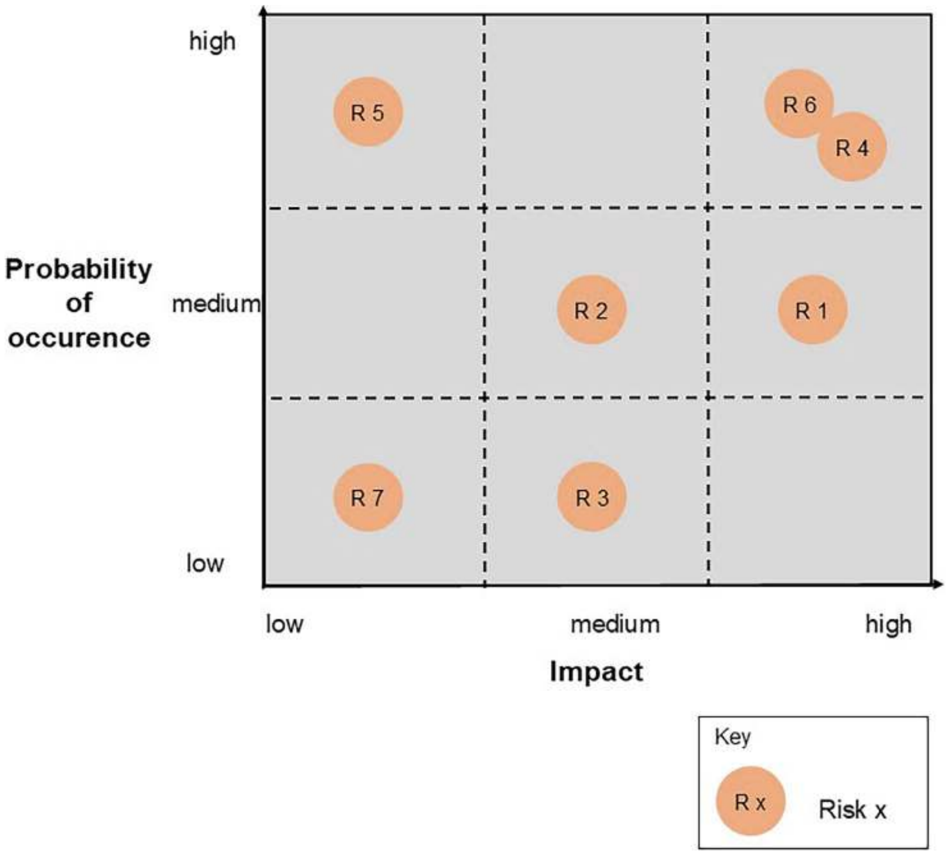


Fig. 3.20 Risk matrix

- **Reduce**

If it is not possible to avoid the risk, an attempt should be made to reduce the risk in terms of impact or the probability of occurrence.

Example: For the printer example, an attempt could be made to arrange meetings with the new printer to make the quality standard of the company transparent and to ensure test prints at an early stage.

- **Transfer**

The transfer of a risk reduces the impact by transferring the (monetary) damage to a third party. The above-mentioned penalties play an important role here.

Example: The printer is contractually obliged in the event of a contract violation regarding the quality of the delivery object (printing of the company brochure) or in case of delay to pay a penalty (penalty regulation).

- **Accept**

For minor risks, the risk can be accepted. That is, no action is taken here.

Example: The company accepts the risk and does not plan any actions.

Figure 3.21 shows again the four risk strategies. Important in this context is also the group of unidentified risks, which means that every project contains a residual risk.

Preventive Actions

After determining the appropriate risk strategy, actions are derived in the context of risk avoidance, risk reduction or risk transfer. Here, a distinction is made between preventive and corrective actions. Preventive actions are actions that are taken to influence the risk according to the strategy.

Corrective action

Regardless of the risk strategy, corrective actions can be identified and initiated that take effect when the risk occurs. A typical corrective action is the fire extinguisher or the sprinkler system in case of fire. The risk has already occurred when the fire starts. The corrective action can also be referred to as a *Plan B*.

Thus, a risk register with all criteria has the structure shown in Fig. 3.22.

A responsible person should be named for each risk or opportunity, who is responsible for the implementation and monitoring of actions during the course of the project.

Another important point in the context of action selection is the estimation of costs for both preventive and corrective actions. Almost all actions cost money or represent a time expenditure. The costs for each individual action should not be greater than the monetary expected value. For example, it is

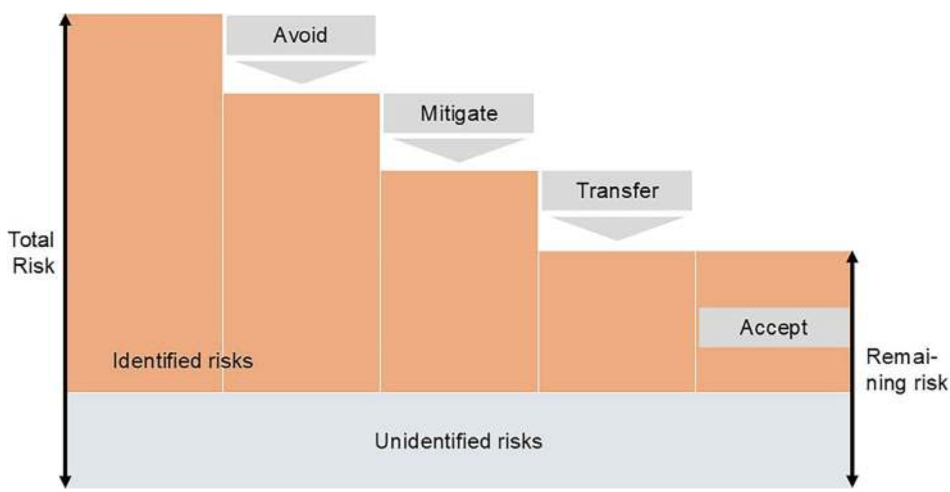


Fig. 3.21 Risk strategies

3

No	Risk	Reason	Impact	Probability	RPI	Corrective Actions	Preventive Actions	Responsibility	Date

- Impact – qualitative or quantitative effect of risk (qualitative expressed by a ordinal scale, e.g. low, medium, high; quantitative expressed by monetary values and delay times)
- RPI – Risk Priority Index (Impact x probability)

Fig. 3.22 Risk register with all criteria

not economical to want to reduce the risk Supplier fails with an expected value of 1000 EUR (quantitative impact 5000 EUR and probability 20%) with an action that costs 5000 EUR. That is, the action would be 5× more expensive than the expected value.

■ **Controlling**

As part of action controlling, the actions are monitored and evaluated. Action controlling serves to maintain and update the risk register.

The essential questions in this step are:

- Which risks have been eliminated?
- Are there new risks (see also risk identification)?
- Are the existing risks still current in terms of impact and probability of occurrence?
- Has the action been completed and the risk thus excluded or reduced?
- How do you deal with the chances gained?

Ei-Ti AG Christmas party—Risk register

Laura Leiter sits down with her team and Emil Expert to go through the first three steps of risk management (identification, analysis and action planning). Emil Expert recommends a qualitative risk analysis to the team, as a quantitative analysis would be too complex. The effort would not be justified for this relatively small project for Ei-Ti AG.

In the risk identification, the team also takes into account stakeholders with a negative attitude.

After about an hour of discussion, they have created the following risk register in the context of risk identification (first step) and risk analysis (second step).

No.	First step: Identification Risk	Second step: Analysis Reason	Impact (descriptive)	Impact (1–3)	Probability of occurrence (1–3)	RPI
1	Stakeholders with a negative attitude do not support the project	Benefits not transparent	Depending on the influence of the stakeholders, the project can be delayed	2	1	2
2	Boredom among the guests	Entertainment not target group-specific	Guests leave early and rate the celebration poorly	2	2	4
3	Feedback is not given	Too difficult, no incentive	No basis for improvement	2	3	6
4	Foreign employees do not participate	Too complicated, no connection to the headquarters	Low employee commitment	1	2	2
5	Poor planning and organisation	Low project management competence	Lack of PM competence of the project team	2	2	4
6	Caterer does not deliver	Bankruptcy	No food	2	1	2
7	No interest from employees in the mobile app	Interests and wishes of the employees are not considered	Product does not reach the market	2	2	4
8	Opportunity: Synergies in procurement	Parallel Christmas party in the neighbouring house	Discounts on joint procurement of technology and catering	−1	2	−2
9	Opportunity: Scrum Master from within the company	Desire of some employees for Scrum training	Lower costs for external Scrum Master	−2	3	−6

Note on chances: The effects are estimated with negative values
Impact and probability of occurrence 1 = low, 2 = medium, 3 = high
WP—Work packages, *RPI*—Risk priority index (results from the multiplication of impact and the probability of occurrence)

3

In a third step, actions to avoid risks and increase chances are identified and evaluated. The team has decided on the following actions:

No.	Third step: Planning of actions					
	Risk	**Strategy**	**Preventive Action**	**Corrective Action**	**Responsible**	**Date**
1	Stakeholders with negative attitude do not support the project	Reduce	See stakeholder register	Conduct conversations	Depending on the stakeholder Paul Perso or Laura Leiter	Immediately
2	Boredom among the guests	Reduce	Gather feedback in advance from test groups	Moderated games	Laura Leiter	By end of WP *Prepare programme*
3	Feedback is not given	Avoid	Highlight importance Offer bonus points for mobile app	Project team goes around and motivates	Laura Leiter	Week 47
4	Foreign employees do not participate	Accept	–	–		
5	Poor planning and organisation	Reduce	Seek support from Emil Expert	Help from Emil Expert	Laura Leiter	In planning phase
6	Caterer does not deliver	Reduce	Phone call in advance of the celebration	–	Sabine Schein	Week 49
7	No interest from employees in mobile app	Reduce	Set up project marketing	Gather feedback	Laura Leiter and Martina Mark	Week 49
8	Opportunity: Synergies in procurement	Accept	Phone call with neighbouring company	–	Sabine Schein	Week 35
9	Opportunity: Scrum Master from within the ranks	Increase (The strategy *Increase* for an opportunity corresponds to the strategy *Reduce* for a risk.)	Offer Scrum Master certification	–	Ina Itti	Immediately

WP—Work Package

3.1.11 Summary Project Planning

- **Project Planning**
- The planning phase is oriented towards the project management elements
  - Project goal/deliverable,
  - Quality,
  - Work,
  - Time,
  - Resources/Costs,
  - Organisation/Communication,
  - Environment,
  - Stakeholder,
  - Risk/Chances and
  - Optional project management elements (procurement management, contract management, claim management, change management, project marketing).
- In the project management element *Project goal/Deliverable* the goals and the deliverable are described in such a way that on the one hand it is transparent what is to be expected at the end of the project and on the other hand the project with its other project management elements especially the work breakdown structure, the time and resource plan can be created.
- The project management elements *Project goal/Deliverable, Quality* and *Work* can be summarised into the element Performance or Scope of performance. In the context of planning and controlling, a separation is useful.
- The work breakdown structure is the basis for further plans (schedule, resource plan, cost plan, organigram), as the plans are based on work package level.
- The three elements Performance, Time and Resources/Costs are very closely linked and form the *magic triangle.*
- The relevant methods and tools are once again summarised in ◘ Fig. 3.23.
- Planning should only be done in the level of detail in which the project can also be monitored.

3

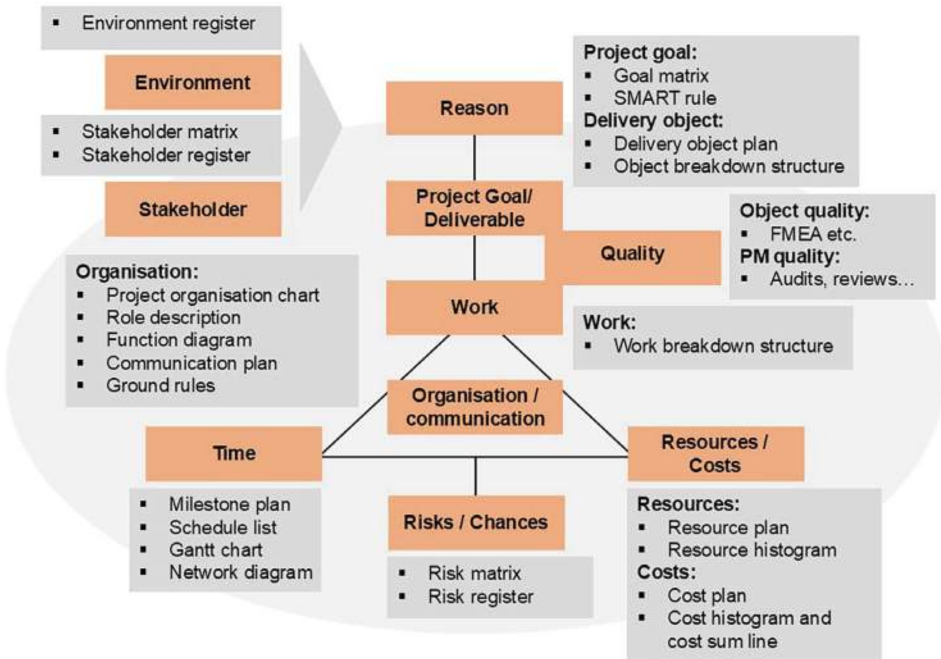


Fig. 3.23 Summary of planning methods and tools of project management

3.1.12 Revision Questions Project Planning

Questions on performance planning (project goals, deliverable, quality and work)

1. Why must project planning start with the planning of project goals, the deliverable, quality and work? (*Solution* ► Sects. 3.1.1, 3.1.2 and 3.1.3)
2. What are the essential methods and tools of planning the deliverable (*Solution* ► Sect. 3.1.1)
3. Why is goal planning also an important topic in the planning phase? (*Solution* ► Sect. 3.1)
4. What types of result plans are there and for which types of projects are they used? (*Solution* ► Sect. 3.1)
5. What is the difference between a result plan and a work breakdown structure? (*Solution* ► Sect. 3.1.3)
6. Why is the work breakdown structure also referred to as *the heart of project management*? (*Solution* ► Sect. 3.1.3)
7. What is the difference between an object breakdown structure and an object-oriented work breakdown structure? (*Solution* ► Sect. 3.1.3)
8. What different approaches to project structuring are there? (*Solution* ► Sect. 3.1.3)

Questions on organisation and communication planning

9. Why is the planning of organisation and communication in the project important? (Solution ► Sect. 3.1.4)
10. What are the essential methods and tools of organisation planning? Briefly explain their characteristics and functions? (Solution ► Sect. 3.1.4)
11. Why should organisation and communication be considered in a project management element? (Solution ► Sect. 3.1.4)
12. What are the similarities and differences between the role description and the responsibility assignment matrix? (Solution ► Sect. 3.1.4)
13. What is the benefit of rules of play in a project? (Solution ► Sect. 3.1.4)
14. What are the tasks of information management in projects? (Solution ► Sect. 3.1.4)
15. What documents are typically used in projects? (Solution ► Sect. 3.1.4)

Questions on scheduling

16. What are the essential methods and tools of scheduling? Briefly outline the advantages and disadvantages. (*Solution* ► Sect. 3.1.5)
17. What should be considered when estimating? (*Solution* ► Sect. 3.1.5)
18. What should be considered when calculating the duration? (*Solution* ► Sect. 3.1.5)
19. What is the difference between duration and effort? (*Solution* ► Sect. 3.1.5)

Questions on resource and cost planning

20. What is generally understood by resources in project management? (*Solution* ► Sect. 3.1.6)
21. What are the most common tools of resource planning? (*Solution* ► Sect. 3.1.6)
22. What possibilities do you know for balancing resources? (*Solution* ► Sect. 3.1.6)
23. What do cost flow and cumulative cost line represent? (*Solution* ► Sect. 3.1.7)

Questions on risk management

24. Why should both risks and chances be considered in projects? (*Solution* ► Sect. 3.1.10)
25. How can risks be categorised? (*Solution* ► Sect. 3.1.10)
26. Explain the essential process of risk management. (*Solution* ► Sect. 3.1.10)

3

27. What is the difference between qualitative and quantitative risk management and how is the difference considered in the structure of a risk register? (*Solution* ► Sect. 3.1.10)
28. What is the difference between preventive and corrective actions? (*Solution* ► Sect. 3.1.10)

3.2 Project Controlling

3.2.1 Basics of Project Controlling (Terms and Control Loop)

Project controlling can be compared to steering a ship. Here, the captain must constantly check the plan that he and his team have created in advance of the journey, and take countermeasures in case of deviations, in order to reach the goal (the right place at the right time) taking into account possible risks. The project leader does exactly the same with his team. After the project plan has been created and accepted, this plan is implemented. However, the project goals can only be achieved if the planned values are regularly compared with the current situation and corrective actions are taken in case of deviations.

First, important terms of project controlling are defined.

Project Controlling

Project controlling includes the control, steering and reporting of the project with regard to all project management elements in the sense of the project goals.

Control

Control is the systematic approach to identifying deviations within project management elements based on planned and actual values (Bea et al., 2018, p. 270).

Management

Management includes all processes, methods, tools and actions used to influence the project and its stakeholders in order to achieve the project goals.

Since project management is a subtask of project controlling, the term project controlling is used in this book in the broader sense.

Reporting is also a subtask of project controlling. This includes all communicative actions within the framework of project controlling.

Project controlling extends over the project management phases from the planning to the completion phase, i.e. it is relevant throughout the entire project duration. It is therefore not only important during the implementation phase, i.e. the implementation of the project phases.

Project controlling forms a control loop that is regularly run through during the course of the project (depending on the size and complexity of the project, about every 2–4 weeks). This is referred to as controlling cycles.

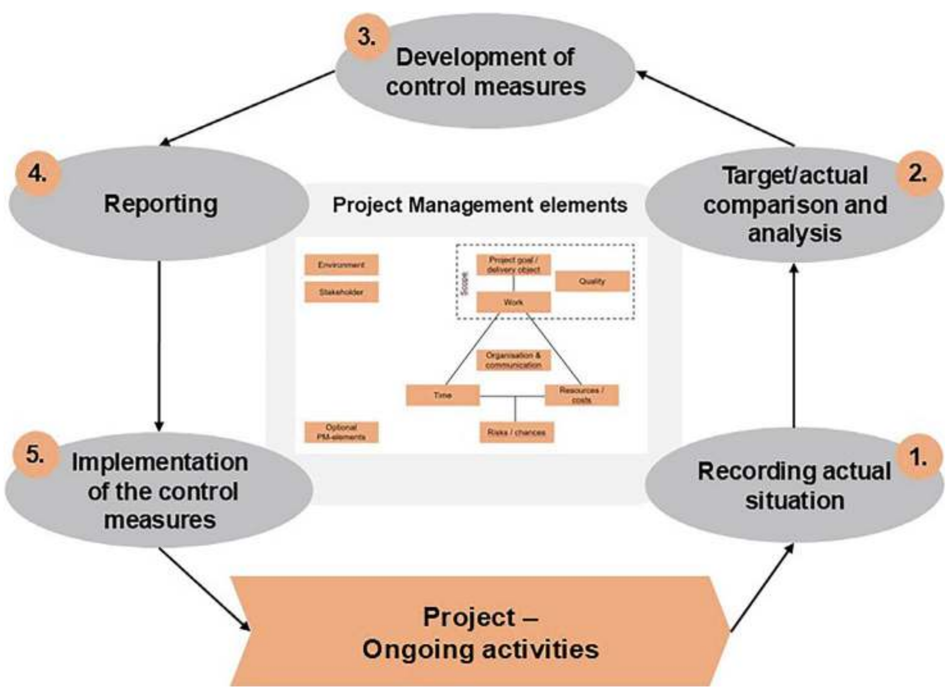
Controlling cycle

The project manager is responsible for the individual activities/process steps of project controlling (◘ Fig. 3.24).

Controlling usually takes place in five steps:

Steps of project controlling

1. In the first step of project controlling, the current status of a project is recorded and made transparent at regular intervals. The project manager, together with the project team, collects the actual values from the work packages or tasks.
2. The second step involves comparing the actual values with the project's planned data (target-actual comparison). If there are deviations, causes are analysed if necessary. The most common causes of deviations are:
   - Deviations due to unrealistic planning. If the project team is inexperienced, there can be underestimations as well as overestimations. The desire or the specification from management to work with "top-down" planned values can also lead to deviations.



◘ **Fig. 3.24** Control loop of project controlling

- Deviations due to problems in implementation (deviation from within). The quality and/or efficiency in the project organisation can lead to deviations.
- Deviations due to unexpected changes (deviation from outside). It often happens in projects that changes occur due to changed customer wishes or emerging problems.

3. In the third step, control actions are derived for the deviations. Control actions can be:
   - Corrective actions to solve a problem,
   - Plan changes (Change Requests) of the deliverable, quality, work, costs, deadlines and organisation,
   - Changes to the overall project (e.g. termination, suspension, replanning).
   - In the case of target changes (e.g. additional requirements from the client), it is necessary to deal with the new situation and possibly adjust the plan.

4. Step four is the project manager's report in the form of a status report to the previously selected stakeholders, especially to the project steering committee with the client. The planned control actions are coordinated in the steering committee.
5. The fifth step includes the implementation by the project team.

Holistic project controlling

In the sense of a holistic project controlling, all project management elements should be monitored, controlled and reported.

Analogous to project planning, controlling also goes through the elements of project management and utilises many of the methods and tools already introduced. In this process, the methods and tools of project planning are extended by a target-actual comparison to a controlling method or a controlling tool.

Methods and tools of project controlling

◘ Table 3.15 provides an overview of the most important methods and tools of project controlling with respect to the relevant project management elements and thus for the construction of a project controlling system.

In ◘ Table 3.15 it becomes apparent that there are special controlling methods and tools, such as the performance level, the Earned Value Analysis, the milestone trend analysis or the mood barometer.

The table is not complete. Especially in larger projects or projects with special customer requirements, additional methods and tools are added. In smaller projects, some methods

Table 3.15 Methods and tools of project controlling according to project management elements

Project management elements	Methods and tools
Project goals and results	– Target plan (target-actual comparison) – SMART rule – Object breakdown structure with target/actual specifications (e.g. via colour coding or crossing out) – Requirement list/plan
Quality	– Failure Mode and Effects Analysis (FMEA)
Work packages	– Work breakdown structure with target/actual specifications (e.g. via colour coding or crossing out) – Degree of progress – Earned Value Analysis (EVA)
Organisation/Communication	– Mood barometer – Flashlight – Feedback discussions
Time and dates	– Process list with target/actual specifications – Bar chart with target/actual specifications – Milestone trend analysis – Earned Value Analysis (EVA)
Costs/Resources	– Resource plan with target/actual specifications – Cost plan with target/actual specifications – Earned Value Analysis (EVA)
Factual environment	– Register of the factual environment – Matrix of the factual environment
Stakeholder	– Stakeholder register – Stakeholder matrix
Risk	– Risk register with target/actual specifications – Risk matrix of the newly assessed risks

and tools may be omitted. However, in project controlling, the tools of project planning are largely used again.

Warning

Basically, the level of detail of project controlling and project planning must match. That is, everything that is planned should also be *controlled*. Or to put it another way:

Only *plan* what you can also control.

The individual methods and tools are presented in the following sections structured according to the project management elements.

3

3.2.2 Controlling of the Various Project Management Elements

3.2.2.1 Project Goals/Deliverable

Depending on the methods and tools used for planning the project goals (e.g. goal matrix) and the deliverable (e.g. Work Breakdown Structure, requirements list, specification sheet) should be used, these methods should be used in the sense of a target-actual comparison within the scope of project controlling.

In particular, changes in goals or changes in the deliverable by the customer must be taken into account. These are always documented in the form of Change Requests (► Sect. 3.2.4), as this results in a change in the magic triangle of project management. All changes should be recorded in the relevant planning documents and the effects on the other project management elements (work, time, resources, costs, risk, organisation) should be checked.

In addition to considering changes, measuring the progress of the deliverable is of great importance, i.e. the answering the questions of how far the deliverable should be completed by a certain date (planned values) and how far it is actually completed on this date (actual value). In practice, the measurement is based on the planned and performed work or a mix of deliverable and work. For this reason, it is also referred to as progress of performance, which combines these two project management elements (deliverable and work). The methods for progress measurement are presented in ► Sect. 3.2.2.4.

3.2.2.2 Work

- **Performance progress control**

Performance progress

The performance progress shows the current status of the created deliverable and/or the work performed. Thus, depending on the object of consideration (deliverable or work), the performance progress can also be called work progress or deliverable progress. For reasons of simplification and the adoption of the terms commonly used in practice, the more comprehensive term of performance progress is used here and in the calculation of the individual key figures a differentiation in deliverable and/or work is made.

The basis for determining the performance progress is provided by the work breakdown structure.

The recording of work progress takes place at the lowest planning level of the work breakdown structure, at the level of the work packages.

The degree of progress (in %) is the ratio of the performance (deliverable or work) provided by a certain date to the total required performance (deliverable or work) of a work package, process, a subproject or the entire project.

Degree of progress

A distinction must be made between the planned degree of progress and the actual degree of progress. The planned degree of progress is the achievement of the work package's performance planned for the specific date. This can already be read or determined in the planning phase based on the bar chart.

Planned degree of progress

The actual degree of progress is the actual work progress determined on the specific date.

Actual degree of progress

To determine the correct degree of progress, the work package description should be defined in concrete, measurable (partial) deliverables so that the planned completion degrees are precisely defined.

For the cyclical determination of the actual degree of completion, the measurement methods should already be defined in the work package description, because the methods can vary depending on the type and duration of a work package. Work packages/processes that are in progress are generally difficult to estimate in terms of performance!

There are various methods to determine the degree of progress.

- **Estimation method**

With the estimation method, the degree of progress is estimated in terms of work or ideally in terms of the deliverable. Usually discrete values, such as 25% steps (0%, 25%, 50%, 75%, 100%) or 10% steps (0%, 10%, 20%, etc.) are used. This method is subjective, i.e. here the degree of progress is influenced by the estimator. Particularly to be considered here is the *Almost—done—phenomenon*. That is, the progress is estimated higher than it actually is. The reasons for this can be varied, from ignorance to fear of failure. Many people also tend to give socially desirable answers. This method is used when progress cannot be goally measured or determined.

Estimation method

- **Quantity proportionality method**

With the quantity proportionality method, certain sizes are set in relation to the degree of progress. These values are quantifiable sizes that describe the progress of work relatively well objectively. The degree of progress corresponds to the ratio of the completed quantity or work to the total quantity/total work of the work package.

For example: Six out of ten subtasks are completed, corresponds to a progress rate of 60%, 40 tests out of 100 tests conducted, corresponds to a progress rate of 40% or 5 m^2 of a

Quantity Proportionality Method

3

20 m^2 wall have been painted, corresponds to a progress rate of 25%.

■ Time Proportionality Method

Time Proportionality Method

The time proportionality method represents the ratio of work time performed to total work time. This method is critical for most work packages as it does not necessarily correlate with the success of the work package. Especially when the duration has been incorrectly estimated, the method does not provide reliable values. However, there are also work packages for which this method is useful. If a work package causes a consistently equal effort throughout the project duration, the time proportionality method is a quick and suitable method. These work packages include, for example, project management and documentation.

■ Milestone Method

Milestone Method or Status Method

The Milestone Method (Status Method) uses events within a work package to determine progress. This method requires some effort in advance. For a work package, for example, the following events (milestones) with corresponding progress rates can be defined:

- Hardware selected—Progress 20%,
- Contract with supplier closed—Progress 50%,
- Hardware installed—Progress 80%,
- Hardware tested—Progress 100%.

■ 0/100% Method

0/100% Method

A very simple method is the 0/100% method, where only the work packages that are completed are calculated at 100%. All other work packages that have not yet started or are in progress receive 0% as a progress value. This method only provides a good estimate of progress with a sufficient number of work packages.

■ 0/50/100% Method

0/50/100% Method

A refinement of the 0/100% method is the 0/50/100% method where work packages not yet started are given a flat rate of 0%, milestones in progress are given a flat rate of 50%, and completed work packages are given a flat rate of 100% as progress. There should be a sufficient number of work packages for this method to provide reliable progress values.

■ Remaining Effort Estimation Method

Remaining Effort Estimation Method

In the remaining effort estimation method, the planned total effort value is not taken into account. The remaining effort is first estimated from the cut-off date and then added to the work completed up to the cut-off date (actual value). This gives a more accurate total effort based on a new estimate. This method avoids the common problem of inaccurate estimation of the total effort of a work package at the beginning of a project. So the formula is:

$$\text{Degree of progress } [\%] = \frac{\text{Current effort}}{\text{Current effort} + \text{Rest effort}} * 100 \ [\%]$$

It is recommended that for all other methods mentioned above for calculating or estimating progress, the total effort is estimated over the sum of actual effort and remaining effort. This approach provides more accurate results. The disadvantage is the increased effort in estimating the remaining effort.

In ◘ Table 3.16, the methods described for determining progress are summarised again and the advantages and disadvantages as well as the fields of application are presented.

Furthermore, the selection of the method depends on the project team's experience with the method.

◘ **Table 3.16** Comparison of methods for determining the progress rate

Method	Advantages	Disadvantages	Applications
Estimation method	– Quick method – Low effort – Theoretically possible for all work packages/ tasks	– Subjective – Relatively inaccurate	Non-critical and longer work packages/tasks
Quantity proportionality method	– Objective – Accurate	– Time-consuming – Only possible for work packages with measurable quantities	For all work packages, whose deliverables or services can be broken down into quantity units
Time proportionality method	– Quick method – Low to medium effort – Theoretically possible for all work packages/ tasks	– Subjective – Relatively inaccurate regarding progress	For non-critical work packages/tasks that run over several phases or the entire project, such as project management, documentation
Milestone method	– Objective – Accurate	– Time-consuming – Only possible for work packages/ tasks with discrete partial services	For all work packages/tasks with discrete partial services, such as development/design, manufacturing/ assembly

(continued)

3

Table 3.16 (continued)

Method	Advantages	Disadvantages	Applications
0/100% method	– Objective – Low effort	– Inaccurate with a small number of work packages/tasks	Many work packages/tasks with short duration
0/50/100% method	– Objective – Low effort	– Inaccurate with a small number of work packages/tasks	Many work packages/tasks with short duration
Remaining effort estimation method	– More accurate estimation of the total effort	– Some effort to determine the remaining effort	With all other methods for a more accurate determination of the total effort

The methods can be mixed, i.e., it can be decided for each work package how progress is best determined in terms of efficiency and accuracy.

Christmas party—Ei-Ti AG—Progress control

Laura Leiter is preparing her first controlling meeting for tomorrow and is unsure how best to action the progress of the project. Since she doesn't want to ask Emil Expert again, she takes a book and reads up on the topic of progress measurement in projects. Unfortunately, she forgot to discuss the topic of progress measurement when describing the work package. So she starts thinking about how progress can be determined. She comes to the following result:

Code	Name	Method	Characteristics
1.1	Project management	Time proportionality method	Depending on the time progress
1.2.1	Create rough concept	0/50/100% method	– Not started: 0% – In progress: 50% – Completed: 100%
1.2.2	Create programme	0/50/100% method	– Not started: 0% – In progress: 50% – Completed: 100%
1.3.1	Invite guests	Quantity-proportionality method	Depending on the number of invitations
1.3.2	Prepare room and technology	Milestone method	Depending on the completed partial results – Stage set up: 20% – Technology installed: 40% – Tables and chairs set up: 75% – Room decorated: 90%

Code	Name	Method	Characteristics
1.3.3	Order food and drinks	0/50/100% method	– Not started: 0% – In progress: 50% – Completed: 100%
1.3.4	Prepare programme	0/50/100% method	– Not started: 0% – In progress: 50% – Completed: 100%
1.3.5	Develop app	Milestone method	Depending on the completed partial results – 1st Sprint: 25% – 2nd Sprint: 60% – 3rd Sprint: 100%
1.4.1	Coordinate celebration	0/50/100% method	– Not started: 0% – In progress: 50% – Completed: 100%
1.4.2	Evaluate feedback	0/50/100% method	– Not started: 0% – In progress: 50% – Completed: 100%

3.2.2.3 Quality

The measurement or determination of quality in projects is carried out, as already mentioned in ► Sect. 3.2.2.3, both at the deliverable level (product quality) and at the project level (project quality).

In the context of measuring and analysing product and project quality, methods and tools from quality management can be used, such as

- Error collection card,
- Quality histogram,
- Correlation diagram,
- Pareto diagram,
- Failure effect and decision method (FMEA),
- Ishikawa diagram (► Sect. 2.8.4),
- Fault tree analysis.

For a description of these specific methods, please refer to further literature (such as Schmitt & Pfeifer, 2015).

In the context of project quality, particular attention should be paid to the following points:

- Uniform and complete definition of the measurement criteria for the work package status.
- In the case of actual data collection, the ratio between measurements and estimates should favour measurements.
- Obtain multiple independent estimates for estimated values.
- Check the completeness and quality of the results when work packages are completed (WP definition!).

- At the end of a project phase, check and approve the completeness and quality of all results achieved in this phase. The basis for the check are the project planning, the implementation guidelines, standards and norms, the specification, the contract.
- Assemble cross-functional teams for reviews of extensive or particularly critical project parts!
- Conduct a final workshop at the end of the project (achievement of goals, remaining work, lessons learned, etc.).
- The project manager and team check (especially in the start-up phase) the suitability of the team composition (team size, skills, existing know-how, social competence, etc).
- In the initiation phase, the mastery of the PM "toolkit" must be checked and possibly retrained:
- PM manual, implementation guidelines, methods, documentation guidelines, reporting, handling of project management software etc.
  - Meetings should be planned and conducted efficiently and effectively. This can be achieved by the following points:
  - Clear agreement of the goals at the beginning of the meeting or workshop and in advance with the invitation.
  - The project manager continuously ensures the meeting is goal-oriented.
  - Visualise decisions and actions! The meeting minutes are created *concurrently* and are visible to all.
  - For actions: Who does what with whom and by when? *Define measurable* goal of the action!
  - At the end of the meeting, conduct a brief *flash* review (reflection, feedback, potential for improvement).

- In the context of project documentation, the following should be noted:
  - Compliance with documentation guidelines (example numbering system).
  - Timely and comprehensive maintenance of databases.
  - Use of the official and agreed forms.
  - Compliance with the documentation guidelines or agreement (type and scope of reports, frequency, distribution, quality).

3.2.2.4 Times

Determination of Schedule Progress

In schedule progress measurement, the planned start and end date is compared to the actual start and end date at the work package level.

In the simplest case, this can be done in a table (◘ Fig. 3.25).

Basis for the determination of schedule progress

The basis for the determination of schedule progress are the schedules, in which the start and end date of the work packages/tasks were planned, as in the task list, in the network plan or in the bar chart.

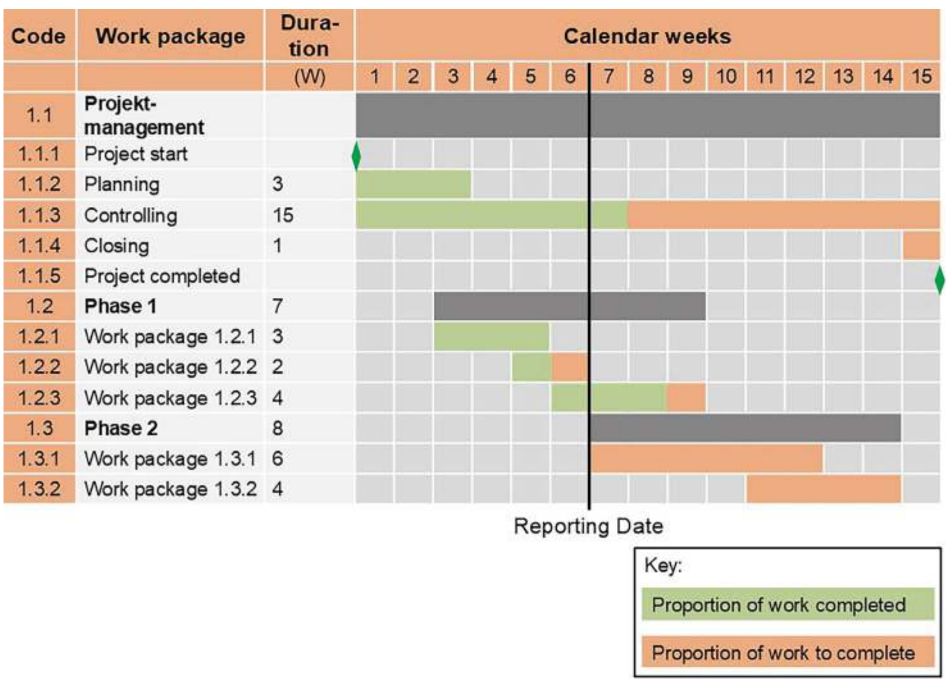
When determining the actual dates for work packages, all work packages/tasks that should have started or ended according to plan by the cut-off date, as well as the prematurely started or finalised work packages/tasks, must be taken into account.

Furthermore, it is sensible, as with the residual value estimation of the degree of progress, to re-estimate the planned values regarding the start and end dates and the still open work packages/tasks.

If a bar chart (◘ Fig. 3.26) was used as a tool in the planning phase, it should also be used again in the context of controlling.

WBS-Code	Name	Plan start	Action start	Plan end	Action end

◘ **Fig. 3.25** Schedule progress measurement at work package level

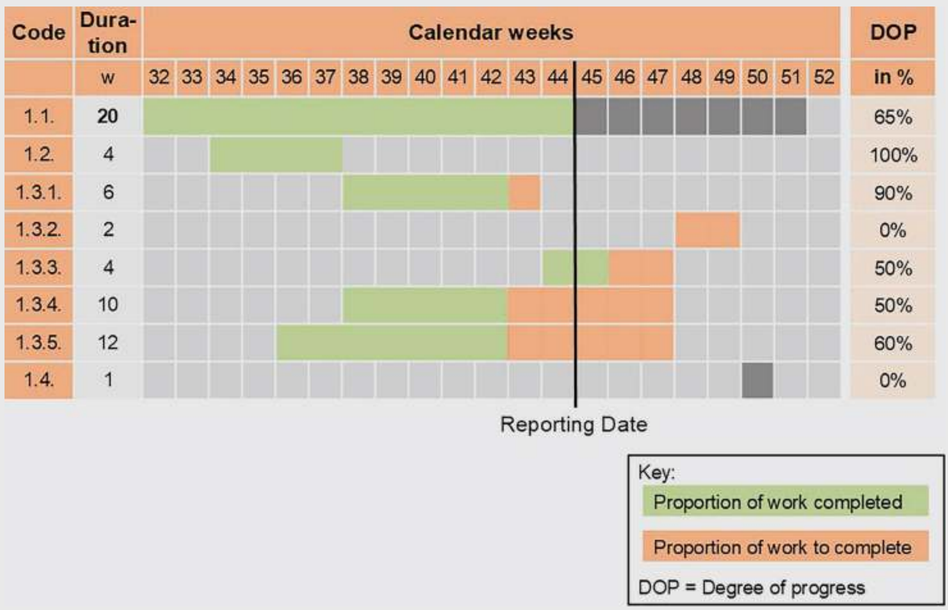


◘ **Fig. 3.26** Bar chart in the context of schedule controlling

In addition to the planned and actual dates of the start and end of the work packages, the progress and thus the degree of progress of the individual work packages can also be read here. The green area of the work packages symbolises the work already completed or the partial deliverable.

Ei-Ti AG Christmas Party—Progress Bar Chart

Laura Leiter and her core team discuss the project progress in the context of the controlling meeting in the 44th calendar week (CW). Based on the defined progress measurement, they have determined the progress shown.www



The progress measurement was also carried out at the same level as the effort estimation, i.e. at phase level for 1.1., 1.2. and 1.4. due to the relatively small work packages. For phase 1.3., the measurement is carried out at work package level.

The degree of progress of the individual phases or work packages is as follows:

- The project management (Phase 1.1) is determined proportionally to time and therefore has a progress of 65% of the entire phase of project management as of the 44th CW.
- The conception phase (Phase 1.2) is already completely finished and the result of this phase is available.
- The progress of the work package *Invite guests* (Work package 1.3.1) is determined proportionally to the number of guests invited. At this point, however, only 90% of the guests have been invited or there are still questions for 10% of the guests. This concerns guests from abroad.
- The work package *Prepare room* (Work package 1.3.2) has not yet been started.
- The two work packages *Order drinks and food* and *Prepare programme* (Work package 1.3.3 and Work package 1.3.4) are measured using the 0/50/100% method. Since these work packages are in progress, their progress is 50% each.

- The work package *Develop app* (Work package 1.3.5) is evaluated based on events. The second sprint is already completed and therefore the work package is rated with 60% progress.
- The phase *Implementation* (Phase 1.4) has not yet started.

Measures in the Context of Schedule Controlling

Often there are delays in projects for various reasons, which must be compensated accordingly. There are a number of measures for this with different efforts and different effects (◘ Table 3.17).

◘ Table 3.17 Options for schedule reductions in a project

Option	Requirement	Impact on other PM elements
Parallelising and overlapping of work packages/tasks	– Work packages/tasks are on the critical path – Resources are available for the new dates	None
Shortening of work packages/tasks	– Work packages/tasks are on the critical path – More resources or higher availability are required	None
Breaking down work packages into tasks with the aim of better scheduling the shorter tasks	Waiting times in tasks that can be used to shorten or tasks that can then be processed in parallel	None
Increasing productivity	"More productive" resources must be available (for people: people with more experience)	None
Shifting of holidays	– Work packages/tasks are on the critical path – Agreement with employees and superiors	None
Purchasing external resources to shorten work packages	– Consideration of the law of diminishing marginal utility – Temporal availability	Increase in project costs and thus approval of the steering committee
Reducing performance (corresponding partial deliverable and its work)	Partial deliverable can be reduced	Reduction of the project deliverable and thus approval of the steering committee
Overtime/extra hours	In agreement with the Working Time Act and possibly the works council	Additional costs for overtime compensation for tariff employees
Outsourcing of the corresponding work package/task	No time delay; the work package must be completed at least in the same time (duration) and at the planned time	Likely higher costs

3

Milestone Plan and Milestone Trend Analysis

▪ Milestone plan

The milestone plan (► Sect. 3.1.5) can be used as a simple scheduling control instrument when using the base values, target values and actual values. The target value of the milestone is compared with the actual value and if there is a deviation from the plan, it is decided whether the subsequent milestones (target values) also need to be moved. Possibly, the shifting of the milestones must be approved by the steering committee. In any case, the shifting of the end milestone of a project must be approved by the steering committee, as this violates the time side of the magic triangle. If there is a change in the plan of the milestones that must be approved by the steering committee, a change request (► Sect. 3.2.4) must be written, i.e. the original target value of a milestone is officially changed by the change request. The base date remains untouched and thus the schedule deviation from the base plan can be traced at the end of the project. The milestone plan in ◘ Table 3.18 corresponds to the milestone plan in ◘ Table 3.8. However, the target values of milestones 3 and 4 had to be adjusted due to the schedule shift of milestone 2. Thus, the milestone table (◘ Table 3.18) results for the key date on 1.7.

▪ Milestone Trend Analysis

Milestone plan

The milestone trend analysis is essentially a graphical representation of the milestone plan, which includes a schedule forecast.

The milestone trend analysis makes it easy to visually identify schedule deviations. For this, the planned and actual values regarding the milestones must be correctly recorded at each controlling cycle and any changes must be realistically

◘ **Table 3.18** Milestone plan

Milestone no.	Code	Milestone name	Base	Plan	Actual
1	1.2.1	Project started	01.04.	01.04.	01.04.
2	1.3.4	Approval granted	15.05.	15.05.	15.05.
3	1.4.6	Goods received	20.06.	20.06.	25.06.
4	1.5.3	Sub-object accepted	20.07.	20.07.	
5	1.6.5	Project completed	30.08.	30.08.	

estimated by the project team. If there are deviations in the dates, the causes must be determined and measures taken to get the project back on track. If the project team cannot achieve the time target with the existing possibilities, decisions must be made on how to deal with this situation. Here too, holistic project controlling is paramount. The effects on the other project management elements must be checked.

A key prerequisite for a successful milestone trend analysis is careful milestone planning including a clearly defined result per milestone and the correct recording of the actual dates.

▶ Example Milestone Trend Analysis

The milestone plan from ◘ Table 3.18 was created on the key date 01.07. This can be seen from the fact that there are no actual values for the values after 01.07. The values before 01.07. are therefore all past values.

For the example, reporting periods are assumed to be the first of each month. Thus, the milestones have taken on the development shown in ◘ Fig. 3.27.

The grey boxes represent planned values on the respective key date, as these values are in the future in relation to the key date.

At the reporting points 01.05. and 01.06. in ◘ Fig. 3.27, there has been no change to the basic plan. At the reporting point 01.07., there has been a shift of milestone 3 to 25.06. At this point, this 25.06. is an actual value, as it is before 01.07. The grey dates at this reporting point 01.07. are the planned values (Milestone 4: 20.07. and Milestone 5: 30.08.). This means that the project management assumes that the shift of milestone 3 has no impact on the subsequent milestones. At the next reporting point 01.08., however, there is a delay in milestone 4 to 15.08. This date is an estimate, as it is after 01.08. Based on this estimate, the project end date is also scheduled for 15.09., so the project is delayed overall. On 01.09., it was then found that milestone 4 was reached a little faster (10.08.), so the end date of the project (milestone 5) is set to 05.09.

		Reporting dates				
Milestone No.	Base	May 1	June 1	July 1	August 1	September 1
1	04-01	04-01	04-01	04-01	04-01	04-01
2	05-15	05-15	05-15	05-15	05-15	05-15
3	06-20	06-20	06-20	06-25	06-25	06-25
4	07-20	07-20	07-20	07-20	08-15	08-10
5	08-30	08-30	08-30	08-30	09-15	09-05

Grey fields indicate planned values at the respective reporting date, because these values lie in the future regarding the reporting dates

◘ **Fig. 3.27** Milestone table as the basis of a milestone trend analysis

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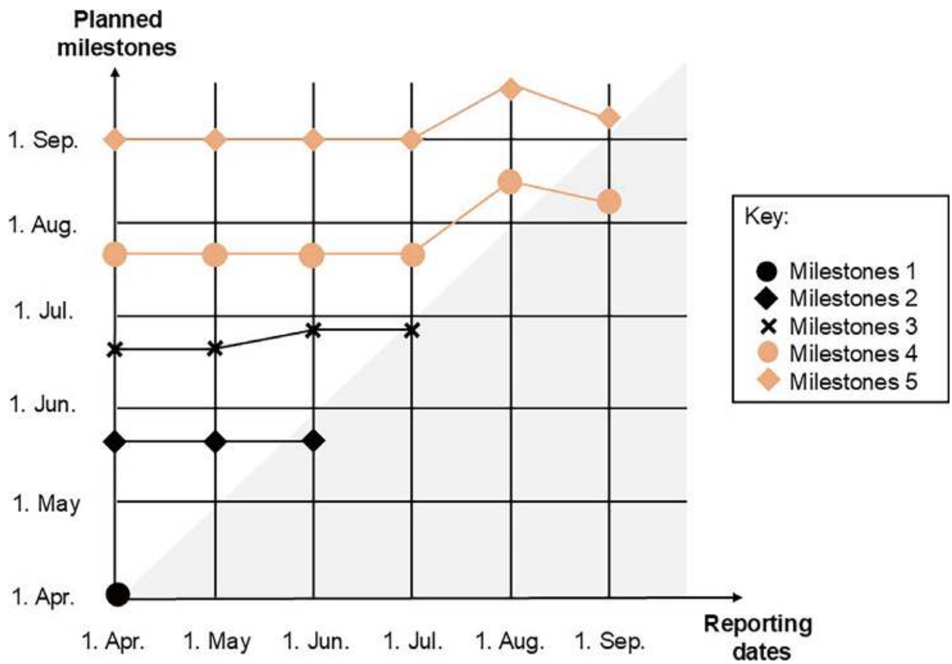

■ **Fig. 3.28** Milestone trend analysis

The corresponding milestone trend analysis is shown in ■ Fig. 3.28. ◄

In ■ Fig. 3.28, one can see the trend of the milestones. Milestones, which lie in the past during the period under consideration, are no longer displayed and are no longer visible in ■ Fig. 3.28. The milestones 1 and 2 have a normal course. With milestone 3 one can see a slightly rising course. Milestones 4 and 5 have initially a rising and then a slightly falling course.

Basically, different curve courses are possible and can be found in practice (■ Fig. 3.29).

Different curve courses of the milestone trend analysis

- **Normal course**

This curve course corresponds to the planned milestone dates. Minor date shifts up and down balance each other out. The project end date is expected to be maintained.

- **Rising course**

Here, far too optimistic date statements were made and the milestones are adjusted upwards with each reporting period. The end date of the project will be delayed.

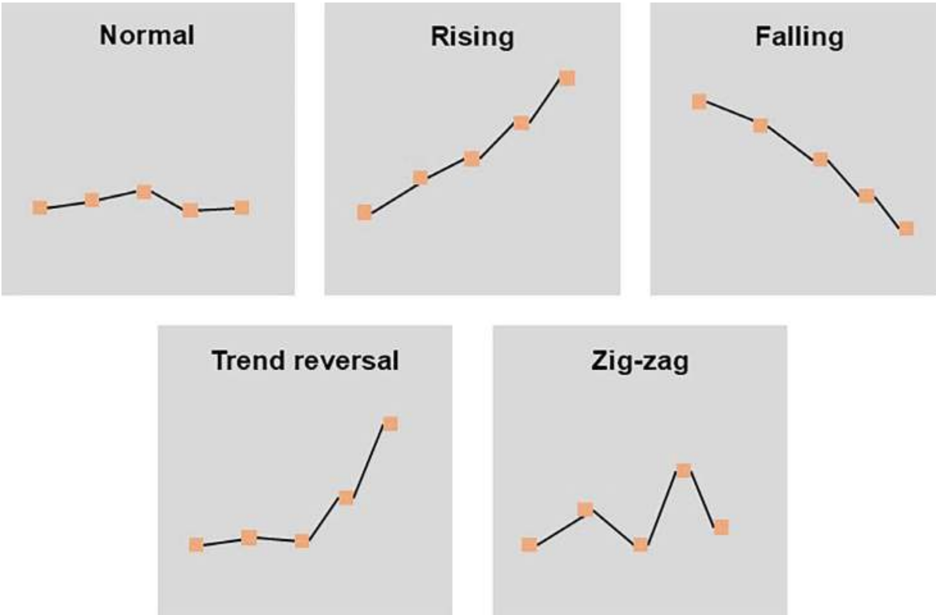

Fig. 3.29 Different curve courses of the milestone trend analysis

- **Falling course**

If the work packages continuously show a date advancement, one can assume that planning was done with too large buffers.

- **Trend reversal course**

Only shortly before the planned completion dates were significant date shifts announced. There is a lack here of an early, realistic date statement. Here it is also difficult within the scope of controlling to counteract in time.

- **Zig-zag course**

With a zig-zag course, one can assume that either planning uncertainty exists or exaggerated planning changes are intended to bring the project back to the base end date. Both indicate poor planning. Thus, the planned end date is rather to be interpreted as uncertain.

3.2.2.5 Resources

The controlling of resources focuses on a target-actual comparison of the planned resources at a certain point in time with the resources actually used.

Resource plan as a controlling instrument

Based on the resource plan in Table 3.19, the plan has been expanded to include the actual data.

Table 3.19 shows the planned and actual values for each role. This results in slight changes for the PM (reduction of

Table 3.19 Example structure of resource plan with target and actual values

Work packages or phases	Effort		Roles (competency requirements)									
WBS-Code	**In PD**		**PM**		**PTM 1**		**PTM 2**		**PS 1 (HR)**		**PS 2 (SW Developer)**	
	Plan	**Actual**	**Plan**	**Actual**	**Plan**	**Actual**	**Plan**	**Actual**	**Plan**	**Actual**	**Plan**	**Actual**
1.1.	5	9	3	5	1	1	1	3	–	–	–	–
1.2	10	13	–	–	1	1	–	1	7	7	2	4
1.3	40	45	–	–	–	–	2	2	3	3	35	40
Total Effort	**55**	**67**	**3**	**5**	**2**	**2**	**3**	**6**	**10**	**10**	**37**	**44**
Gross Availability			10	10	20	20	3	3	30	20	40	35
Planned Absence			–	–	3	3	2	3	–	–	–	–
Net Availability for the Project			**10**	**10**	**17**	**17**	**1**	**0**	**30**	**20**	**40**	**35**
Over-/Undercoverage			**+7**	**+5**	**+15**	**+15**	**–2**	**–6**	**+20**	**+10**	**–2**	**–9**

PM—Project Manager, *PTM*—Project Team Member overlap from seven to five project days). However, this reduction has no impact on the resource situation. Impacts arise when comparing the planned and actual situation of PTM2 and PMA2. Here, a significant undercoverage has emerged, which must be discussed in the context of the controlling meeting. It must be checked what the planning difference is due to in order to improve it in the future.

The actual effort is recorded in most organisations via an hour log, which is now done digitally.

When controlling resources, the options listed in ◘ Table 3.12 apply for a resource balance.

3.2.2.6 Costs

Cost Controlling

As part of cost controlling, actual costs of resources per phase or work package should be recorded, broken down by cost types and cost centres, analogous to the structure of cost planning. The actual personnel costs result from the actual effort multiplied by the daily rate. The actual effort should already have been recorded as part of resource controlling (► Sect. 3.2.2.5).

The basis of cost controlling should be a clear WBS structure, which is reflected in accounting, so that employees can record their efforts according to the work packages.

Causes of cost deviations

Cost deviations can have the following causes:

- premature completion of work packages,
- lower or higher resource consumption,
- higher hourly rates than calculated,
- unplanned outsourcing due to lack of resources,
- advanced orders,
- higher award prices,
- price increases not planned,
- Incorrect bookings.

■ **Remaining costs (cost to complete)**

Remaining cost approach

Analogous to the remaining effort estimation method (► Sect. 3.2.2), cost controlling should also work with a remaining cost approach. The remaining cost approach serves to improve the statement of planned costs.

The remaining costs are determined for the work (performance) still to be done (e.g. by interviewing the employees). The remaining costs can then be added to the actual costs and represent the current costs (the new planned value) as of the key date (extrapolation). ◘ Figure 3.30 graphically represents this approach.

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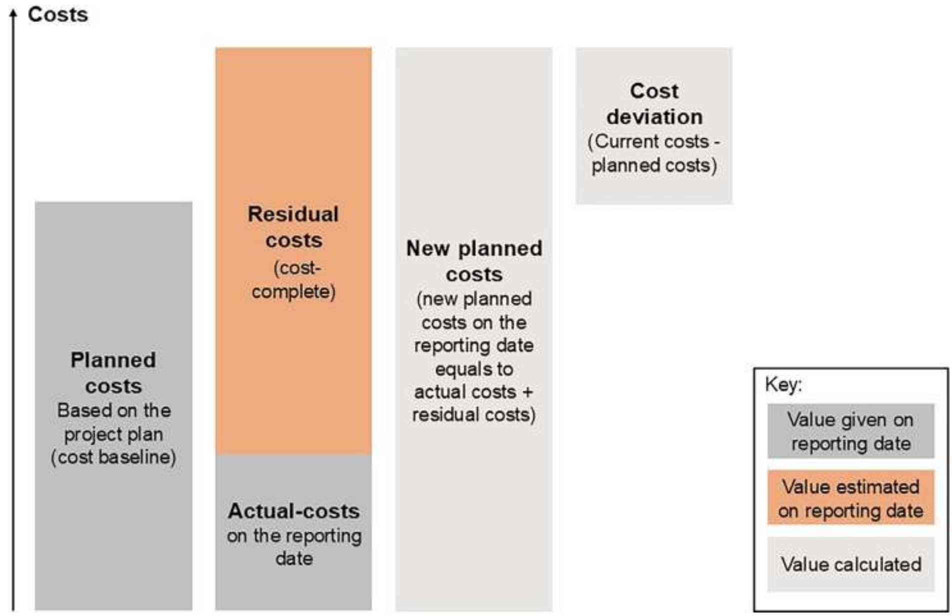


Fig. 3.30 Remaining costs for calculating total costs

Earned Value Management (EVM)

Often, distortions or incorrect results arise from the sole consideration of costs. Cost controlling should always be done in conjunction with progress. Integration, i.e. joint consideration of costs, time and work/performance, should be aimed for. For this purpose, Earned Value Management was developed, which considers these three sizes together and enables both a status and performance view as well as a forecast.

Explanation of Earned Value Management

The logic of Earned Value Management is explained using a small example based on Fig. 3.31.

▶ Example Earned Value Management

A building with four floors is to be built, with each floor costing 1 million euros. That is, the total cost (Budget at Completion—BAC) of the project amounts to 4 million euros. The duration of the project is set at 12 months.

After 9 months, the status of the project is assessed. The planned value (Planned Value—PV) at this point in time should be 3 million euros, as at this point three floors should have been built at 1 million euros each. The current situation looks somewhat different. So far, two floors have been completed at 1.5 million euros each, i.e. the current costs amount to 3 million euros (Actual cost—AC). From a pure cost perspective, one could say that it is running perfectly in terms of cost, because at this point 3 million euros were planned (PV) and exactly 3 million euros (AC) have been spent. However, the progress or the deliverable has not been considered here. It is only two floors that have been built, which have a completion value of 2 million (Earned Value—EV), i.e. 1 million per floor based on the planned value.

With the five values at the cut-off date

- BAC: 4 million euros,
- Duration: 12 months,
- PV: 3 million euros,
- AC: 3 million euros,
- EV: 2 million euros

deviations, status, performance at the cut-off date as well as a forecast for the future can now be calculated. In this example, costs and time in relation to performance are to be presented:

- Performance Cost: CPI (Cost Performance Index): EV/AC = 2/3 = 0.66
- Performance Time: SPI (Schedule Performance Index): EV/PV = 2/3 = 0.66
- Cost Forecast: Estimate at Completion (EAC): BAC/CPI = 4 million euros/0.66 = 6 million euros
- Time Forecast: Estimate at Completion time (EAC_t): Duration/SPI = 12 months/0.66 = 18 months. ◄

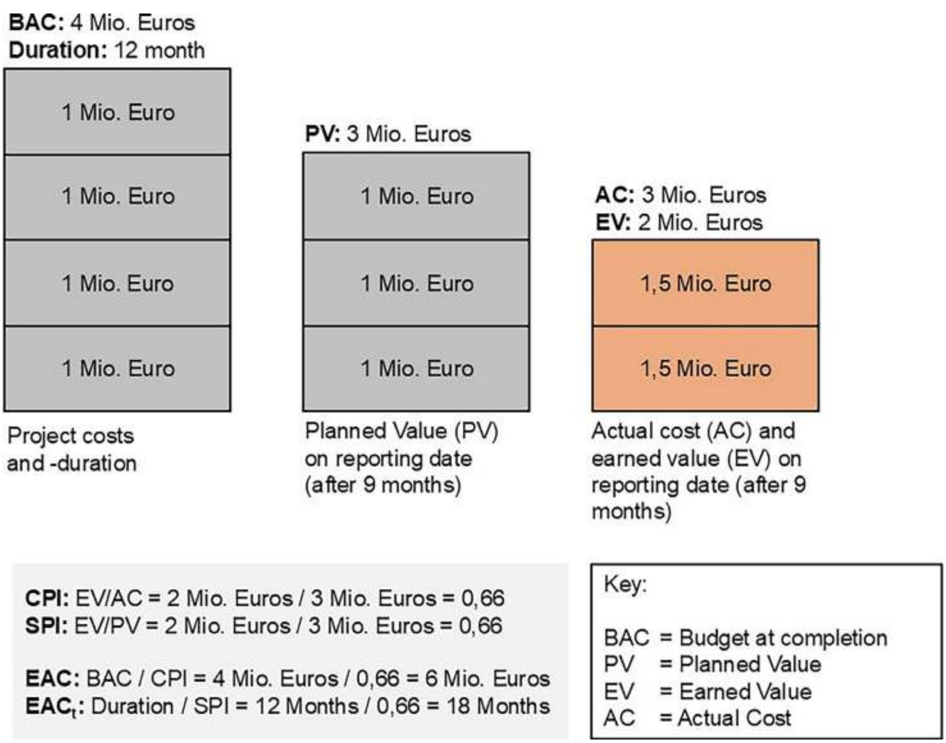


Fig. 3.31 Explanation of Earned Value Management

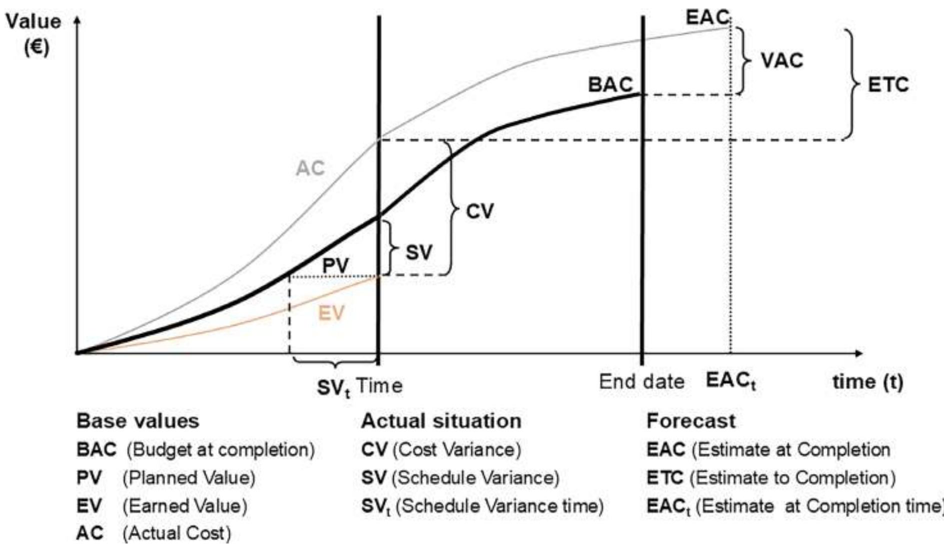
The graphical illustration of Earned Value Management is shown in ◘ Fig. 3.32.

Earned Value Management is based on four basic sizes (BAC, PV, AC and EV), from which all other parameters are calculated. ◘ Table 3.20 provides an overview of the parameters, the corresponding definition and a brief explanation.

3

Application of Earned Value Management.

Due to the effort and susceptibility to errors for a few work packages, Earned Value Management is rather applicable for large projects. There should be many work packages (>50 work packages) to have a solid calculation basis (see also Wanner, 2013).



◘ **Fig. 3.32** Earned Value Management—graphical representation

◘ **Table 3.20** Parameters of Earned Value Management

Parameter	Definition	Explanation
Basic parameters		
BAC	Budget at Completion	The BAC corresponds to the total cost of the project
PV	Planned Value	The PV runs along the cost sum line and corresponds to the planned costs at the cut-off date
AC	Actual Cost	The AC are the current costs at the cut-off date They correspond to the costs that have been incurred up to the cut-off date. These can be determined via the bookings of the expenses and invoices up to the cut-off date

(continued)

Table 3.20 (continued)

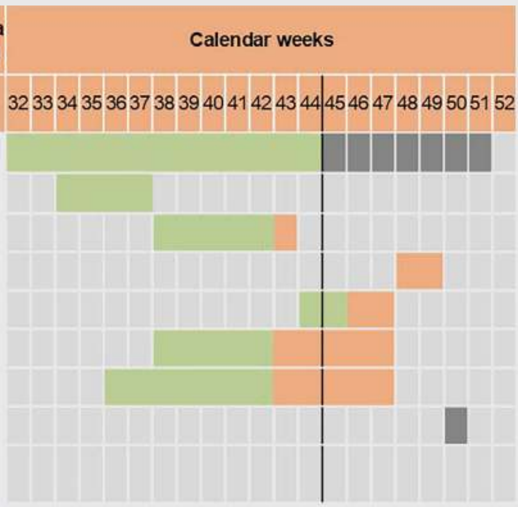
Parameter	Definition	Explanation
EV	Earned Value	The Earned Value corresponds to the completion value The completion value refers to the completion degree corresponding (plan) costs of a work package, process or the entire project
Current situation: Deviation parameters		
CV	Cost Variance = EV − AC	Cost variance at the cut-off date (earned value and current costs)
SV	Schedule Variance = EV − PV	Schedule variance at the cut-off date
SV_t	Schedule Variance time = planned time (PT) − elapsed time (ET) With PT—Planned Time And ET—Elapsed Time	Time-related schedule variance at the cut-off date *How much more time was needed until EV = PV is?*
Current situation: Performance parameters		
CPI	Cost Performance Index = EV/AC	The CPI is a cost-related performance indicator. It can be seen as an efficiency factor or economic factor at the cut-off date It answers the question: *How much money have I earned for 1 euro?*
SPI	Schedule Performance Index = EV/PV	The SPI is a time-related performance indicator. It provides information about the time deviation of the project at the cut-off date It answers the question: *By how much does the project deviate in time from the plan?*
Forecast parameters		
EAC real.	Estimation at Completion realistic = AC + (BAC − EV)/CPI	Estimated total costs at completion The EAC is a forecast indicator that calculates the new budget based on the current performance
TCPI	To Complete Performance Index = (BAC − EV)/(BAC − AC)	Necessary efficiency factor to achieve the remaining work with the given budget (BAC)
EAC_t or SAC	Est. at Completion time or Schedule at Completion = Total duration/SPI	Expected total project duration
ETC	Estimate to Completion = (BAC − EV)/CPI	Estimated remaining costs until completion
VAC	Variance at Completion = BAC − EAC	Total cost variance at completion

3

Christmas party Ei-Ti AG—Earned Value Management

Emil Expert had already informed Laura Leader at the beginning of the controlling phase that she certainly did not need to apply Earned Value Management for this project, as the number of work packages for Earned Value Management was too small. Laura Leader decides to use Earned Value Management anyway, to illustrate it to other participants as an example and to use it for practice purposes. However, she only includes the personnel costs for the EVM calculations, as the consideration of material costs with different booking dates can sometimes produce distorted results in the context of EVM.

To this end, Laura Leader and her team collect the required values of the considered phases and work packages:



Code	Duration	DOP	Effort	BAC (only PC)	PV	EV	AC
	w	in %	in PD	in t€	in t€	in t€	in t€
1.1.	20	65%	10	10	6,5	6,5	10
1.2.	4	100%	10	7	7,0	7,0	7
1.3.1.	6	90%	3	2,1	2,1	1,9	1,9
1.3.2.	2	0%	10	7	0,0	0,0	0
1.3.3.	4	50%	4	2,8	0,7	1,4	2,1
1.3.4.	10	50%	10	7,0	4,9	3,5	3,5
1.3.5.	12	60%	72	57,6	43,2	34,6	29,6
1.4.	1	0%	5	3,5	0,0	0,0	0
Total			124	97	64,4	54,9	54,1

Key:
Proportion of work completed
Proportion of work to complete
DOP = Degree of progress
PC = Personnel costs

■ Earned Value Management Christmas Party

The values are determined as follows:

- Bar chart with progress degree from estimate (see preceding image).
- The BAC over the cost plan related to personnel costs (incl. cost trend, cost sum line; see image).
- The PV from the planned progress to the cut-off date (see bar chart in the image).
- The EV from the calculation of the progress degree and the planned personnel costs (■ Fig. 3.21). In the previous examples of the Christmas party at Ei-Ti AG, the progress of the work packages was already determined and described.
- The AC results from the actual bookings of the employees' efforts. Laura Leiter enters all data into a spreadsheet program and determines the following values:

Parameter	Calculation	Result	Interpretation
BAC	see image in the box	97 k€	This corresponds to the total budget of the personnel costs of the Christmas party
PV	see image in the box	64.4 k€	Costs to the cut-off date (week 44). Corresponds to the value on the cost sum line of personnel costs at the end of week 44
EV	see image in the box	54.9 k€	Completion value to the cut-off date related to personnel costs. One can see in comparison to the plan value (PV) that not as much value was created as planned
AC	see image in the box	54.1 k€	The current costs to the cut-off date. They are also lower than the planned costs to the cut-off date (PV), i.e. 9.6 k€ (64.4 k€ to 54.9 k€) less has been spent than planned
Duration	see image in the box	20 weeks	The project has a planned duration of 20 weeks
CV	EV – AC	0.8 k€	The cost variance calculates the deviation of the completion value and the current costs to the cut-off date. This is with 800 € based on the AC (54.1 k€) or EV (54.9 k€) quite low and can be neglected i.e. cost-wise the project is doing well
SV	EV – PV	−9.6 k€	The planning variance shows a significant difference of approx. 10 k€ between completion value and plan value, i.e. more was planned than was ultimately achieved by the cut-off date
CPI	EV/AC	101%	Due to the low cost variance, the cost performance is also almost ideal
SPI	EV/PV	85%	The Schedule Performance Index certifies with 85%, that the project has only achieved 85% of the planned value by the cut-off date
EAC	AC + (BAC − EV)/CPI	95.6 k€	If the cost performance (CPI) continues in this way, the project will cost 96.6 k€, i.e. it will cost slightly less than planned, as the CPI is slightly above 100%
EAC_t or SAC	Duration/SPI	23.5 weeks	If the SPI continues in this way, the project will last 23.5 weeks, i.e. it will last 3.5 weeks (17.5 working days) longer than originally planned
ETC	EAC – AC	41.5 k€	From now on, the project will cost another 41.5 k€ (remaining costs) in terms of staff

Options for Cost Reduction

Analogous to resource optimisation or balancing and the options for schedule optimisation, options for cost reduction are presented in ◘ Table 3.21.

3

Table 3.21 Options for schedule reductions in a project

Option	Prerequisite	Impact on other PM elements
Increase in productivity	There must be "more productive" resources available (for people: people with more experience)	None
Reduction of performance (corresponding partial deliverable and its work)	Partial deliverable can be reduced	Reduction of the scope of delivery and thus approval of the steering committee
Reduction of quality (and thus of work)	Quality can be reduced	Reduction of the scope of delivery and thus approval of the steering committee
Technically cheaper alternatives	With the same scope of performance and quality	None
Leasing instead of buying operating resources	There must be the possibility of leasing	None, there is a shift from investment to operating costs
Change of supplier	Cheaper suppliers are on the market	None
Overtime/Extra work	If overtime/extra work is cost-neutral	None
Take more advantage of chances (e.g. purchasing associations, merging with other projects)	Functioning risk and opportunity management	Depending on the opportunity, risks may arise
End work packages when the partial deliverable is completed, not when the hours are used up	Professional project culture	None

3.2.2.7 Controlling of the Factual Environment, the Stakeholders and the Risks/Chances

The topics of factual environment, stakeholders and risks are still independent topics in project management, but can be summarised in the context of controlling due to their uniform methodology and close linkage.

Tasks of controlling the factual environment, the stakeholders and the risks/chances

The controlling of these three project management elements is about both the controlling of the initiated actions and the identification of new risks and chances through the factual environment, stakeholders and other project-internal sources. Since the negative influences from the factual environment and the stakeholders are always also part of risk management, the measures of the factual environment and stakeholder management are also part of risk management.

As with the controlling of target management and the deliverable, the methods and instruments are the same as in the planning phase. In controlling, a cyclical review of the currency of the relevant registers from the planning phase (factual environment, stakeholders, risks and chances) is carried out with regard to the status of the actions, the risks and chances, and the identification of new influences that represent risks or chances.

Results and subject of risk controlling

The results and subject of risk controlling are:
- Adjusted risk register (new, changed, dropped),
- Adjusted financial assessment,
- Adjusted risk portfolio,
- Revised action plan,
- Revised cost and effort estimate for actions,
- Revised personnel deployment plan,
- Revised overall assessment of the project, also as an input size for the project portfolio,
- Suggestions for organisation and aids.

3.2.2.8 Organisation and Social Controlling

The controlling of the organisation can be divided into the two areas of controlling the structures, processes and roles on the one hand and social controlling on the other.

Controlling of Structures, Processes and Roles

The controlling of structures, processes and roles focuses on the organisational and procedural structures including the roles of project management. The procedural structure of project management should not be confused with the procedural structure of the project, which represents the content-related process. The controlling described here refers to the organisational management aspects. In each controlling cycle, it should be briefly reflected whether the existing structures with the organigram, the chosen project management processes and the role description still fit the current project situation. If there are situations or changes in the course of the project that have an impact on the organisation of project management, this should be taken into account in the instruments. For example, there may be a new work package due to a new customer requirement. Because of the new work package, there is a new work package manager and thus possibly a change in the organigram. Moreover, this work package must be added to the responsibiltiy assignment matrix and possibly a role must be adjusted or newly defined.

■ Competence building

As already mentioned in ► Sect. 3.1.4, the participants in the project team (project leader, project team member) and the project staff are selected in the planning phase, particularly with regard to their competence (role assignment). Measures for competence building can already be initiated in the planning phase (trainings, coachings etc.). If it is determined during controlling that the competences are not sufficient or possibly further competences are needed due to further work packages (change of work scope), these must either be procured via additional internal or external personnel or the existing personnel must be trained. The following measures are available for this:

- Training off the job (technical trainings, method trainings, social competence trainings etc.),
- Trainings on the job (support by experts during the project),
- Technical coaching,
- Motivation-enhancing measures.

3.2.2.9 Social Controlling

Social controlling is becoming increasingly important as the human being is moving more and more into the centre of the project. This development is particularly due to the increased performance pressure and thus the importance of health and stress management (cf. Reichart & Müller-Ettrich, 2014), new leadership approaches (► Sect. 6.3) and the development of the topic of self-determination and self-organisation (such as in agile project management, ► Chap. 6).

Social controlling is a controlling of the project participants, mainly the project team and the project staff. It is about reflecting and possibly adapting and changing feelings, behaviour, communication and attitudes. Social controlling includes the personal and social competences from the areas of self-management (► Sect. 6.1), Communication (► Sect. 6.2), Leadership (► Sect. 6.3), Teamwork (► Sect. 6.4) and Conflict Management (► Sect. 6.5).

Methods and tools of social controlling

Methods and tools within the framework of social controlling are:

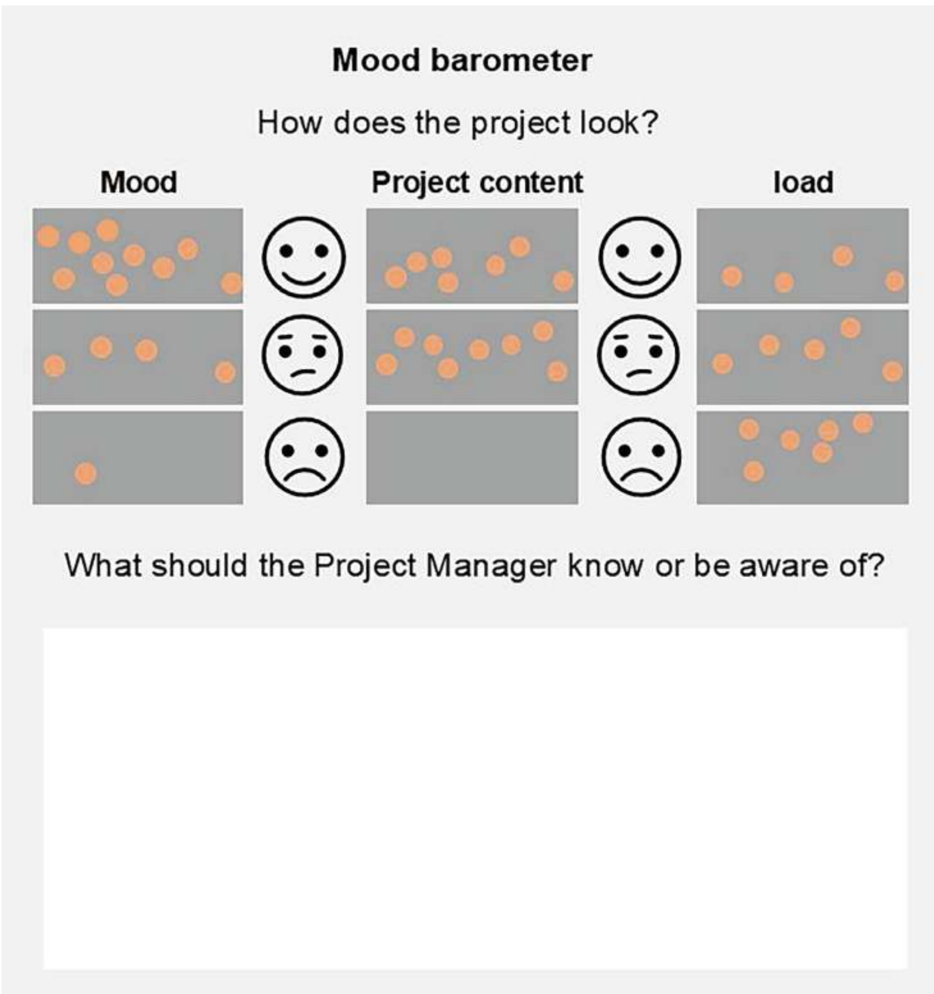
- Reflection and feedback on working in the project team,
- Analysis tools:
  - Flashlight (explanation see below),
  - Mood barometer (explanation see below),
  - Surveys,
  - Informal meetings,
- Control measures:
  - Adjustment of the organigram,
  - Clarification and/or adjustment of roles,
  - Clarification and/or adjustment of communication structures,
  - Change in the composition of the project team,
  - Re-negotiation of rules of the game.

Flashlight

The flashlight is a querying technique, usually open or also covered by cards, to clarify the following questions:
- Mood in the team,
- Feedback in general or on specific topics.

Mood barometer

The mood barometer is a simple query and analysis tool that usually captures the mood via sticky dots (◘ Fig. 3.33). Furthermore, it also collects feedback through additional questions/topics. It can be used for the following purposes:
- Determine the mood in the team,
- Collect feedback,
- Create space to clear up uncertainties,
- Address questions, feelings, criticism,



◘ **Fig. 3.33** Mood barometer

- Recognise trends (early warning system),
- Visualisation.

Conflicts that are identified within the framework of social controlling, can be solved using the competencies, approaches, methods and tools of conflict management (► Sect. 6.5).

3.2.3 Reporting

Reporting is a key element of project controlling. The purpose of project reporting is to inform all project participants as well as all relevant individuals in the project environment (stakeholders) promptly, as needed and continuously about the current project status and thus provide a comprehensive basis for efficient project control.

The people responsible for reporting are the project leader and the core team.

Reporting cycles

The frequency of reporting is based on the controlling cycles of the project, for medium to large projects usually every 2–4 weeks, for smaller projects correspondingly shorter. In addition, there can be different cycles for different reports to give. For example, in addition to the standard project status report for the steering committee, status reports can also be written at the sub-project level for the line, which have a higher frequency. This may be necessary, for example, when very innovative or sensitive sub-deliverables are being developed that require more attention and thus more intensive controlling.

Success factors of reporting

The characteristics of successful reporting are:
- Target group-oriented reporting,
- Current information about the essentials,
- Essential and understandable statements and graphics,
- Efficient process in report creation.

Essential elements of reporting in practice are the status report, which is described in more detail in ► Sect. 3.2.3.1 and the traffic light assessment (green, yellow, red), which is explained in ► Sect. 3.2.3.2.

3.2.3.1 Status Report

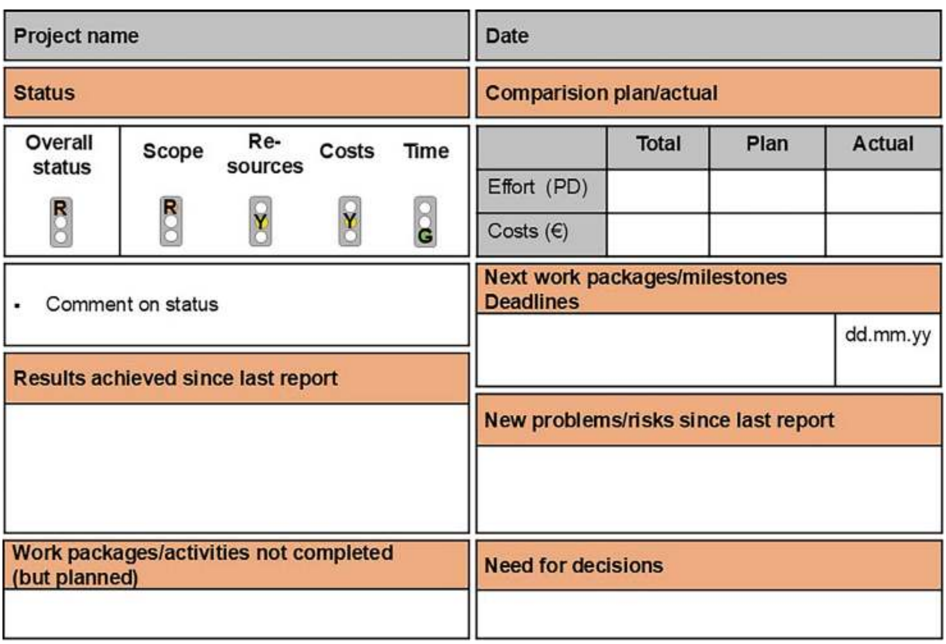
The project status report is prepared by the project team, especially the project manager, and usually results from the regular status meetings of the project team. The project status report provides an overview of the current status of the project. The status report for large projects consists of the individual work package status reports as well as the additional topics discussed in the status meeting, such as trends, risks, claims etc. For smaller projects, the status report is prepared by the project manager or together in the project team in a meeting. The status report often has a scope of one A4 page (project status at a glance), which is created in the form of a graphics program to present it.

For larger work packages (e.g. with a duration of more than 6 weeks), a work package status report makes sense. The work package status report then regularly (e.g. fortnightly or monthly) provides information about the current status of the respective work package. It is usually structured similarly to the project status report.

Even though the status report is only used in the controlling phase, it should be designed in the planning phase. Most organisations that already professionally operate project management, have templates for status reports (◘ Fig. 3.34).

The following content questions should be answered briefly and concisely by a status report:

- **Current**
  - What are the current, project-relevant innovations or developments?



◘ **Fig. 3.34** Status report

- **Goals/conditions**
  - What (intermediate) goals should be achieved in the short term?
  - Are these goals at risk?
  - Are conditions violated?

- **Status of the essential project management elements (deliverable, work, quality, time, resources, costs, organisation)**
  - Status of all work packages, sub-projects or the overall project,
  - Cost situation,
  - Resource situation,
  - Milestone status,
  - Risk status,
  - Trend analysis (e.g. milestone trend analysis or earned value management).

- **Measures and decisions**
  - What is the status of the initiated measures incl. effectiveness?
  - Are new measures necessary?
  - What decisions need to be made?

3.2.3.2 Traffic Light Assessment

An important topic in reporting is the efficient communication of the status, which usually takes place at management level and thus in the steering committee in the traffic light colours (green, yellow, red).

◘ Figure 3.35 provides a definition of the traffic light colours.

In the context of reporting and presenting the status of relevant project management elements, the following rules should be considered:

- A traffic light assessment should be carried out for each work package.
- The traffic light assessment must not be carried out without the consent of the work package manager for the work package.
- If a project team member cannot attend a meeting, the traffic light assessment should be carried out in advance.
- The traffic light assessment is reset one level if the respective measures are successful (red to yellow by project steering committee, from yellow to green by the project team).

Fig. 3.35 Definition of traffic light colours

- If the project management element or work package is repeatedly rated yellow for the same reason (e.g. twice), then the traffic light is set to red.
- The project meeting should only be concluded when relevant work packages have been assessed.
- Red lights/projects are reported by the project manager *immediately* to the client.
- The worst key point assessment determines the overall project assessment.

3.2.4 Change Request Management

In projects, changes always arise that have different reasons and different impacts.

Even if the project planning is very good, changes can arise based on the following causes:

- The factual environment has changed (e.g. new laws, new projects, strategies, technologies).
- The structure of influential stakeholders changes (e.g. the steering committee or project client with new ideas).
- The customer has new wishes or requirements.
- Risks occur, problems arise.

These changes must be dealt with appropriately within the framework of project management. In the first step, the effects of the change should be assessed in order to decide in the second step whether this change is accepted. In the third step an adjustment of the affected project management elements takes place.

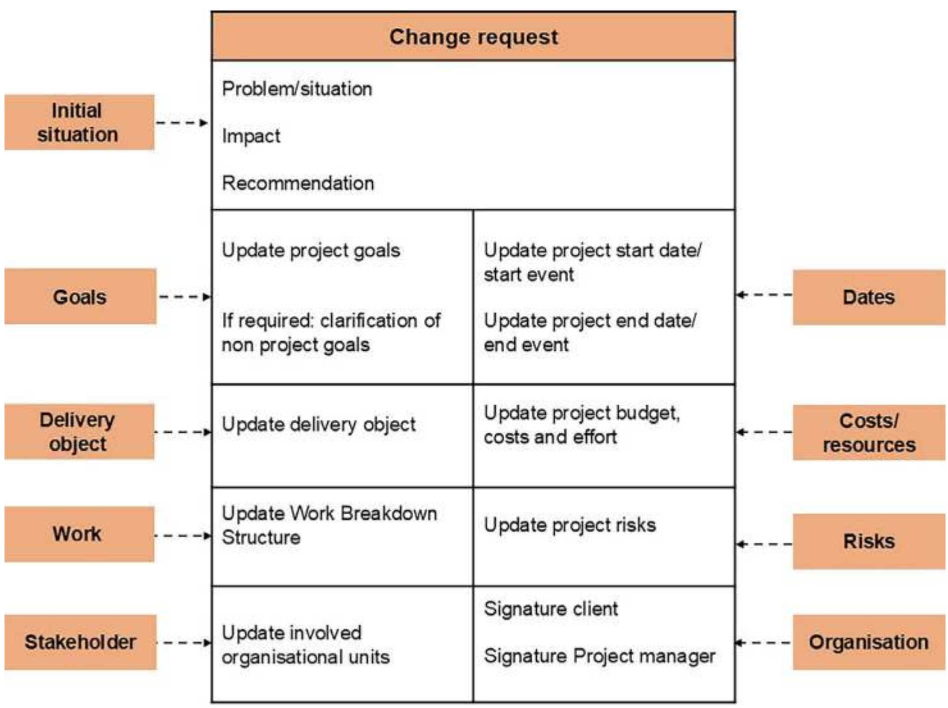
Change Request Management

Change Request Management (change management) includes a procedure for the identification, evaluation, processing, management and controlling of change requests during the project.

Change Request

A Change Request is a request (usually in written form), which describes a necessary or desired change in the project.

Change Requests resemble the project application in structure. They are expanded to include the presentation of the current situation with the corresponding problem, the impact of the problem and possible recommendations (◘ Fig. 3.36).



◘ **Fig. 3.36** Change Request

Change Requests particularly include the following parameters:

- Situation: What led to the change request or the necessity? (Reason)
- Description of the change: What should be changed?
- Effects of the change: What happens if the change is implemented?
- Impact on the project: Which project management elements are affected by the change and in what form? (Updating of the corresponding project management element)
- Signatures of the applicant and decision-maker: usually client and project manager

3.2.5 Summary Project Controlling

- **Project Controlling**
- Holistic project controlling represents a continuous process, whose *life cycle* extends from the start phase to the completion phase.
- The process of project controlling is closely embedded in the overall process of project execution.
- Without sound project planning, no control is possible.
- A holistic project controlling encompasses all project management elements.
- Only *plan* what *can* also be controlled.
- There are three categories of controlling instruments in project management:

1. There are controlling instruments that are identical to the planning instruments. This involves checking the current situation of the respective project management element. In the event of a possible change, the plan is adjusted accordingly. These are referred to as qualitative controlling instruments, such as
   I. goal matrix,
   II. organisational chart, role description, VEMI matrix, communication plan,
   III. register of the factual environment,
   IV. stakeholder register,
   V. risk register.

2. Furthermore, there are the quantitative instruments of project controlling. Here, the planning method or instruments are extended by the actual values or status. The following instruments should be mentioned:
   I. project structure plan,

II. milestone plan,
III. bar chart,
IV. resource plan,
V. resource histogram,
VI. cost plan,
VII. cost flow and cost cumulative line.

3. The third category includes the controlling instruments that were developed exclusively for controlling. These include:
   I. progress measurement,
   II. milestone trend analysis,
   III. earned value management,
   IV. social controlling.
   V. Within the framework of reporting, the status report plays an important role.
   VI. Changes in the project are handled via change requests within the framework of change request management.

3.2.6 Review Questions Project Controlling

Project Controlling

1. What does project controlling mean within the framework of project management? (Solution ► Sect. 3.2)
2. How can the essential methods and instruments of project controlling be categorised? (Solution ► Sect. 3.2)
3. What is a controlling cycle? (Solution ► Sect. 3.2.1)
4. Which project management elements should be controlled? (Solution ► Sect. 3.2.2)
5. What is the degree of progress and how can it be determined? (Solution ► Sect. 3.2.4)
6. What methods are there within the framework of progress determination and what are their advantages and disadvantages? (Solution ► Sect. 3.2.4)
7. Briefly explain the structure and process of a milestone trend analysis. (Solution ► Sect. 3.2.2.4.3)
8. How does the controlling of resources in the project proceed? (Solution ► Sect. 3.2.2.5)
9. What are the most important parameters of Earned Value Management? Briefly explain them. (Solution ► Sect. 3.2.2.6.2)
10. Briefly explain the process of Earned Value Management. (Solution ► Sect. 3.2.2.6.2)

11. Why is social controlling in projects so important? (Solution ► Sect. 3.2.2.8.1)
12. How is a status report structured? What is the difference from a Change Request? (Solution ► Sect. 3.2.3.1)
13. What is the benefit of Change Request Management? (Solution ► Sect. 3.2.4).

3.3 Project Closure

The project closure is the last of the four project management phases. As part of the project closure, the project is officially ended. Ideally, no further tasks or activities will arise afterwards. The project closure is thus the counterpart to the initiation phase. The duration and effort of the closing phase depend, as with the other phases, on the size and complexity of the deliverable and the resulting work. The project closure also represents the conclusion and evaluation of project controlling. The aim is to make the experiences and knowledge from the current project available for future projects.

3.3.1 Processes of Project Closure

Various activities and processes are distinguished as part of a project closure:
- Acceptance of the project deliverable,
- Post-calculation,
- Dissolution of the project team and infrastructure,
- Final analysis and project reflection,
- Experience assurance incl. final documentation and handover to knowledge management,
- Possibly planning of remaining activities,
- Possibly agreement on maintenance contracts or activities.

▪ Acceptance of the project deliverable

The acceptance of the deliverable is carried out by the project client (in the case of external projects by the customer) and is based on the acceptance criteria defined in the project order (in the case of external projects in the contract) and in the project plan. The acceptance should definitely be documented in writing.

- **Post-calculation**

The calculation of project costs based on all incurred costs and efforts is an important task within the central controlling (cost management) within the organisation.

The review of the business case is usually too early at this point, as the benefit consideration often takes place over several years after the end of the project. The cost consideration, on the other hand, can usually be completed in the closing phase.

- **Dissolution of the project team and infrastructure**

The project organisation should be completely dissolved. In addition, this also includes the official ending of the project in the relevant IT systems and possibly the return of aids, such as tools, premises or other resources. An emotional conclusion in the form of a party or a joint meal is also an important point.

- **Final analysis and project reflection**

The reflection of the project with regard to the various project management elements, but also with regard to the interaction, is an important point for the further development of the project participants and for improving project management in the organisation. For this purpose, so-called Lessons-Learned-Workshops (► Sect. 3.3.3) are usually conducted.

- **Experience assurance incl. final documentation and handover to knowledge management**

An important and usually the last document to be created is the project closure report. It analyses, reflects and comments on the essential project management elements for the project. The closure report is presented in ► Sect. 3.3.2.

- **Possibly planning of remaining activities**

If there are remaining activities for the project, a decision must be made on how to deal with them. Basically, three alternatives are available:

- The project is extended.
- A small follow-up project is opened.
- The activities are handed over to the line organisation (routine activities).

The choice of an alternative depends on the scope and content of the remaining work.

- **Possibly agreement on maintenance contracts or activities**

If the project provides for a deliverable that must be maintained afterwards (machines, IT systems, construction projects etc.) all tasks, contracts and roles should be clarified during the closing phase in order to design the maintenance contracts and activities after the project.

3.3.2 Final Report

The essential documentation in the context of project closure is the final report. For internal projects, there is usually a Final Report. For external projects, there may be an internal final report (for the organisation only) and a final report for the client (client organisation).

Figure 3.37 shows the structure of a final report.

A project final report should have the following structure, which should be based on the project management elements:

- Summary (initial situation, main results, possibly highlights and lowlights of the project),
- Summary of the lessons-learned results,
- Project results (target-actual comparison with regard to the various project management elements, goals, project deliverable, quality, work, time, resources, costs, organisation and communication, environment, stakeholders and possibly optional project management elements),

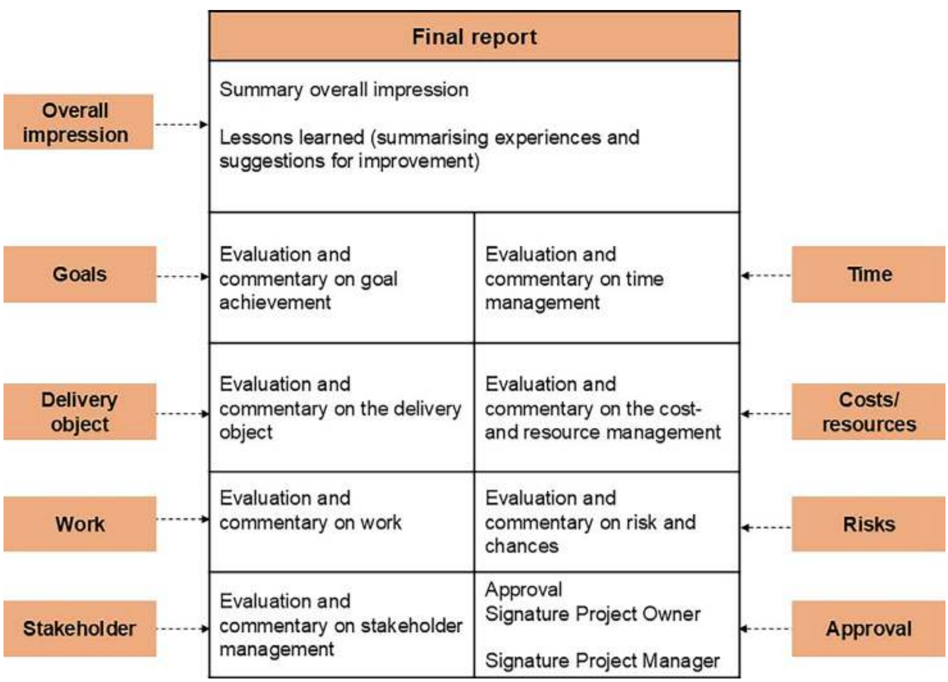


Fig. 3.37 Structure and topics of a final report

- Project controlling (project changes, controlling measures, problems and disturbances during the implementation, experiences),
- Possibly a reference to follow-up projects.

The project final report should be made accessible for future projects.

3.3.3 Lessons Learned

Lessons Learned

Lessons Learned are insights, knowledge or experiences that were generated and documented during the project implementation.

The core of the Lessons-Learned method is the Lessons-Learned workshop, to reflect on the project and identify and evaluate the positive as well as negative experiences.

Essentially, the Lessons-Learned method consists of three steps:

- **Workshop Preparation**

The preparation of the workshop focuses on the following topics:

- Goals and topics that should definitely be addressed. Possibly, the focus of the workshop is also determined (technical-content aspects, the reflection of the process course or both).
- When reflecting on social and/or emotional topics, instruments such as questioning techniques should be selected in advance (possibly external moderation).
- Coordination with the client regarding topic selection.
- Possibly an external moderator in case of tensions and conflicts.
- Determination of the participants. In addition to the project team, possibly also clients and customers can be invited.
- Development and creation of the agenda and the workshop design. The design provides a detailed overview of when who has to do what and how much time has to be spent on it. Typical questions for reflection are:
  - What went well and what went less well in the project?
  - What should be done differently in future project work? What should or must change?

- Clarification of logistical issues (premises, projector, metaplan walls, moderation case, drinks etc.).
- Invitation of all participants including sending of the agenda.

▪ Workshop Implementation

The implementation of the Lessons-Learned workshop should be based on the workshop design. However, it is also important to design the workshop flexibly, to allow additional important topics that were not recognised in advance and also to give space to conflicts. A workshop can basically be compared to a mini-project, where you can't plan everything in advance. Important notes for implementation are:

- Greeting the participants and creating a relaxed atmosphere especially in conflict-ridden projects,
- Presentation of the goals, the agenda including times, the process and the roles in the workshop (moderator, time responsible, documentation etc.),
- Presentation and agreement of *ground rules* for the workshop,
- Explanation of the selected questioning techniques (► Sect. 2.8),
- Documentation of results visible to all on the flipchart or the metaplan wall, best to create a photo protocol,
- Adhere to break times,
- Agreement on further proceedings,
- Demand feedback at the end of the workshop.

An important prerequisite for a beneficial Lessons-Learned-Workshop for all participants is:

- Willingness of the project leader and the project team to face personal feedback,
- Willingness of the project leader and the project team to also include unpleasant things (mistakes, conflicts) in the review,
- Mutual trust,
- Possibly customer survey,
- Involvement of the client.

▪ Workshop follow-up

- Send the photo protocol and/or the documented results,
- Handover of the results to responsible places in the organisation (e.g. central knowledge management, Project Management Office (PMO, ► Sect. 7.4), Quality management etc.),

- Involvement or addressing of agreed topics (To-Dos) to appropriate recipients, if they did not participate in the workshop,
- Ensuring the controlling of the agreed topics (To-Dos).

3.3.4 Summary Project Completion

- **Project completion**
- The project completion is a phase of the project management lifecycle and not to be neglected.
- Essential tasks of the completion phase are:
  - Acceptance of the project deliverable,
  - Post-calculation,
  - Dissolution of the project team and the infrastructure,
  - Final analysis and project reflection,
  - Experience assurance including final documentation and handover to knowledge management,
  - Possibly planning of remaining activities,
  - Possibly agreement on maintenance contracts or -activities.
- The essential documentation of the completion phase is the final report.
- Lessons Learned is an important part of the completion of a project and serves the continuous improvement of the project management in the organisation.

3.3.5 Review Questions Project Completion

Project completion

1. Why is the completion phase important in the context of project management? *(Solution ► Sect.* 3.3*)*
2. What are the essential tasks in the context of project completion? *(Solution ► Sect.* 3.3.1*)*
3. Which topics should be addressed in a final report? *(Solution ► Sect.* 3.3.2*)*
4. Why can a Lessons-Learned-Workshop be seen as a mini-project? *(Solution ► Sect.* 3.3.3*)*.

Agile Project Management

Contents

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4

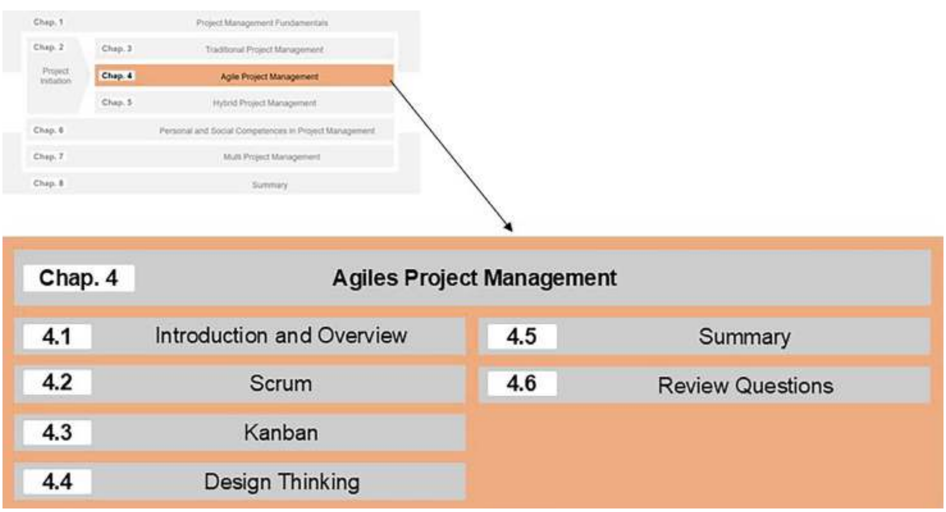
Learning Objectives of This Chapter

After reading this chapter ...

- you will know the special features and characteristics of agile project management.
- you can differentiate agile from traditional project management and know the overlaps.
- you know the Scrum approach with its elements and are able to participate in an agile project according to Scrum.
- you know the Kanban approach with its elements and are able to participate in an agile project according to Kanban.
- you know the Design Thinking approach with its elements and are able to participate in an agile project according to Design Thinking.
- you know what hybrid and adaptive project management means and how to choose the appropriate project management approach.

The fourth chapter has the structure shown in ◘ Fig. 4.1.

As already mentioned in ► Sect. 1.3, agile project management is becoming increasingly important. Therefore, this chapter provides an overview of agile project management and various approaches such as Scrum, Kanban and Design Thinking. Moreover, a direct comparison to traditional project management is made.



◘ **Fig. 4.1** Structure this chapter

4.1 Introduction and Overview

Twelve Agile Principles

The four values of agile management, *Individuals and Interactions, Working Software, Collaboration with the Customer, Responding to Change* (▶ Sect. 1.3.2), form the basis for the 12 agile principles:

1. "Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
4. Business people and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to that they complete the task.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a steady pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity—the art of maximising the amount of work not done—is essential.
11. The best architectures, requirements, and designs emerge from self-organising teams.
12. At regular intervals, the team reflects on how to become more effective and adjusts its behaviour accordingly." (Beck et al., 2001)

The relationship between values, principles, methods, and procedural models is further clarified in ◘ Fig. 4.2.

Agile project management can be seen as a tree that only stays alive through its roots (values and mindset), the trunk (principles) gives the tree stability and the leaves (methods) are visible, bundled on individual branches (procedural models). This means that agile procedural models, such as Scrum (▶ Sect. 4.2), integrate various agile methods. The successful application of agile procedural models is only sustainable if the agile values and principles are taken into account.

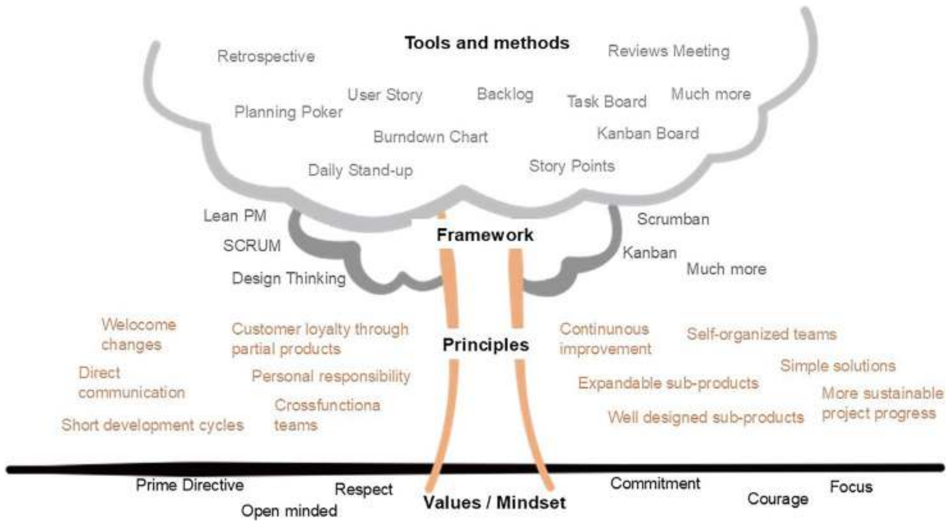


Fig. 4.2 The agile tree—relationship of agile values, principles, methods, and procedural models

The agile approach is based on the consideration of new approaches in software development at the end of the last century to increase the success rate in this type of project. As described above, new values and principles were initially put at the centre. At the same time, Scrum also emerged as a procedural model for handling projects.

Characteristics of agile project management

Other characteristics of agile project management, in addition to iterative and adaptive planning and agile values and principles, are the lean and flexible design of the project and its management and thus the rapid coordination within the team. Another fundamental difference lies in the perspective on the magic triangle. In traditional project management, the limitation *deliverable* and thus also the *work* are fixed, the *time* and the *costs* are estimated based on the deliverable and the work. In agile project management, the question is rather *What do I get when for my money?,* i.e. here time and costs are fixed and the deliverable is variable. Fig. 4.3 illustrates this difference.

In agile project management, roughly outlined project goals and a roughly outlined deliverable are at the beginning of a project, which is refined and worked out in line with customer requirements as the project progresses and the solution path is adapted (increment and iteration). Therefore, the integration of the customer into the project plays a crucial role.

In addition, changes regarding the deliverable to be created are consciously built into the project process and are seen as important and sensible. The team manages itself in an agile

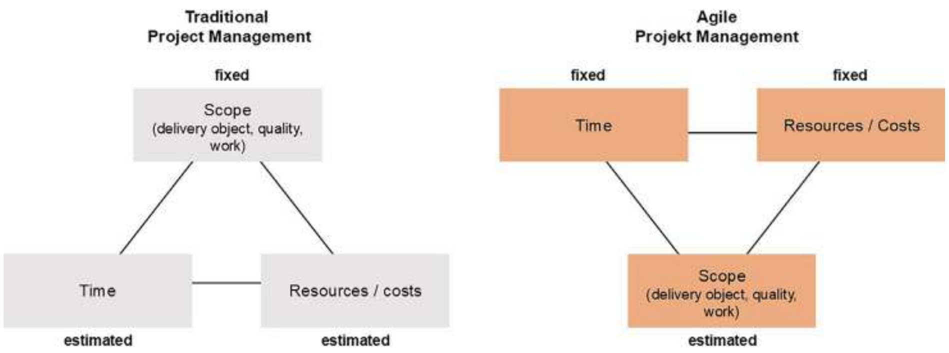


Fig. 4.3 Project constraints in traditional and agile project management

project and there is no commissioned project manager in the traditional sense. The team is given responsibility for the project (see also Bea et al., 2018, p. 583 ff.; Gray & Larson, 2014, p. 582 ff.; Pichler, 2009, p. 1).

Success criteria of agile project management

The success criteria for agile project management are:

- the communication and interaction of the developers,
- the delegation of responsibility from the line manager to the developers,
- this delegation in turn requires the management's trust in the development team,
- the customer and thus the requirements for the project result are regularly involved,
- the knowledge and decision-making authority lie with the development team,
- the transparency of the project through close cooperation and direct exchange of the entire agile team.

Differences traditional and agile project management

The differences between traditional and agile project management are summarised in Table 4.1.

At this point, it should be emphasised once again that despite all the The project management elements shown in Table 4.1 (▶ Fig. 1.20) are the same in the agile environment. That is, the topics that need to be managed are identical. Only the approach model is different.

Advantages and disadvantages of agile project management.

The main advantages and disadvantages of agile project management are shown in Table 4.2.

The following explains the Scrum and Kanban and Design Thinking models.

4

Table 4.1 Differences between traditional and agile project management

Feature	**Traditional Project Management**	**Agile Project Management**
Project type	– simple to complicated projects in terms of requirements and approach	– complex projects in terms of requirements and approach – All projects where the deliverable can be easily changed (e.g. concepts, software, prototype development)
Goals/ Deliverable	– Defined at the beginning of the project – SMART formulated and broken down through goal hierarchy – Constant over project duration	– Formulated as a vision, thus rather vague – Changes in requirements are desired
Client	– Client with focus on the final deliverable – Involvement through steering committee (reporting)	– Project Owner represents customer view or is the customer – Strong involvement in the project
Project management	– Appointed project manager with core project team	– There is no project manager as a person – Project management lies with the development team
Team	– Requires leadership – Usually distributed spatially (possibly virtual) – Usually also bound by line tasks	– Works independently – Organises itself – Interdisciplinary – Is locally concentrated (one office) – Rather small team (< 10 people) – Usually not bound in line tasks and other projects
Planning	Intensive planning phase with focus on time, cost, resources, risks and organisation, which is adapted to the deliverable and the required work	Due to predefined fixed project management elements, such as time, cost, organisation, planning is reduced to a minimum in terms of task distribution and implementation
Change Request	– Defined process is in place – Should be avoided if possible	– Is accepted and desired – Planned as a fixed element in the development processes
Documentation	Quite extensive documentation about project order, project plan with all sub-plans, status reports, change requests, final report etc.	Reduced to a minimum (requirement lists, such as backlogs, controlling board, e.g. burn-down chart or Kanban board)

Table 4.2 Advantages and disadvantages of agile project management

Advantages	Disadvantages
– High transparency—Through continuous information exchange, the development team has a complete overview of the current development status, potential risks and problems at all times. This transparency reduces errors and makes development more efficient – High flexibility—The development team is flexible in dealing with requirements. Changes are possible and desired at any time – Risk minimisation—Risks are identified earlier through the early acceptance and integration of the increments into the overall system	– Only possible with high availability of the development team (at least 50% availability) – Low control – Dependence of the results on the self-organised team – High demands on the independence and the responsibility of the individual team members

4.2 Scrum

Scrum is the best-known representative of the agile models. Scrum is a term from rugby and translates to *Scrum*. This term emphasises a key feature of agile project management, namely teamwork with timely and efficient communication.

Three principles of Scrum

Scrum relies on three principles to reduce complexity:

- **Transparency:** Due to the close cooperation there is high transparency regarding the work, progress and obstacles. All topics are documented daily.
- **Inspection:** At certain cycles, functioning partial delivery objects are handed over and tested.
- **Adaptation:** Based on the inspection, an adjustment of the requirements is made. This results in a current requirements list adapted to the customer's needs and wishes after each cycle.

The process of a project according to Scrum is shown in Fig. 4.4.

A key feature of Scrum is the development of the deliverable or, in Scrum language, the product based on functional partial delivery objects, the so-called product increments, which are realised within a development cycle of usually 4 weeks, the Sprint.

Scrum is essentially a very structured approach model,[1] characterised by the three components events, roles and artefacts, which are described in the Scrum Guide (Schwaber & Sutherland, 2020):

1 This does not contradict agility. Because agility is primarily based on agile values and principles and can still be very structured.

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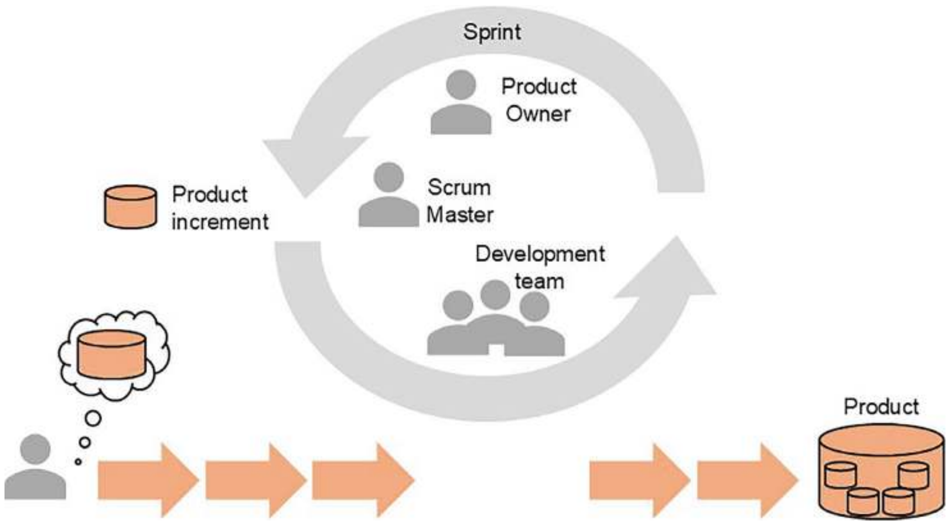


Fig. 4.4 Scrum procedure

- The Scrum roles:
  - Product Owner
  - Scrum Master
  - Development team

- The Scrum artefacts:
  - Product Backlog
  - Sprint Backlog
  - Product Increment
  - In addition to the artefacts described in the Scrum Guide, there are others that are frequently used in practice and are therefore introduced: Impediment Backlog, Taskboard and Burn-down Chart.

- The Scrum Events:

  - Sprint
  - Sprint Planning
  - Daily Scrum
  - Sprint Review
  - Sprint Retrospective.

4.2.1 Scrum Roles

Scrum Roles.

First, the three roles are described:

- **Product Owner**

The Product Owner is responsible for the features and economic success of the product. They have a very good understanding of the customer and the product.

Product Owner

- **Scrum Master**

The Scrum Master is responsible for the successful implementation of the Scrum approach and supports the team in terms of efficient working. The Scrum Master usually does not contribute content.

Scrum Master

- **Development Team**

The development team is responsible for the development and delivery of the product increments and thus the product. It also bears the responsibility for adhering to the agreed quality standards.

Development Team

4.2.2 Scrum Artefacts

A product idea is described in terms of requirements using so-called User Stories. A User Story is a specific way of formulating requirements. User Stories follow the following structure:

User Story

1. Naming the role from whose perspective the requirement is formulated,
2. Formulation of the requirement or the goal to be achieved,
3. Formulation of a justification.

► Example

Based on this three-part structure, a user for a mobile restaurant app could formulate the following User Stories as an example:

As a user, I want to be located automatically in order to find suitable restaurants in the vicinity of my location.

As a user, I want to be able to manually change the location in order to find suitable restaurants in other selectable regions.

As a user, I want to be able to select by the criteria of *price, taste, location* in order to find suitable restaurants for me. ◄

At the beginning of many projects, there are still quite vague requirements. These vague requirements are included and concretised in the course of the project. Requirements that are rather vague and thus at a high level of abstraction are called Epics.

Epic

The aim is to break down the Epics into estimable User Stories during the Sprints.

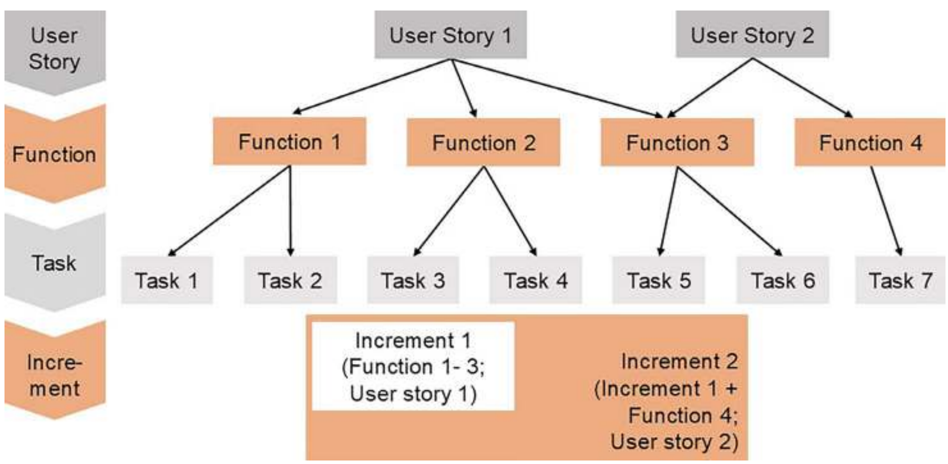
The quality of User Stories can be checked according to the INVEST principle. INVEST stands for:

INVEST Principle

- Independent, i.e. the User Stories should be independent of each other.
- Negotiable, i.e. the User Stories should be negotiable.
- Valuable, i.e. the User Stories represent a value for the customer.
- Estimatable, i.e. the User Stories are estimable.
- Small, i.e. the User Stories are small enough to be estimated.
- Testable, i.e. the User Stories are specified in such a way that the requirements can be tested (cf. Pichler, 2009, p. 44 ff.; Cohn, 2013).

User Stories represent the requirements of various user groups for a product. To get from the User Stories to the product, they must first be translated into functions. The functions are realised during the sprint through individual tasks, which at the end of each sprint represent a product increment (working partial result). The relationship between User Stories functions, Tasks and increments is not linear. Instead, a *n:m—relationship* of the individual elements arises.

▫ Fig. 4.5 shows the dependencies.



▫ **Fig. 4.5** Relationship User Stories, Function, Task, Increment

Christmas Party at Ei-Ti AG—User Stories and Epics
Laura Leiter has invited to a workshop regarding the determination of requirements for the Ei-Ti app. At the table sit Managing Director Gerd Genau, Marketing Director Martina Mark as designated Product Owner, Emil Expert, Sabine Schein, Sven Soft as future Scrum Master and Ina Itti, who absolutely wanted to be there. Laura Leiter is quite nervous, sitting with the managing director and some other executives so soon after joining the company. Together with Emil Expert and Sven Soft she has prepared the workshop and is glad that Sven Soft is taking over the moderation. Laura Leiter has prepared flipcharts together with Sven Soft to record all requirements. The flipcharts fill up quite quickly and after not even 45 min have the following content:

Type and No.	User Role	Requirement	Reason	Acceptance Criteria
1 (US)	As a Manager ...	... I would like a graphical overview of the results of the survey of an event, divided by the function in the company, ...	... to get statements about the achievement of an event's goals.	Each question can be graphically evaluated by company functions
2 (US)	As a Manager ...	... I would like to offer a competition in the form of a company quiz, ...	... to explain the company to the employees in a playful way and to motivate them to participate in the quiz	Games work flawlessly
3 (US)	As a User ...	... I would like the app to be multilingual, ...	... to understand everything and thus use the app	Native Speaker approves the languages
4 (US)	As a User ...	... I would like to easily communicate with my work colleagues and exchange photos, files etc., ...	... to maintain contact and communicate quickly and easily	Feature works flawlessly without delay
5 (US)	As a User ...	... I would like to have my colleagues with photos and a few personal and professional details stored, ...	... to get to know them better and find someone easier	Approval by staff council and employees
6 (US)	As a User and employee of the Berlin Office ...	... I would like to be informed about lunch options in the vicinity via the app and if necessary also be able to order food, ...	... so I don't have to spend so much time searching for and ordering food at lunchtime	Feature works flawlessly without delay
7 (US)	As a manager ...	... I want the app to be further developed, ...	... to regularly implement improvement suggestions and offer the app as a product	Programming standards maintained and interfaces open
8 (US)	As a marketing manager ...	... I want to provide employees with company information, ...	... so that employees are always up to date and quickly informed	

Type and No.	User Role	Requirement	Reason	Acceptance Criteria
9 (Epic)		User management		
10 (Epic)		Administration area		
US—User Story				

After the workshop is over, Laura Leader asks Sven Soft and Emil Expert for advice, as she noticed the following during the workshop:

The marketing director Martina Mark has had employee requirements written down without consultation. Emil Expert explains to Laura Leader that the Product Owner in Scrum takes the customer's perspective. However, if there is no feedback from the employees, this can lead to acceptance problems. Emil Expert promises Laura Leader to discuss these requirements again with Martina Mark.

- **Product Backlog**

Product Backlog

The User Stories and Epics are the essential part of the Product Backlog. The Product Backlog contains all requirements in the form of User Stories, functionalities, improvements, bug fixes etc., which are to be implemented in the Scrum project. The Product Backlog is a dynamic list that is supplemented and adjusted during the Scrum project.

- **Sprint Backlog**

Sprint Backlog

Based on the prioritisation and the estimation (▶ Sect. 4.2.4) the team now takes as many User Stories into a Sprint as it thinks it can complete in this time. The User Stories to be realised for a Sprint are collected in a Sprint Backlog.

- **Taskboard (Task Backlog)**

Taskboard

The tasks, which serve to create functions and thus to fulfil the User Stories, are displayed on a so-called Taskboard (Task Backlog). The Tasks can be structured and controlled relatively easily through the three-part division of the Taskboard into *Tasks open, Tasks in progress and Tasks done*. The Taskboard is a tool of the Sprint Backlog.

- **Burn-down-Chart**

As part of progress measurement in the agile environment and especially in Scrum, Burn-Down-Charts are used (◘ Fig. 4.6), which represent the planned work against the actual work performed e.g. in the form of Story Points (estimation of com-

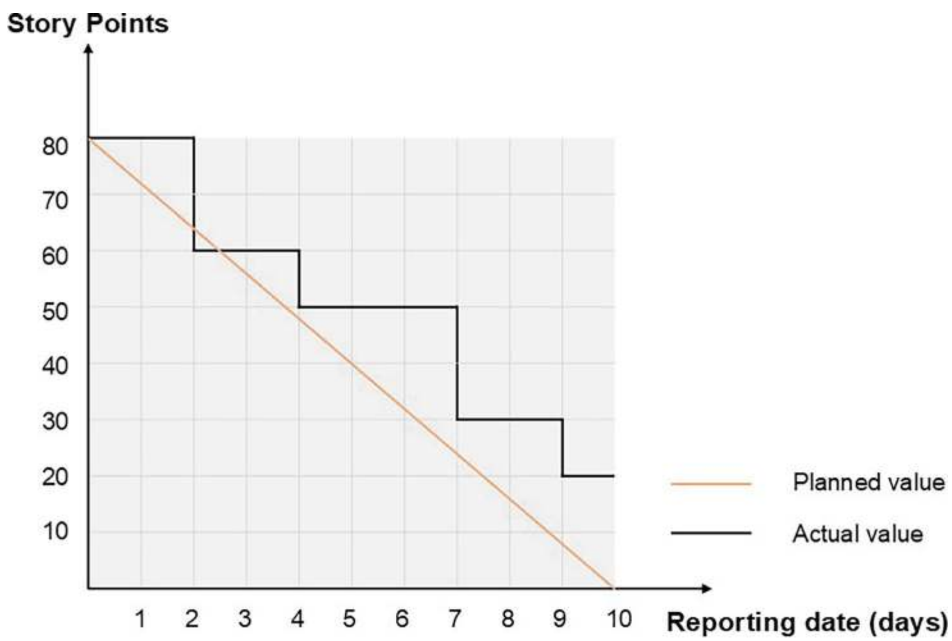


Fig. 4.6 Burn-down-Chart

plexity ► Sect. 4.2.4). The maximum number of Story Points to be processed in the Sprint are entered on the x-axis. Then the plan line is drawn (from the maximum Story-Points value to the 0-line at the end of the Sprint). At each Daily Scrum, it can be easily traced how many Story Points have already been completed ("burned down", hence *burn down*).

▪ Impediment Backlog

Impediment Backlog

In the context of every project, there are obstacles (problems) that need to be overcome. In Scrum, the identified obstacles are recorded in a so-called Impediment Backlog.

The Impediment Backlog is a collection of problems that prevent the development team from efficiently completing tasks. It is filled during the Daily Scrum or the Sprint Retrospective at the end of the Sprint. The Scrum Master is primarily responsible for solving the obstacles.

▪ Product Increment

Product increment
Definition of Done

At the end of a Sprint, the completed product increment is available, which implements the user stories in the form of functions and other features, ready for acceptance by the Product Owner. This results in an increment per sprint which in turn is part of the following increments (Fig. 4.7).

An increment can be considered and accepted in isolation.

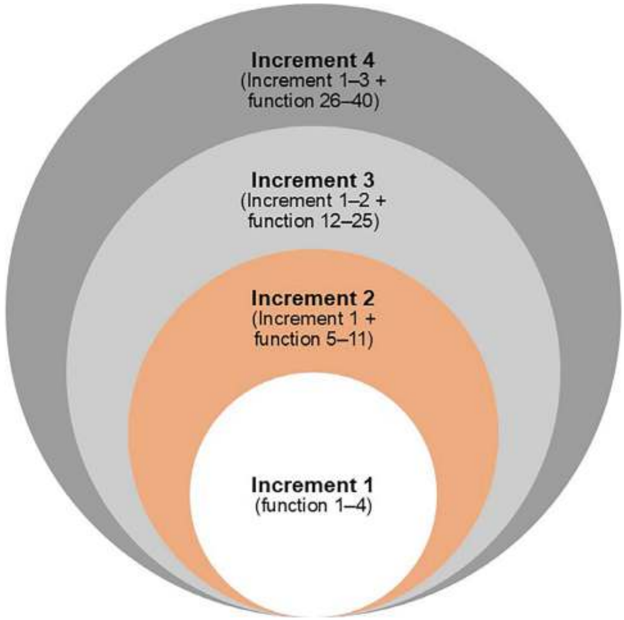


Fig. 4.7 Product increment

In order to be able to decide on the success of an increment and thus on the fulfilment of the user stories, the scope of the increment and corresponding completion criteria must be defined in advance. This is the Definition of Done, i.e. the description of when an increment is defined as completed. The Definition of Done is made by the development team. This includes the acceptance criteria of the user stories. However, the Definition of Done is not to be equated with the acceptance criteria of the user stories. The Definition of Done refers to the product increment and is realised through the functions of the increment based on the user stories.

Examples of Definition of Done are:

- Programming the software for the functions,
- Fulfilment of the acceptance criteria of the functions,
- Creation of the documentation,
- Application of the standards of software development,
- Conducting a review,
- Conducting functional tests,
- No open points or errors.

The artefacts are summarised in Table 4.3.

Table 4.3 Scrum artefacts

Artefact	Description
Product Backlog	The Product Backlog lists all requirements in the form of User Stories that are to be implemented during the project. The Product Backlog can also directly include functionalities, improvements, bug fixes etc. that are to be implemented. The Product Backlog is usually structured using the columns *To—Do, in progress, done*
Sprint Backlog	From the Product Backlog, based on the estimates and prioritisation, as many User Stories or functionalities etc. are transferred to the Sprint Backlog as the team can implement in one sprint. In addition, the Sprint Backlog is a plan to make progress in the Daily Scrum transparent. The Sprint Backlog should also contain the three columns *To—do, in progress, done*
Taskboard	The overview of individual tasks for developing functions can be displayed on a taskboard. The tasks should be assigned to individual team members and, as with the Sprint Backlog and Product Backlog, the columns *To—do, in progress, done* should be used. The taskboard can in turn be a flip chart, an Excel sheet, or Post-It notes on the Scrum board with the heading *Task*
Burn-down Chart	The Burn-down Chart is a graphical control and steering tool for the individual sprints. It visualises the work done and the work still to be done at a specific date. The representation is usually in the form of Story Points. In addition, the Burn-down Chart can be used as a forecasting tool to determine to what extent the development team can achieve the planned goal
Impediment Backlog	The Impediment Backlog is the documentation of obstacles during a sprint in the form of a list. The obstacles refer to everything that prevents a team from fulfilling the tasks. The Impediment Backlog can be a list on a flip chart, an Excel sheet, a ticket in a task management tool or Post-It notes on the Scrum board with the heading *Impediments*
Product Increment	An increment is the result of a sprint (partial deliverable). It includes the functions and features to fulfil the user stories of the sprint. At the end of a sprint, the increment must be in a functional state and fulfil the team's *Definition of Done* .

4.2.3 Scrum Events

- **Sprint**

A sprint is a development cycle that results in an increment. It includes the following events:

Sprint

- **Sprint Planning**

At the beginning of each sprint, the sprint goal is set, the user stories are estimated and selected for the sprint as part of sprint planning. The Product Owner participates in this. This is followed by the task planning of the sprint, in which the development team breaks down the user stories into tasks. At this part of the sprint planning, usually only the Scrum Master and the development team are present. Thus, the sprint planning is divided into three parts, which answer the three essential questions of project management:

Sprint Planning

1. Why?: Setting the sprint goal
2. What?: Estimation, prioritisation and selection of user stories for the sprint,
3. How?: Derivation of tasks for the sprint.

- **Daily Scrum**

Daily Scrum

4

In a daily meeting, the so-called Daily Scrum Meeting, the team and the Scrum Master come together for a short and fixed time (e.g. 15 min.) and briefly report on the status achieved since the last daily meeting, about obstacles, the tasks planned until the next Daily Scrum and possibly about synchronisations with other tasks in the team. The Daily Scrum should be kept deliberately short, but take place daily to ensure communication within the team.

- **Sprint Review**

Sprint Review

The acceptance of the increment developed in the sprint takes place in the so-called Sprint Review. At this appointment, which usually lasts 4 h, the development team presents the result of the sprint to the Product Owner and other interested parties. It is important that only functional increments are demonstrated.

The team takes the feedback from the Product Owner and subsequently incorporates it into the Product Backlog in the form of new or adjusted user stories.

At the end of the Sprint Review, the Product Owner decides on the acceptance of the increment and possibly further adjustments. The Sprint Review is conducted at the end of each sprint. This ensures that the accepted functional increments of the deliverable generate a benefit as early as possible.

- **Sprint Retrospective**

Sprint Retrospective

Furthermore, in a so-called Sprint Retrospective at the end of each sprint, the lessons learned from the sprint are reflected and improvement measures for the next sprint are derived.

In summary, the Scrum events are presented again in ◘ Table 4.4.

Time Boxing is also a special term in Scrum and indicates the precisely defined frequency and duration of each event.

◘ Figure 4.8 summarises the Scrum approach model incl. The events and artefacts.

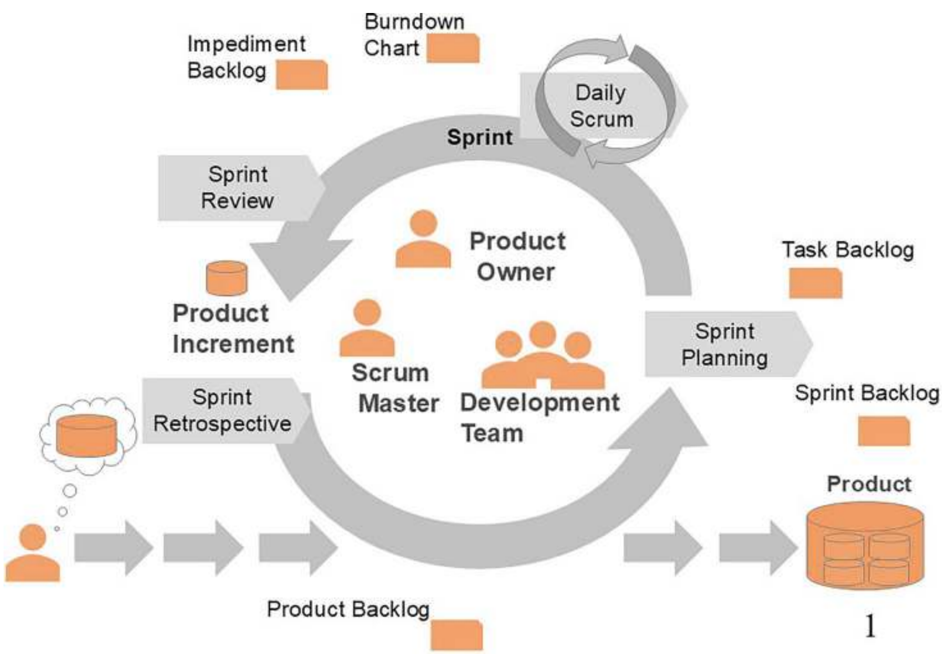


Fig. 4.8 Scrum approach with events, artefacts and roles

Table 4.4 Scrum Events

Event	Description	Time Boxing
Sprint	A fixed cycle in which an interdisciplinary team works independently and self-organised on the implementation of the sprint's specifications. The project team develops a deliverable product increment	Four weeks
Sprint Planning	A coordination and planning appointment, which consists of three parts: 1. Setting sprint goal (Why?) 2. Selection of user stories for the sprint goal (What?) incl. Prioritisation and estimation of individual stories 3. Determination of tasks (How?)	At the beginning of the sprint, 8 h
Daily Scrum	A daily coordination appointment of 15-min duration, in which each developer briefly answers three questions: – What have I achieved since the last Daily Scrum? – What possibly prevented me from achieving more? – What do I have planned until the next Daily Scrum?	Daily 15 min
Sprint Review	Presentation or demo of the product increment as a result of the sprint. Feedback from the customer.	End of the sprint, 4 h
Sprint Retrospective	Reflection of the current sprint. Improvements are identified, planned and implemented.	End of the sprint, 3 h

4

4.2.4 Agile Estimation Methods

The estimation of the size of the User Stories is also a special feature of Scrum. In traditional project management, the work required to create a deliverable is estimated in duration and effort, e.g. a work package 4711 has an effort of 100 project days and lasts 20 days. In Scrum, the estimation is relative or comparative between the individual User Stories with a neutral size, the so-called Story Points. Points are awarded per User Story depending on the relative size, which is an expression of complexity. The points are usually discrete values. In most cases, an adapted Fibonacci sequence is used (1, 2, 3, 5, 8, 13, 20, 40, 100 points).

The idea behind this new estimation is to focus on the User Stories—and thus indirectly on the result (product deliverable)—and not on the effort depending on the experience and productivity of the team. I.e. an experienced team in traditional project management will estimate the effort lower than an inexperienced team. In the agile environment with Story Points the estimation is related to the result and not to the effort and thus the team performance.

Further advantages of the agile neutral estimation based on Story Points are:

- Relative or comparative estimates can be made faster than estimating absolute sizes. Estimating things in relation to each other is easier than estimating an absolute size. Thus, one can relatively easily put things in an order to each other.
- The estimation of complexity is static, i.e. the value does not change. In the estimation of efforts or times, the productivity is increased over the course of the project due to the team's experience, thus necessitating a new estimate. Although the gain in experience plays at least as important a role in agile methods, it is not part of the Story Points.
- Through the discussions and estimates in the entire development team, a common view of the project is created. Uncertainties and open points are often recognised early and discussed.

Velocity

The so-called Velocity factor is used to estimate effort and thus make statements regarding productivity. The Velocity indicates how many Story Points can be implemented in a defined time period.

Determination of the Velocity

The Velocity factor corresponds to the completed Story Points of a sprint. Only in the first sprint is a determination not possible, as no values are available yet. Here, the Velocity can either be estimated or determined from historical data with the same team composition.

In practice, the estimation based on Story Points initially, especially when coming from traditional project management, requires some adjustment. One often falls back into the "old" estimation using effort and duration, at least one tries to build bridges here (e.g. one Story Point equals one day's effort). However, this approach is not very effective. For this, one must first understand and internalise the idea of Story Points. It is an expression of the size or complexity of a User Story. It can be explained, for example, with the floor plan of a flat. If the floor plan does not contain any square metre information, it is difficult to estimate how long a team of painters will take to paint the walls. However, once the painting team has painted one room, it can estimate the other rooms based on their relative sizes to each other (cf. Mike Cohn, 2006, p. 39 f.).

Methods for estimating story points

There are various methods to estimate story points. The most common methods in practice are the estimation conference, planning poker *(planning poker)* and the swimlane approach *(swimlane)*.

Estimation Conference

Estimation conference

The estimation conference is an open discussion for estimating story points. After the product owner has presented the user stories and questions have been clarified, the team estimates the individual user stories collectively in a discussion. The Scrum Master takes on the moderation, which is particularly important in the estimation conference.

Planning Poker

Planning poker

In planning poker, each team member receives a stack of cards (e.g. index cards) with the previously determined possible story points (e.g. Fibonacci numbers). Each user story is explained by the product owner, possible questions are clarified. Afterwards, each participant places his estimate face down on the table (one card). When the cards of all development team members are face down on the table, they are turned over simultaneously. If there are deviations in the estimates, the team member with the lowest and highest value should explain his estimate. Then a new vote is taken until a common estimate is available.

Swimlane Method

Swimlane method

In the swimlane method, the user stories from the product backlog are collectively distributed to the corresponding story points which are arranged side by side on a flipchart or whiteboard. Since the arrangement looks like swimlanes, this method has been given the name *swimlane—method* (◘ Fig. 4.9). If you use a flipchart, you can write the user stories on sticky notes, then label them with the corresponding

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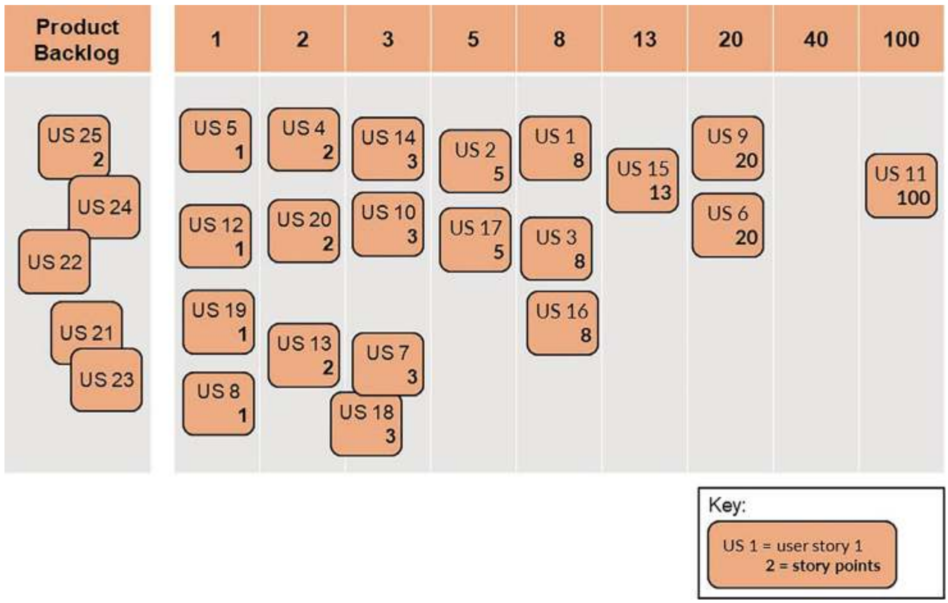


Fig. 4.9 Estimation using the swimlane diagram

story points, prioritise them and then transfer them to the sprint backlog according to priority. Of course, the whole thing also works digitally.

Magic Estimation

■ **Magic Estimation**

The development team divides the user stories among themselves and lines up in a row. One after the other, each team member then assigns his user story to the corresponding story points. This can be done on a swimlane structure on a metaplan wall or digitally. The next person can then either move the previous user story or if they agree with the estimate, assign their own user story to the story points. The movement of user stories are marked accordingly. If user stories have been moved more than three times, they are subsequently discussed and then after a common agreed estimate also pinned to the swimlane diagram. The magic estimation process is a very efficient process, as the estimation of many user stories takes place without discussion. Only the moved user stories are discussed. The process is often used with a large number of user stories.

It is important with all estimation methods that a simple average formation or voting should be avoided if possible and a consensus should be found.

After the development team has estimated the user stories, these are prioritised by the product owner in terms of their customer value, i.e. the order of the user stories is determined according to customer benefit. This can be done using

- a simple ranking (from the most important user story to the least important user story) or
- the MoSCoW classification (***M*** *ust Have,* i.e. must-have user stories, ***S*** *hould have,* i.e. should-have user stories, ***C*** *ould have,* i.e. could-have user stories and ***W*** *on't have,* i.e. user story for the next version) or
- classified from class 1 (very important) to n (rather unimportant).

Prioritisation of User Stories

Christmas Party at Ei-Ti AG—Scrum Application/Sprint Run-Through

As the development of the mobile app is to be done according to Scrum, the Scrum team with the three roles is first defined.

- Product Owner: Martina Mark
- Development team: Laura Leiter, Elena, Emma, Edgar, Eddy
- Scrum Master: Sven Soft

As Sven Soft does not have much experience with Scrum yet, but is to become an agile expert at Ei-Ti AG, Emil Expert has assured the management that he will be available as a coach for Sven Soft and the entire Scrum team.

Emil Expert suggests a sprint length of 2 weeks based on the vague requirements for this app. This results in a total of six sprints for a duration of the work package "App Development" of 12 weeks, which corresponds to the total duration of the Scrum project (12 weeks/2 weeks sprint length = 6 sprints). The Scrum team wants to work with the following events and artefacts, which according to Emil Expert (Coach) are also used in many other companies.

Events:

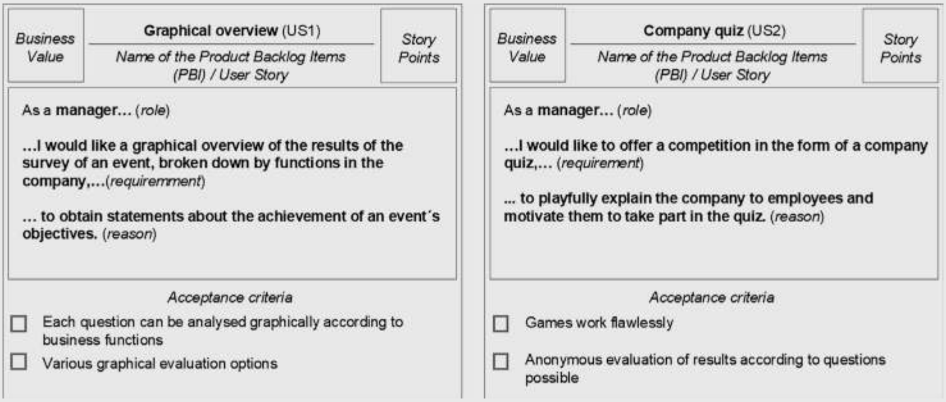
The duration of the events is determined based on the sprint length (Time Boxing):

- Sprint Planning: 4 h (time boxed)
- Daily Scrum: 15 min
- Sprint Review: 2 h (time boxed)
- Sprint Retrospective: 1.5 h (time boxed).

Artefacts:

- Product Backlog
- Sprint Backlog
- Task Backlog or Task Board
- Burndown Chart
- Impediment Backlog

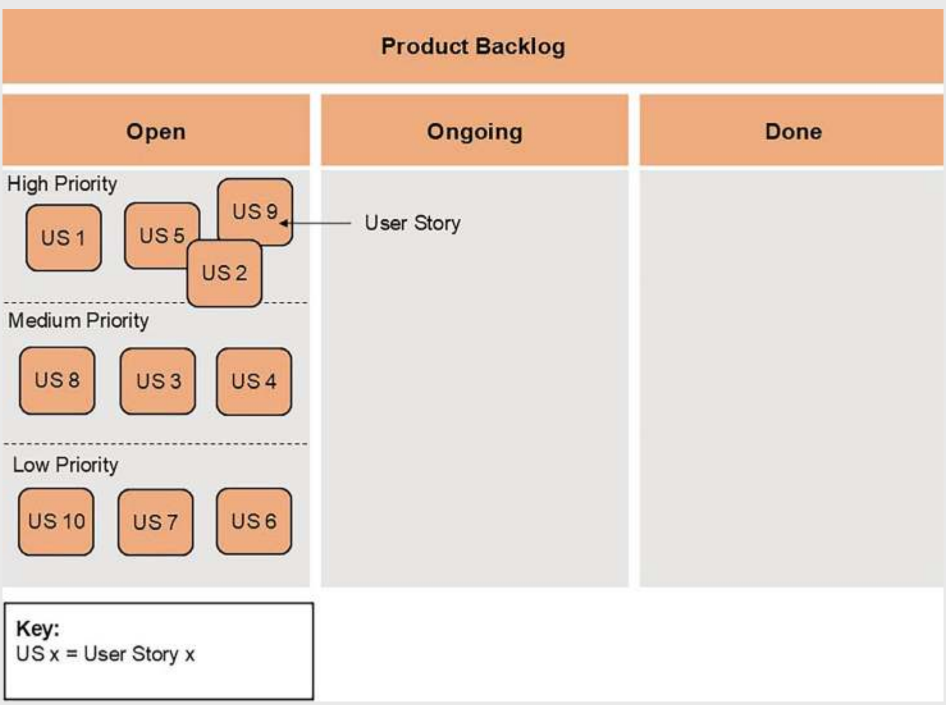
A few weeks ago, some User Stories were already identified. The User Stories have the following structure, which the Scrum team uses as a template for all further User Stories.



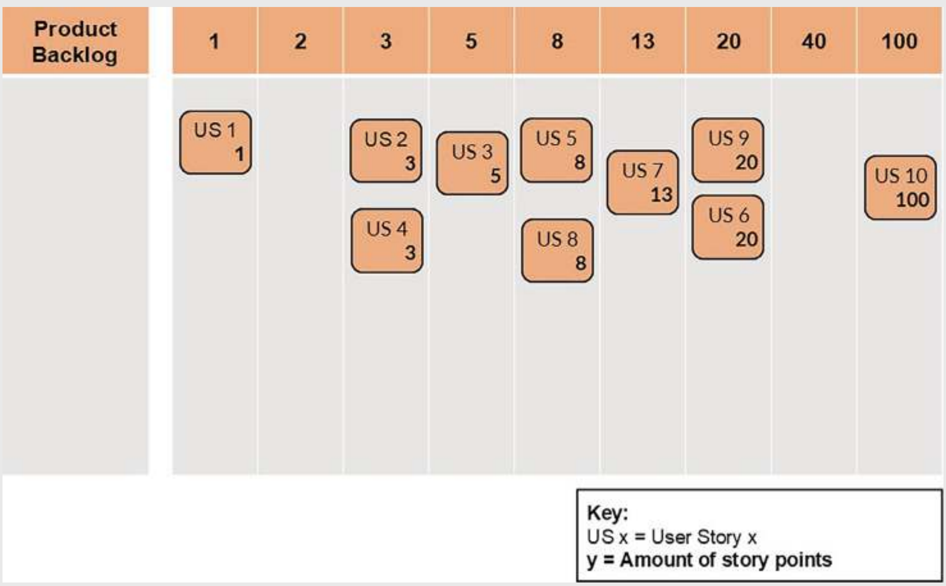
Martina Mark (Product Owner) only takes responsibility for the Product Backlog. Sven Soft explains to her that she should first prioritise the User Stories. She does this using a simple classification with

- Very important (£££)
- Important (££)
- Less important (£)

The Product Backlog now contains the prioritised User Stories.



In a next step, Martina Mark, Sven Soft and Laura Leiter and the rest of the development team sit down together to estimate the complexity of the individual User Stories, so that the development team can estimate how many User Stories can be processed in a sprint. Sven Soft has coordinated with Emil Expert in advance and suggests Planning Poker for the estimation (► Sect. 4.2.4). Sven Soft has brought a set of cards for each development team member. Martina Mark presents the User Stories to the development team again and then each User Story is estimated by the development team using the poker cards. Sven Soft as Scrum Master moderates the Planning Poker rounds and Martina Mark answers the content-related questions about the User Stories. After about 1 h, the five development team members have estimated the ten User Stories using Story Points. They had a lot of fun, which made the work much easier. Due to the many questions, everyone now has a very good understanding of the requirements. Everyone is satisfied with the result. Martina Mark then also uses the swim lane method (► Sect. 4.2.4) to visualise and classify the User Stories and the Story Points for everyone on a flip chart.

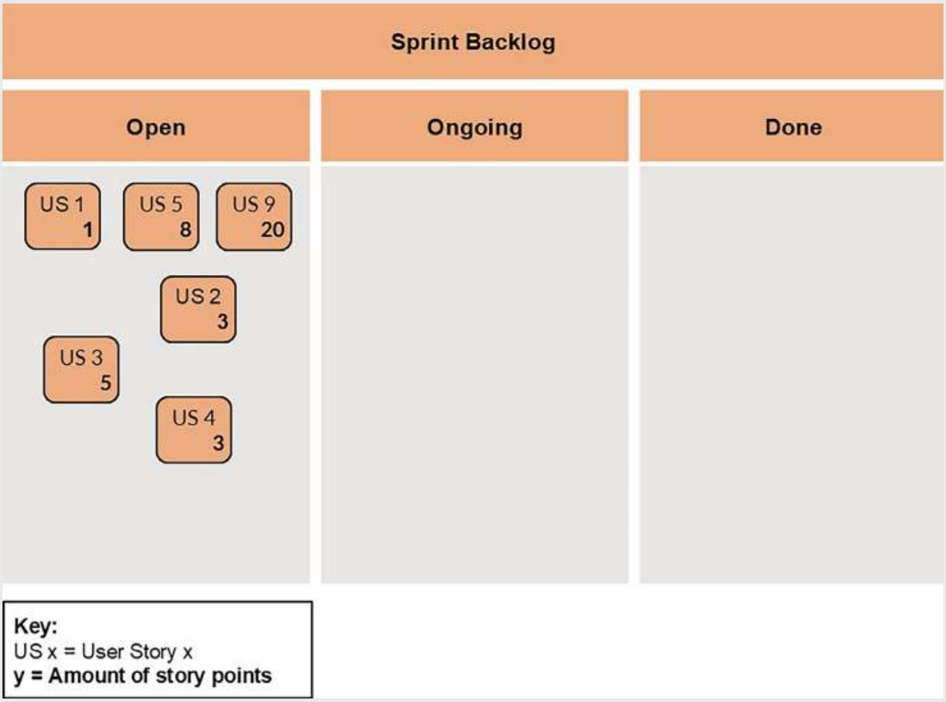


This allows the team to start the first sprint on the coming Monday.

The Scrum team starts on Mondays with the Sprint Planning, which was scheduled from 9 to 13 h (8 h timeboxed). First, the Product Owner Martina Mark presents the prepared sprint goal (WHY?) and discusses it with the development team. The sprint goal for the first sprint is “Simple recording of feedback in digital form”. The entire team supports this sprint goal.

In a second step, Martina Mark presents the Product Backlog. The development team then selects, with the support of Martin Mark, the User Stories that support the sprint goal and are feasible within the scope of a sprint (WHAT?). The development team then transfers the User Stories into the Sprint Backlog developed with the help of Sven Soft.

The development team agrees on the following User Stories:

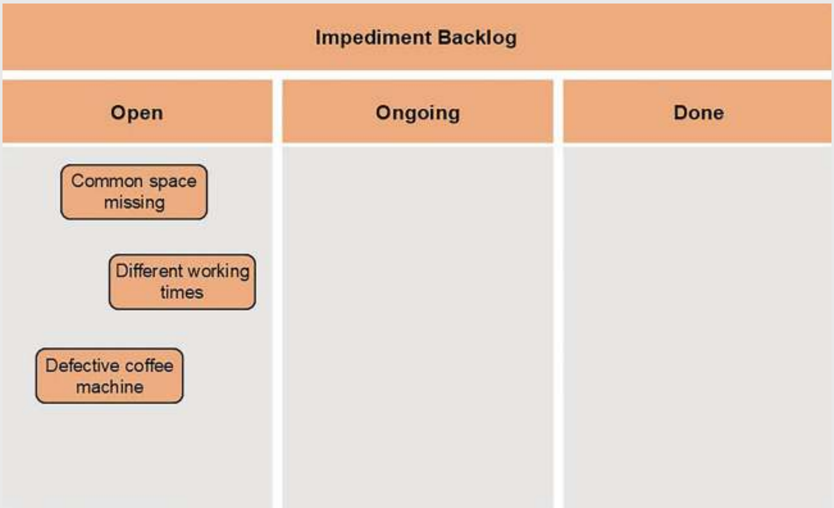


In the third part of the Sprint Planning, the development team now discusses how it can technically and professionally implement the individual User Stories, so that at the end of the sprint an increment (working partial delivery object) is created. The team is not entirely sure whether it can really present a solution that can be used after just 2 weeks. But Emil Expert as a coach encourages them. The first Sprint Planning has thus already worked well according to the assessment of Sven Soft (Scrum Master) and Emil Expert (Coach).

In the next few days, the development team will work through the individual tasks of the Task Backlog. During the sprint, the development team meets daily for the Daily Scrum, with the intention that all team members answer three questions to get an overview of the current situation and upcoming To Do's:

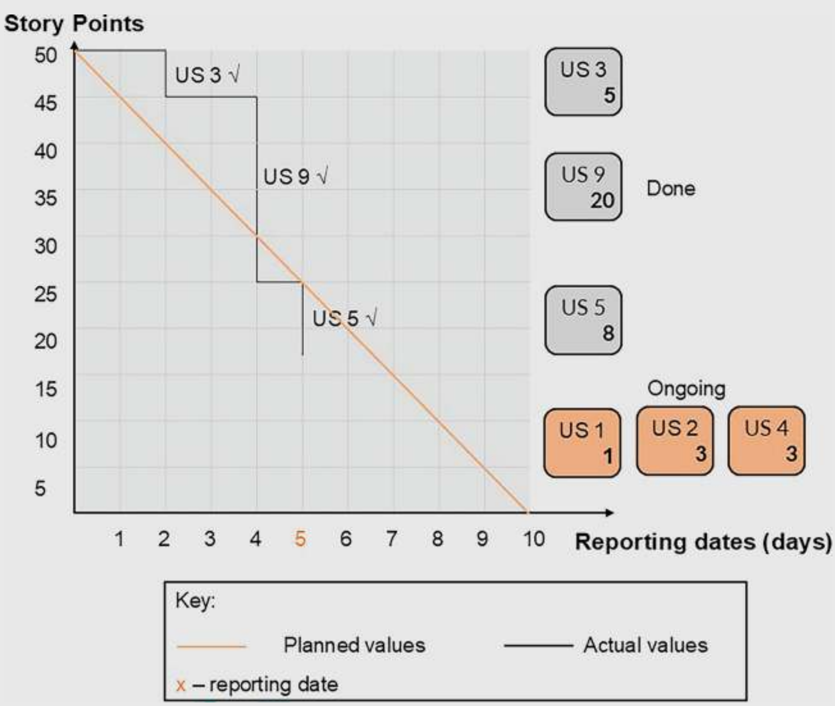
1. What has happened since the last Daily?
2. What do I want to do before the next Daily?
3. What is preventing me from doing it?

Because the Daily is only 15 min long and thus a fixed time frame is set, the team members do not feel exhausted or robbed of their time. Reflecting on themselves daily and also hearing what is bothering the other team members is motivating and they get a clear goal setting for the day. Regarding the third question of obstacles in the project, the Scrum Team fills an Impediment Backlog, which Sven Soft as Scrum Master regularly maintains. Three points have already been identified.



Sven Soft wants to tackle these three topics immediately and have them solved by the next Sprint. He is confident that he will get the budget for a new coffee machine from the management quite quickly. Also, the move to a new room is possible in the short term, as there is still a large office room for 6 people in the building. He wants to address the issue of common working hours again in the context of the retrospective at the end of the sprint and hopes for a good compromise.

After half of the sprint time (1 week), the development team with the help of Sven Soft creates the following Burndown Chart:



The User Stories 3, 9 and 5 could already be completed in the first half of the Sprint time. The User Stories 1, 2 and 4 are still open. The development team hopes to be able to complete these by the end of the sprint, as more story points were achieved than planned by the deadline.

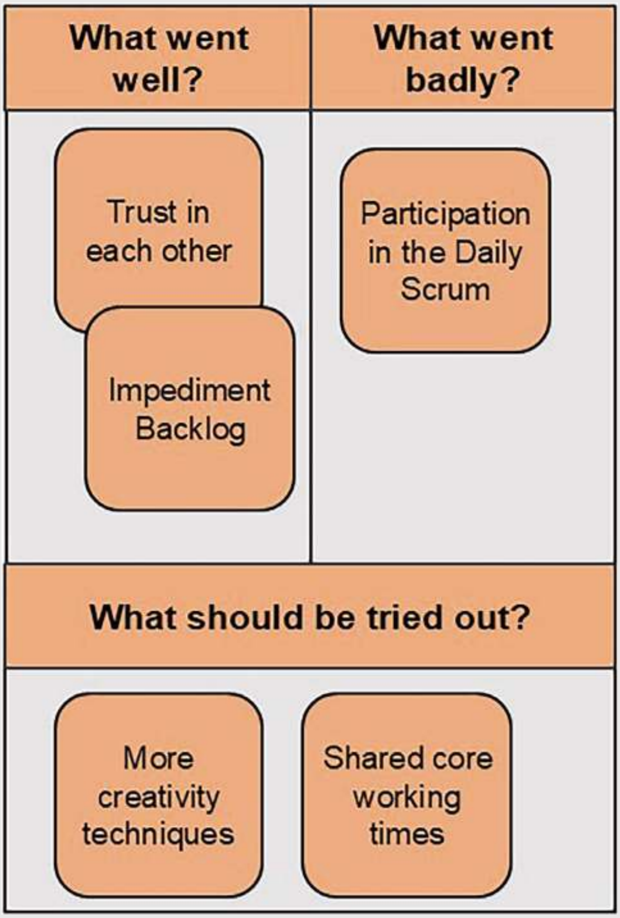
On Friday of the second week, the Sprint Review is planned for the morning (2 h timeboxed). The development team presents Martina Mark with the developed increment. The increment implements all User Stories mentioned in the Sprint Backlog which were all accepted by the Product Owner Martina Mark.

In addition, further requirements for the mobile app were identified by Martina Mark and other stakeholders and formulated in the form of new User Stories.

On Friday afternoon, Scrum Master Sven Soft, the development team, and Martina Mark gather for a retrospective to discuss the course and possible improvements in collaboration. Sven Soft schedules the retrospective for 1.5 h (timeboxed). He structures the retrospective around three questions:

1. What went well and should be expanded?
2. What didn't go so well and should be improved or avoided?
3. What should we try out?

The entire Scrum team identified the following five points regarding the above three questions during a brainstorming session:



Sven Soft is particularly pleased with the solution to the problem of different working hours. The team has voluntarily suggested harmonising the working hours by applying core working hours from 9 to 4 pm.

Overall, the Scrum team (Scrum Master, development team, and Product Owner) is satisfied with the result of the first sprint.

Due to the improvements worked out in the retrospective and the measures derived from the impediment backlog, the entire Scrum team is motivated and looking forward to the second sprint next Monday.

In summary, the essential principles of the Scrum method should be mentioned again:

1. Structured approach model with roles, events, and artefacts and fixed times (Time Boxing),
2. Empirical process control through retrospective, daily scrums, and impediment backlog,
3. Self-organisation and collaboration,

4. Customer orientation through value-based prioritisation by the Product Owner,
5. Iterative development.

4.3 Kanban

4

Kanban is fundamentally not a pure project management method, but rather a principle for visualising and controlling tasks in certain work methods. It originated in production and has been adapted to the agile world (especially IT projects).

Kanban method

Kanban is a method where the number of parallel tasks (work items) is limited to avoid bottlenecks. In Kanban, each team member takes his work item from the predecessor as soon as he is ready for further work. This pull principle creates a workflow. Any bottlenecks become quickly transparent.

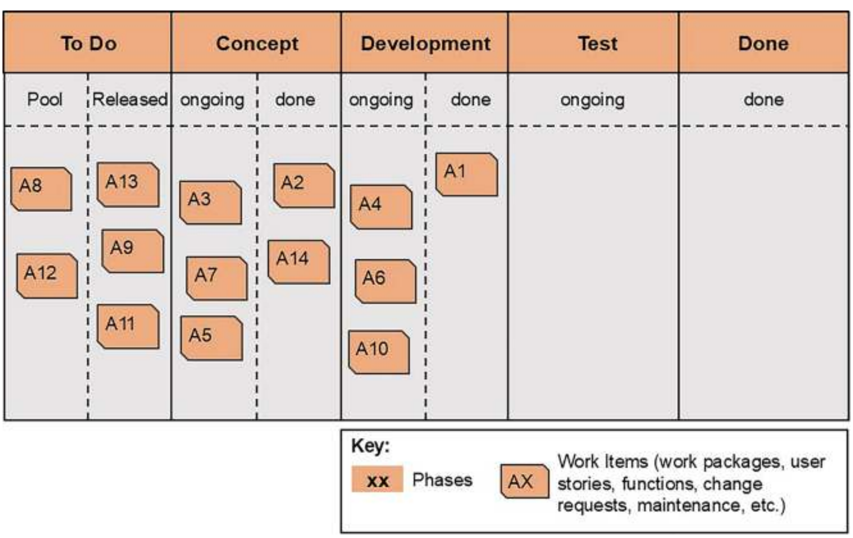
Features of Kanban

In principle, Kanban can be described and implemented with the following practices or core characteristics:

- "Visualise the flow of work (workflow).
- Limit the work in progress (amount of work started).
- Carry out measurements on the flow and control it.
- Make the rules for the process explicit.
- Use models to identify opportunities for improvement." (See Anderson et al., 2015, p. 19 ff.)

Visualise the Flow of Work (Workflow)

The central tool for visualising work is the Kanban board (◘ Fig. 4.10). It is both a visualisation and a control instrument.



◘ **Fig. 4.10** Kanban board

Work in Progress (WIP)

Kanban is a process-oriented system that works according to the pull principle. Due to the process orientation, the individual phases of the project are written on a board. The work that must be done during the Kanban project is also listed in a backlog (To-do) at the beginning of the process like in Scrum. Each phase is divided into the two statuses *in progress* and *completed.* Divided. In addition, there is a limit for each phase on so-called Work Items (task packages) that can be processed in parallel per phase. This limit is represented by the *Work in Progress* (WIP).

The Work Items can be work packages, user stories, features, change requests, bug fixing activities, etc.

In practice, the Kanban board is either a board (e.g. a whiteboard) with cards or sticky notes, or a digital product.

- **Limit the Work in Progress (Amount of Work Started)**

The number of Work Items per phase is limited in Kanban by the Work in Progress limit (WIP limit). A limitation of the Work Items per phase improves the workflow in terms of a shorter lead time and/or a higher throughput.

The lead time is the duration that a Work Item per phase and in total needs until completion. That is, you can measure the lead time per phase for a Work Item and the total lead time.

The throughput is the number of Work Items that can be processed per period (e.g. per week).

Since resources and especially personnel in an organisation are limited, there are always bottlenecks in the scheduling of projects. This fact is explained in more detail in the so-called bottleneck theory (see also Goldratt, 2002; Techt & Lörz, 2011). However, if the bottleneck is identified and the entire workflow is sensibly limited in terms of resource harmonisation, the lead time per Work Item can be improved. That is, for example, if the WIP limit of a phase has been limited to three and three Work Items are currently being processed, no fourth Work Item may be accepted. ◘ Figure 4.11 shows the Kanban board from ◘ Fig. 4.10 with the corresponding WIP for the three phases Concept, Development and Test.

In the example, the phase *Development* has a WIP of 4. Since there are already 4 Work Items here, regardless of whether they are currently being processed *(in progress)* or have been completed and are waiting for the next phase *(completed),* no further Work Item can be transferred to this phase.

Furthermore, the Work Items can also be limited individually, i.e. per employee. This limitation can be made in addition to the WIP limitation of the phases.

Carry out measurements of the flow and control it.

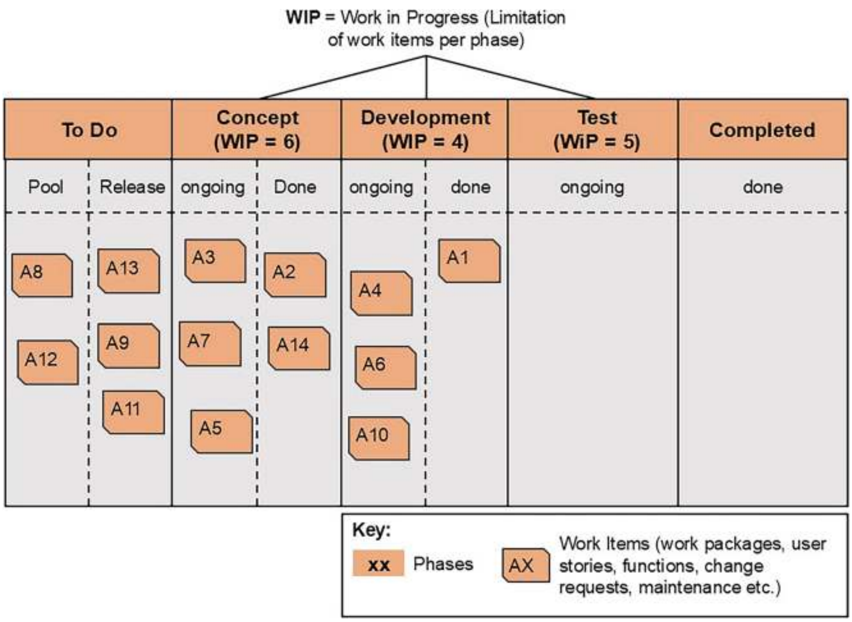


Fig. 4.11 Kanban board with limitations

Key figures for controlling the workflow

First of all, meaningful key figures for the analysis and control of the Kanban project should be found. The focus here is primarily on the analysis and control of the workflow. The following parameters are suitable for measuring and controlling the workflow and are used in practice:

- Lead time,
- Throughput,
- Waiting time,
- Cumulative flow.

The lead time and the throughput have already been described above.

The waiting time is the time of Work Items, in which these are not processed until the start of the next phase. The longer the waiting time of individual Work Items, the less productive the Kanban system.

The cumulative flow is the number of Work Items in a certain phase.

To improve the Kanban system, the selected key figures must be collected and the system must be controlled accordingly. In Kanban, the focus of measurements and optimisations is on the system, not on individual employees.

Make the Rules for the Process Explicit

Here, rules are developed and made transparent that regulate the collaboration within the team.

Rules within Kanban can cover the following topics similar to traditional project management:

- Meetings with start time and duration,
- Rules for handling the Kanban board (e.g. moving cards),
- Rules for limiting work (WIP limit) or limits per employee,
- Communication rules (e.g. daily short meetings similar to the Daily Scrum, improvements, acceptances, escalations),
- Priorities (How are priorities handled?),
- Definition of Done (When is a work item, a partial deliverable or the entire deliverable finished?).

The joint formulation of rules creates a basis for the collaboration of the participants. An attempt should be made to explicitly formulate all rules that control the workflow.

Use Models to Identify Opportunities for Improvement

All feedback from the system, especially the metrics, but also obstacles or ideas for improving the workflow or collaboration must be collected and jointly evaluated and implemented within the framework of an improvement process in order to constantly improve the Kanban system.

There are various Kanban elements that are intended to continuously improve the process.

Feedback Meetings

Feedback meetings can provide specific hints or ideas for process improvement. These meetings can take place in the following manner:

- daily stand-up meeting in front of the Kanban board,
- brief discussion of all tickets, with a particular focus on difficult tickets,
- Discussion of approaches to difficult tickets (removing blockages),
- additionally (monthly) a larger retrospective meeting to improve workflows.

Measurements serve as input for improvement. The measured metrics must be evaluated and improvement suggestions identified and assessed.

With the help of these elements, transparency can quickly be brought into the development process and the process can be sustainably managed and improved.

Summary Features of Kanban

Kanban can be summarised with the following characteristics:

- Kanban is a pull system.
- With Kanban, the current state of the workflow is visualised on a *Kanban—Board*. Each phase has a column. The work items go through the phases.

- The work is limited to the real capacity of the system. The number of work items is limited for each column, so that not too many tickets are present in a column at the same time (= Work in Progress, WIP).
- A *Pull—System* is used. Project teams work independently on their work items and pull new work items as soon as capacities have become available in the system.
- The Kanban system is constantly improved. The improvement of relevant metrics, such as lead times and throughput, ensure a maximum customer benefit, minimal rework and thus the efficiency of the system.

Comparison of Kanban and Scrum

Similarities between Kanban and Scrum

Kanban has many similarities with Scrum:
- It is agile.
- Both methods use the pull principle.
- The work is limited.
- Both methods are based on self-organising teams.
- Projects are carried out in small teams.
- In both methods, the system is continuously optimised by evaluating empirical data (team velocity/lead times)
- Both methods rely on transparency to improve the process.
- Both methods use simple tools.

However, there are also some differences to Scrum (Table 4.5).

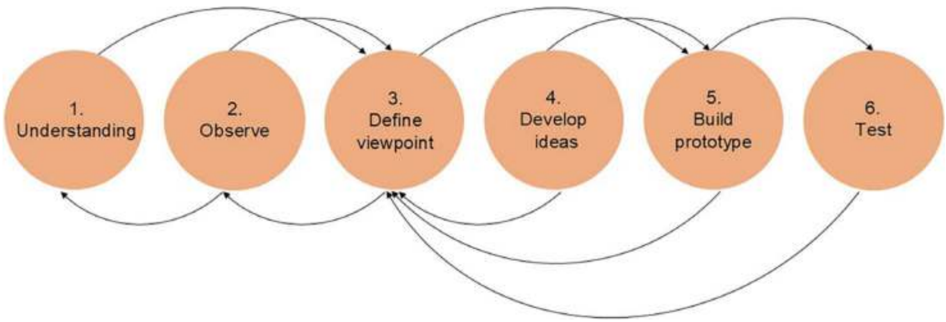
Table 4.5 Differences between Scrum and Kanban

Topic	Scrum	Kanban
Limitation of work	Iteratively per sprint by the team	Continuously for the individual phases in the process
Roles	3 roles (Product Owner, Scrum Master, Development Team)	No specifications
Metrics	Velocity	Lead time, throughput, etc.
Estimates	Complexity via Story Points	–
Tools	Backlog and Tasks Boards, Burn-down Chart, Impediment Chart	Kanban Board
Duration of individual events	Time Boxing, i.e. all events are time-bound	No specifications

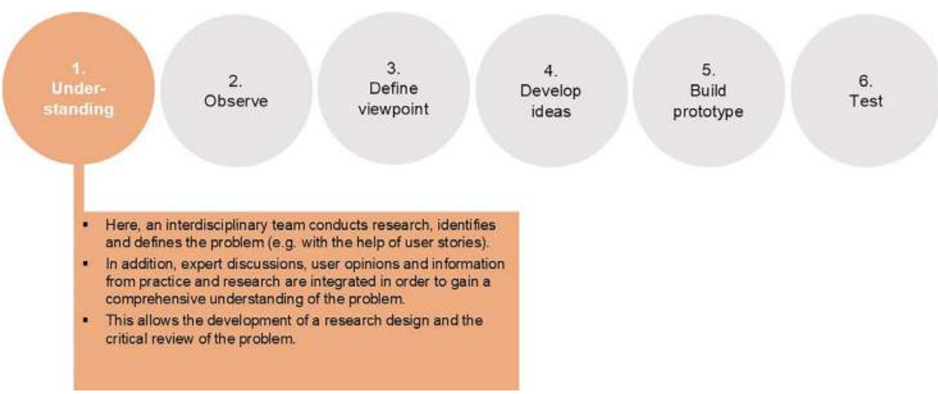
4.4 Design Thinking

Design Thinking is an agile approach that enables creative and systematic problem-solving and thus also the development of customer-centric products. This model is based on the agile principle of customer focus, where the customer and their needs are at the centre of consideration. In Design Thinking, problems and needs are viewed from different angles and implemented iteratively within the framework of prototype development.

Design Thinking consists of several phases, with a five-step approach according to Stanford University or a six-step approach according to the Hasso Plattner Institute being most commonly used. The following figure presents the six-step approach of the Hasso Plattner Institute (HPI).

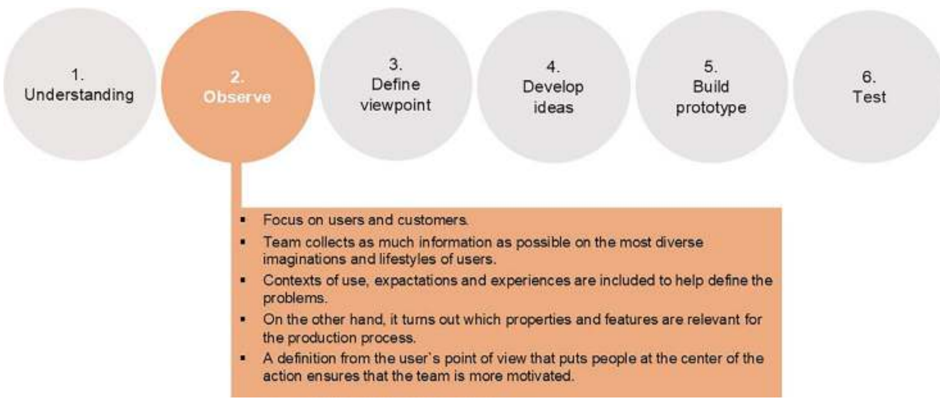


1. **Phase: "UNDERSTAND"**
   In the first step, an interdisciplinary team identifies and defines the problem. The problem can be described via user group-specific requirements. User Stories (► Sect. 4.2.2) can also be used for this purpose.
   In addition, expert discussions, user opinions and information from practice and research can be integrated to gain a comprehensive understanding of the problem. This allows the development of a research design and the critical review of the problem.



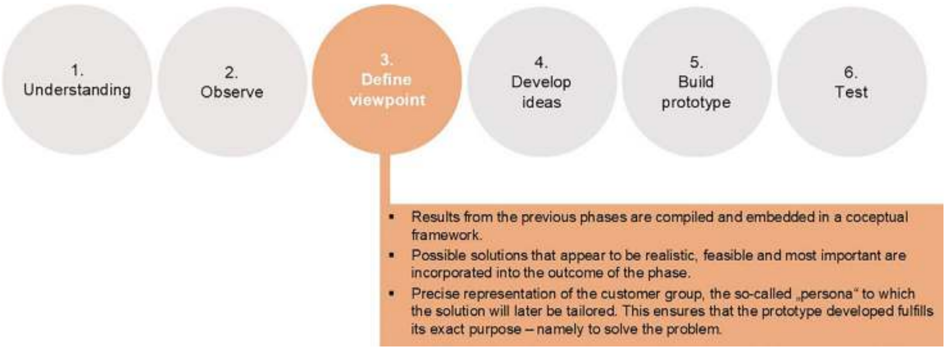
2. **Phase: "OBSERVE"**

   In the second step, the user and customer are the focus of the Design Thinking team in order to gather as much information as possible about the different perceptions and life worlds of the users. This includes usage contexts, expectations and experiences, which facilitate the definition of the problem. It becomes clear which functions, add-ons and requirements are prioritised. Furthermore, it becomes apparent which characteristics and features are not relevant for the production process. A definition from the user's perspective, which puts people at the centre of events, ensures a higher motivation of the team.



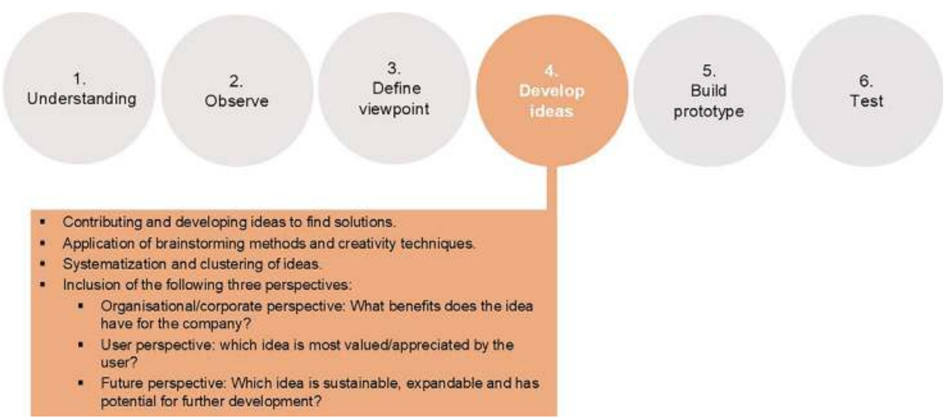
3. **Phase: "DEFINE STANDPOINT"**

   At this point, the results from the previous phases are collected and embedded in a conceptual framework. The solution possibility that appears realistic and feasible and at the same time most important is incorporated into the result of the phase. In addition, a precise representation of the customer group, the so-called "persona", is created, to which the solution will later be tailored. This ensures that the developed prototype fulfils its purpose—namely to solve the problem. User Stories can also help to define the customer's standpoint in this phase (► Sect. 4.2.2).



4. **Phase: "DEVELOPING IDEAS"**
   In this phase, the team can bring in and develop creative ideas. Creativity techniques facilitate the process and promote open-ended thinking and thus innovative ideas. It should be taken into account that everything that comes to mind for the team members should be said. Because creativity develops better in impossibilities than in limitations. Once enough ideas have been collected, they are systematised and clustered, creating a structure. Another process of idea development involves including the following three perspectives:
   1. Organisational/entrepreneurial perspective: What benefit does the idea have for the company?
   2. User perspective: Which idea is most appreciated by the user?
   3. Future perspective: Which idea is sustainable, expandable and has potential for further development?

In ► Sect. 2.8, several creativity techniques were already introduced that can be used in this phase.



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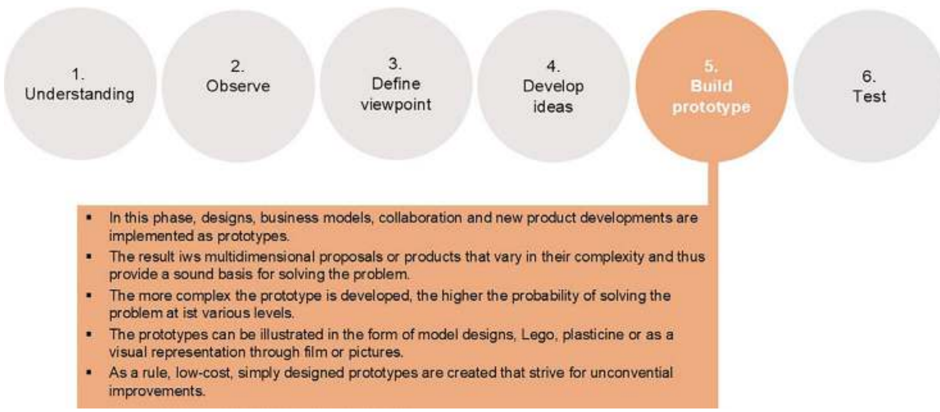
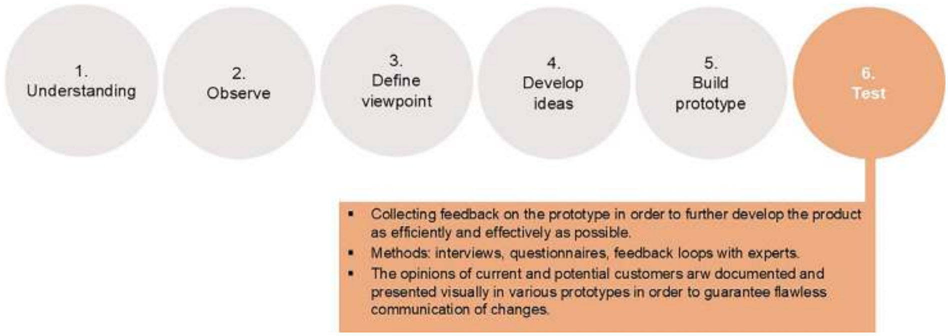
5. **Phase: "BUILDING A PROTOTYPE"**
   The prototype is the first tangible solution approach, which can take different forms. Designs, business models, forms of collaboration or new product developments can be developed in the form of prototypes. As a rule, multidimensional proposals or products are created in this phase, which vary in their complexity and thus provide a solid basis for solving the problem. The more complex the prototype is developed, the higher the probability of solving the problem at its different levels. The prototypes can be illustrated in the form of model drafts, Lego, plasticine or as a visual representation through film or image. As a rule, cost-effective, simply designed prototypes are created that aim for unconventional improvements.
6. **Phase "TESTING"**



Finally, in the last phase after the handover of the prototype, feedback is collected in order to develop the product as efficiently as possible. Feedback loops with experts, for example, serve this purpose. The opinions of current and potential customers are documented and visually represented in different prototypes to guarantee flawless communication of changes. The advantage of this representation is that the conceptual design is exceeded and becomes tangible and realistic in the form of a model. This helps the customer, the team and also third parties to get a concrete idea about the product.



Design Thinking is a flexible framework for developing innovative and creative problem solutions. The sequence of phases can vary and is not to be considered sequentially. It is possible to design the phases in parallel, overlapping or flexible in their order.

Christmas Party at Ei-Ti AG—Design Thinking

Laura Leiter and her team want to organise something special for this year's Christmas party. Something that is of interest to the employees and also reflects the company. She recently attended a Design Thinking workshop and she is now fired up to try this approach with her team.

1. **Understand:**
   Is there any problem that bothers the employees of Ei-Ti AG? Laura Leiter asks directly in her team. She finds that everything is generally fine, but they often lack the opportunity to get in touch with other colleagues. In addition, most team members do not consider the upcoming Christmas party to be sustainable. They would like a stronger awareness, for example, of the waste produced and the short lifespan of the decorations, for example. These are already two very good problem approaches for Design Thinking, thinks Laura Leiter. She asks in the team who would like to help her solve these problems. Wants. Everyone signs up. Some agree to look up and read literature on the topic of "Sustainability in Companies". That's great, says Laura Leiter, because this way the team can also rely on research and find inspiration for possible solutions.
2. **Observe:**
   Next, it's time to observe and understand the employees and their needs in relation to the previously defined problems. Some team members suggest keeping an eye out in the canteen. Lunch break is somehow also a small event within a certain framework. There, the employees are relaxed and have the opportunity to talk about private matters. One employee sits alone at a table and asserts that he unfortunately finds it difficult to get in touch with other colleagues, especially since he is always working from home when his colleagues are in the office. Another employee mentioned that it bothers her that the canteen still provides plastic cutlery and plastic cups. She had just come from a meeting, in which only disposable cups and plates were used. Through this short excursion in the canteen, Laura Leiter and her team were now able to get a more accurate picture of the needs of the employees of Ei-Ti AG.

3. **Define standpoint:**
   Now it's time to gather the new insights. Because the target group was already addressed in the observation phase, Laura Leiter and her team can get a more accurate picture of the target group: For this, they create so-called personas. This will make it easier to tailor the solution exactly to them. For their project, they create two personas.
   1. Konrad Contact. Konrad Contact is 37 years old and has been with Ei-Ti AG for 8 years. He is a family man and has been working from home 3 days a week since the pandemic began. He likes his job and is a very sociable person. In his free time, he enjoys going bouldering with his friends from the football club. Konrad Contact likes to try new things and is open to many things. He is a big family man and likes to have people around him. Since his partner works shifts, he works from home as much as possible to be at home when the children come home from school and nursery. Even though he is glad to have this opportunity, he would occasionally like to go to the office more often, as he misses contact with his colleagues and so far there is no good way to get much interaction with the employees from home.
   2. Nora Sustainable. Nora Sustainable has just joined Ei-Ti AG. She is 26 years old and after her computer science degree, which she completed with top marks, she added a master's degree in environmental management. She is very interested and active in politics and supports the Fridays-for-Future movement. In her job it is important to her that it provides added value for her and society. She believes that one can do something for the environment everywhere. Nora Sustainable is always found with her thermos flask and her aluminium lunch box. She likes to try out new vegan recipes and lets her colleagues taste them. All in all, she is very satisfied with her job and Ei-Ti AG, but she has noticed some aspects that could be improved in terms of sustainability.
4. **Develop ideas:**
   Now it's time to get down to business. The team has both the problem and the personas in front of them. They now have an understanding of what the employees might want for the Christmas party. Laura Leiter suggests trying the creativity method 6–3-5, a brainwriting method, where each person develops three ideas for the Christmas party that include both the aspect of simple getting to know each other and sustainability. Then these written down ideas are passed on to a team member and further developed. In the end, everyone has thought about each idea once and there are now many ideas for the Christmas party. But not every idea is necessarily suitable for the given purpose. Laura Leiter suggests clustering the ideas and considering both the business perspective and the user and future perspective. The team now jointly considers which of the ideas makes the most sense for the given occasion and ultimately decides on a combination of two ideas.
5. **Build prototype:**
   In this phase, it's about implementing the idea. The team wants to develop an app that involves all employees in one aspect of the organisation of the Christmas party. Namely, regarding the decoration. The party should also be nicely decorated. But garlands and paper napkins ultimately produce a lot of waste. The goal of this Christmas party is therefore to produce as little waste as possible in the end. The employees should be involved in this. Each employee should think of a decoration element and bring it along. To do this, he takes a photo of the decoration element and then writes a few sentences about why he chose it. In addition, he creates a profile in the app with anecdotes and characteristics

about himself. The others can then match the decoration element to the right person as a guessing game. At the end of the Christmas party, the winner is announced. The app thus enables the organisation of the decoration and at the same time the more personal getting to know the employees. And it will also provide conversation material.

6. **Test:**
   The first prototype is ready and the team is very curious about how the idea will be received by the employees. They ask a few employees to test the app. to download and try out. Afterwards, they gather feedback. In general, the idea is very well received, but here and there improvements are suggested. For example, it was criticised that there is no real guide, or no information about how much or how detailed one should describe their decorative element. Here it would be better if certain points were given that one simply had to fill out. Also, a list of decorative elements that might be suitable is desired. The team can do a lot with this.

4.5 Summary

All the methods presented in Sects. ▶ 4.2, ▶ 4.3 and ▶ 4.4 support the twelve agile principles (▶ Sect. 4.1). ◘ Table 4.6 summarises the methods mentioned again and refers to their relevance for the corresponding agile values and principles.

The agile methods presented in this chapter are summarised in ◘ Fig. 4.12 in addition to the traditional methods.

Summary Agile Project Management

- Characteristics of agile project management are:
  - iterative and incremental approach,
  - self-management of the development team,
  - delegation of responsibility from the line manager to the developers,
  - involvement of customers,
  - transparency for the development team through close collaboration and direct exchange during development.

- Scrum and Kanban are the two most commonly applied methods in practice.
- Scrum is characterised by three roles (Product Owner, Scrum Master, Development Team), five events (Sprint, Sprint Planning, Daily Scrum, Sprint Review, Sprint Retrospective) and six artefacts (Product Backlog, Sprint Backlog, Taskboard, Product Increment, Impediment Backlog, Burn-down Chart).
- Kanban follows five rules (workflow visualisation, WIP limit, workflow control, process rules and continuous improvement process).
- Design Thinking is a method for very quickly creating solutions (prototypes).

4

Table 4.6 Overview of agile methods and their relevance for the agile values and principles

Agile method	**Support for agile values and principles**
Backlog (e.g. Product and Sprint Backlog)	Expandable sub-product; Transparency
Cross-functional Team	Cross-functional Teams
Dailys/Stand-up Meeting	Direct Communication
Development Team	Cross-functional Teams, Self-organisation
Impediment Backlog	Continuous Improvement
Increment	Expandable sub-product;
Iteration	CIP; Customer loyalty through quick delivery of partial deliveries
Kanban Board	Transparency
Persona	Customer Focus
Planning Meeting	Iterative and/or incremental approach; Customer loyalty through quick delivery of partial deliveries
Product Owner	Customer Perspective
Pull Principle	Sustainable Project Progress
Retrospective	Continuous Improvement
Review Meeting	Short Development Cycles; Customer Focus
Scrum Master	All Agile Values and Principles
Self-organised Team	Self-organised Teams
Swarming	Continuous Improvement
Time Boxed	Sustainable Project Progress
User Stories	Customer Perspective
Story Points and Agile Estimation Method (e.g. Planning Poker, Magic Estimation)	Transparency

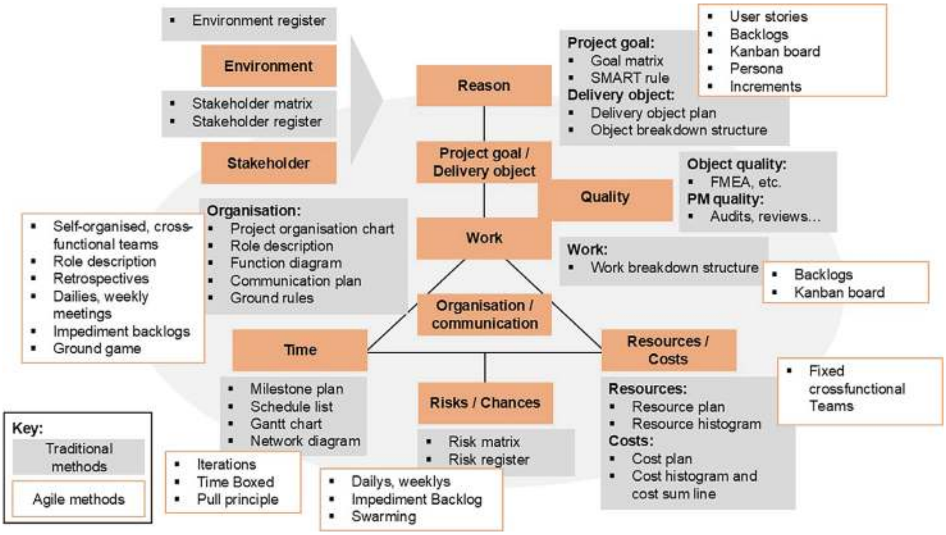


Fig. 4.12 Method Selection Traditional and Agile Project Management

4.6 Review Questions

Agile Project Management

1. What are the main differences between traditional and agile project management? (*Solution* ► Sect. 4.1)
2. Why is Scrum an agile approach model (*Solution* ► Sects. 4.1 and 4.2)
3. What are the special features of Scrum? (*Solution* ► Sect. 4.2)
4. What is the main difference between the estimates in traditional and agile project management? (*Solution* ► Sect. 4.2.4)
5. What are the special features of Kanban? (*Solution* ► Sect. 4.3)
6. What are the six steps of Design Thinking? (*Solution* ► Sect. 4.4)

Hybrid Project Management

Contents

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Learning Objectives of This Chapter

After reading this chapter ...
- you will know the essential characteristics of hybrid project management.
- you will know different approaches of hybrid project management.
- you will know the elements of a project management procedural model.
- you will understand how to build a project management procedural model.
- you will know the essential requirements and success factors of hybrid project management
- you will know optional project management elements, such as procurement, contract management, claim management, change management and project marketing

The fifth chapter of the book deals with hybrid project management and covers various aspects such as the typical approaches (► Sect. 5.2), the selection process of a hybrid approach (► Sect. 5.3), common procedural models (► Sect. 5.4) as well as the individual development of hybrid procedural models (► Sect. 5.5). Furthermore, the requirements for hybrid project management and the success factors in the application of hybrid project management are presented (► Sect. 5.6). In addition to the project management elements derived in ► Chap. 1 and described in detail in ► Chap. 3, further optional project management elements are described, which could be of importance for both traditional, agile and hybrid project management (► Sect. 5.7). The chapter also includes a continuous example to illustrate the topics in a practical way and concludes with a summary and review questions (► Sects. 5.8 and ► 5.9).

This chapter has the structure shown in ◘ Fig. 5.1.

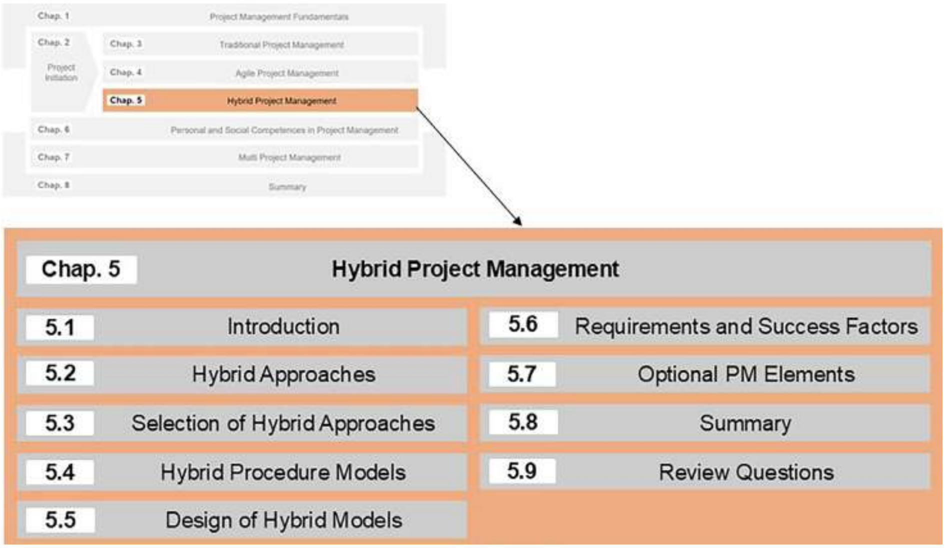


Fig. 5.1 Structure ► Chap. 5

5.1 ► Introduction

Hybrid Project Management

The combination or joint application of agile and traditional procedural models is referred to as hybrid project management.

Furthermore, the combination of project management procedure models in a broader sense can also be referred to as hybrid project management. This means that the combination of purely traditional or agile procedure models (e.g. Scrum and Kanban as so-called Scrumban) is referred to as a hybrid approach (Timinger, 2021, p. 184; Hüsselmann 2021, p. 51). This expanded perspective is the basis for this book.

The combination of traditional and agile approaches and methods can be seen as a continuum, i.e. projects can be arranged on a scale from completely traditional to completely agile. In between, depending on the requirements of the project, there are different distributions of traditional and agile approaches, which can be arranged on this spectrum.

Figure 5.2 illustrates this fact.

In the future, there will be fewer and fewer projects that are exclusively traditional or exclusively agile. The majority of projects will be handled in a hybrid manner.

The joint application of different approaches and procedure models within a project can have different manifestations. Basically, a distinction can be made between distributed hybrid approaches and integrated hybrid approaches (Fig. 5.3). With distributed approaches, either traditional or agile meth-

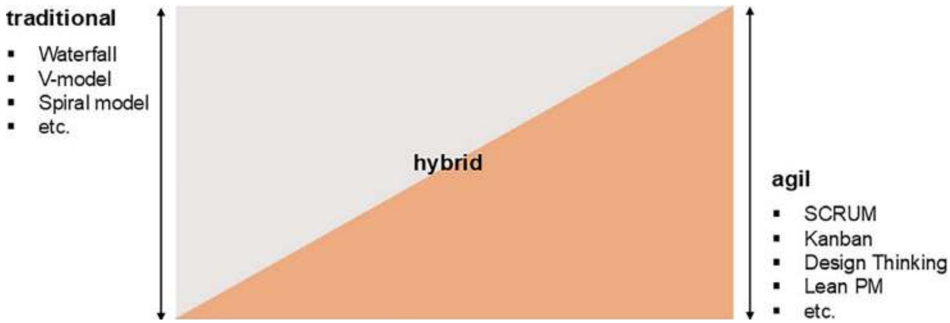


Fig. 5.2 Hybrid Continuum

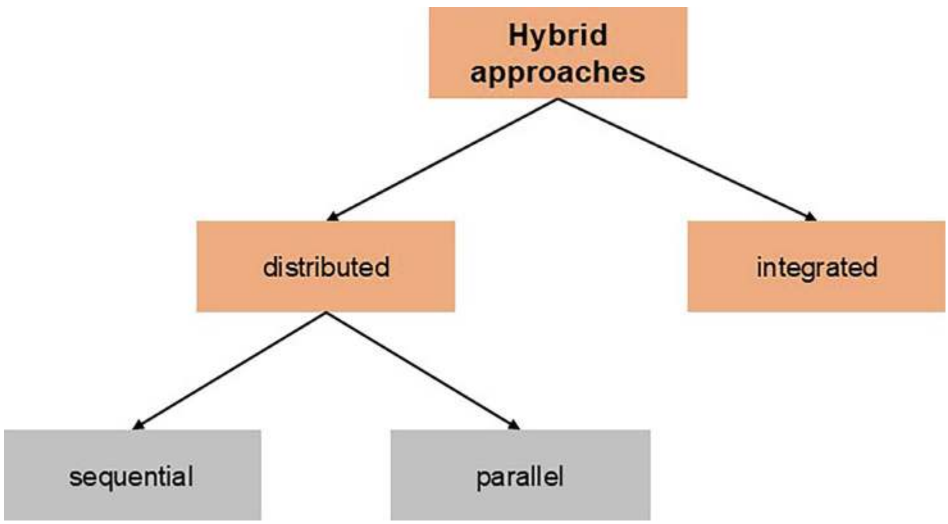


Fig. 5.3 Types of hybrid approaches

ods are used in the processing of individual tasks (work packages, product backlog items, user stories, work items etc.) within a project. Here, a further distinction can be made between sequential and parallel manifestations. With an integrated approach, the mixing of the two approaches is done for a task. The following describes the three manifestations (cf. also Timinger, 2021, p. 184 ff.).

- **Distributed Sequential Manifestation**

Individual project phases are carried out either according to the traditional or the agile approach. For example, planning phases within a development project can be carried out agilely and the development of the prototype can then be handled traditionally.

- **Distributed Parallel Manifestation**

Here, the two approaches are applied in parallel, i.e. within a project, for example, a traditional approach can be used for a work package, while an agile approach is chosen for another work package to be processed in parallel.

- **Integrated Manifestation**

In the integrated manifestation, both traditional and agile project management approaches and methods are used for a task, such as a work package, within a project. For example, in a fundamentally traditionally managed project, agile methods (e.g. daily scrums, Kanban board, burn-down charts) can be applied. This manifestation often also includes a mix of agile standards, such as Scrumban (► Sect. 5.4.1.2).

5.2 Hybrid Approaches

In practice, some typical approaches have crystallised recently, which will be presented in the following. The approaches presented in the following sections are thus an implementation of the structures described in ► Sect. 5.1.

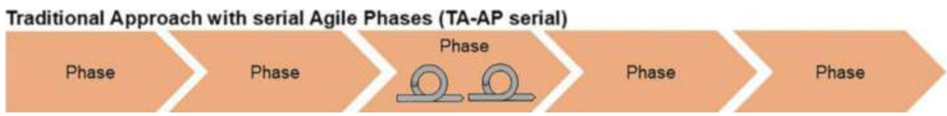
5.2.1 Traditional Approach with Agile Methods (TA-AM)

In this hybrid approach, agile methods, such as daily or retrospectives, are used in a typical traditional model (e.g. waterfall model).

The TA-AM approach is suitable for any traditional procedural model that integrates the advantages of agile approaches. The requirements and the approach and methods are clear and known in this approach. By applying agile methods, customer orientation, transparency and/or communication and thus cooperation in the team are improved. In particular, the methods Daily, Backlogs/Kanban Board support transparency in the project, which also brings a great advantage in traditional project management, as the project participants know the status of the project and can thus act more efficiently and effectively. Retrospectives support the continuous improvement process already within a project and not only at the end of a project, as is the case with lessons learned in traditional approaches. (see also Hellbeck, 2023, p. 62).

◘ Figure 5.4 graphically illustrates the TA-AM approach.

■ **Fig. 5.4** Traditional Approach with Agile Methods (TA-AM)



■ **Fig. 5.5** Traditional approach with serial agile phases (TA-AP s)

5.2.2 Traditional Approach with Serial Agile Phases (TA-AP s)

This approach is characterised by a traditional serial structure (phase orientation). Agile work is carried out within one or more phases (■ Fig. 5.5). Thus, the traditional structure provides a certain level of planning and control security and is primarily used in companies that are more traditionally oriented, but the deliverable is so complex that agile approaches and procedures are more sensible in some phases. A certain level of security is created by the traditional structure, which is particularly useful in hierarchically structured organisations.

The agile phases are found in practice at the beginning of the project when the requirements, the approach and methods may not yet be known. This approach is found due to its sequential structure, for example, in some construction projects or also in product development projects, where at the beginning of the project the product idea must first mature, as the requirements are not entirely known. Often, a Design Thinking or Scrum approach is started here and then transferred into a traditional approach when the requirements and implementation are clear. On the other hand, the agile phases can also be embedded in the implementation phase, i.e. in the middle of the project, meaning the requirements are clear at the beginning and during the implementation, the customer is involved to provide timely and regular feedback. A typical approach of this method is the Water-Scrum-Fall model (► Sect. 5.4.1.1) (see also Timinger, 2021, p. 185; Hellbeck, 2023 p. 64).

5

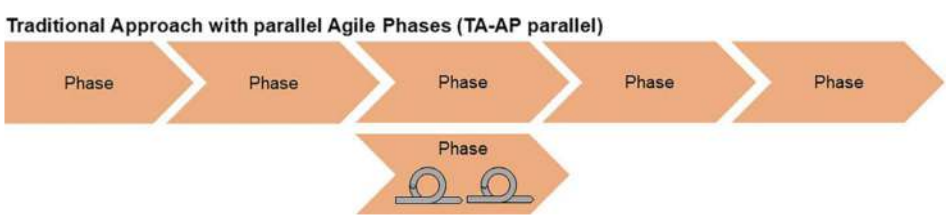
5.2.3 Traditional Approach with Parallel Agile Phases (TA-AP p)

A similar approach to the TA-AP s approach is the TA-AP p approach, which also has a traditional superstructure for the reasons mentioned under ► Sect. 5.2.2. In contrast to the purely serial phases of the TA-AP s approach, the TA-AP p approach also has parallel phases. This fact makes the approach somewhat more challenging in the context of project management, as partial deliverables from the various agile and traditional phases must be synchronised, as they serve together as input for the next phase. That is, in this approach, synchronisation plays a significant role. This approach is also used in development projects in which both hardware and software are developed (see also Timinger, 2021, p. 185; Hüsselmann, 2021, p. 51; Hellbeck, 2023, p. 64).

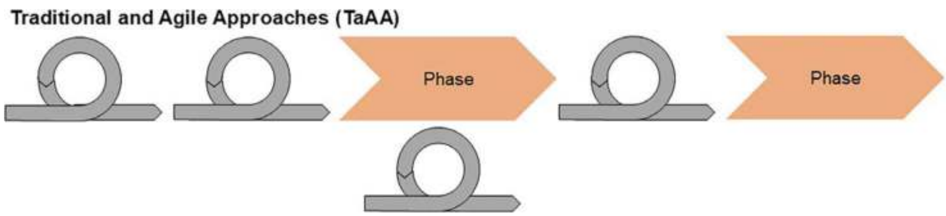
◘ Figure 5.6 illustrates the basic structure of this approach.

5.2.4 Traditional and Agile Approaches (TuAA)

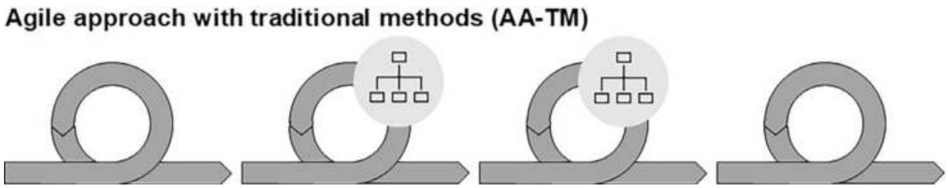
The TuAA approach is a combination of different existing approaches, which are processed both in parallel and serially (◘ Fig. 5.7). The difference to the two TA-AP approaches (► Sects. 5.2.2 and ► 5.2.3) is that here, not necessarily one approach is leading. That is, in contrast to the TA-AP approaches, this approach does not necessarily have to have a traditional structure. It is not thought in phases, but the advantages of the two approaches are used situationally for the implementation of the project or development of the deliverable. This makes this approach more complicated on the one hand, but on the other hand, it also allows the organisation more leeway in the design of project management. A typical example would be the handling of a project starting with Design Thinking, followed by a plan-based approach with some work packages that are implemented with Scrum and Kanban. This approach is used to gradually reduce quite high



◘ **Fig. 5.6** Traditional approach with parallel agile phases (TA-AP p)



■ **Fig. 5.7** Traditional and Agile Approaches (TuAA)



■ **Fig. 5.8** Agile approach with traditional methods (AA-TM)

complexity at the beginning and to involve the customer intensively in some parts (see also Hüsselmann, 2021, p. 51).

5.2.5 Agile Approach with Traditional Methods (AA-TM)

Also applied in practice is the hybrid approach, the agile approach (e.g. iterative approach), where traditional methods are used (■ Fig. 5.8). The reason for using traditional methods is often collaboration with suppliers or customers who demand traditional methods (such as a milestone plan) or it is relevant due to contractual conditions, e.g. in tenders from suppliers who demand a kind of specification sheet.

5.2.6 Freestyle Approach

This approach follows no guidelines and adapts to the project conditions accordingly (■ Fig. 5.9). It can contain all kinds of combinations of approaches, methods, roles and structures. It has an integrative character. A representative of this approach is the Scrumban model (► Sect. 5.4.1).

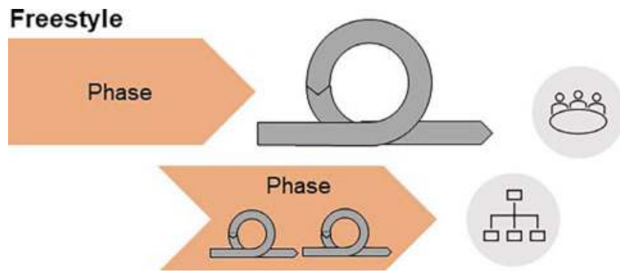


Fig. 5.9 Hybrid Freestyle Approach

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5.2.7 Summary of Hybrid Approaches

In Table 5.1, the approaches are summarised again and compared in terms of their essential characteristics and their assignment to the hybrid structure (distributed vs. integrated).

Ei-Ti AG Christmas Party – Project Management Approach
Laura Leiter is asked by Gerd Genau what kind of project management approach is being used for the Christmas party, as the traditional project management approach is being combined with the agile approach for app development.

Laura Leiter explains the structuring of hybrid approaches (Table 5.1). Due to the work package *Develop app,* which is implemented according to Scrum, the whole project gets a hybrid structure with a distributed parallel character. It is the so-called TA-AP p approach (Traditional Approach with Agile Phases parallel; ► Sect. 5.2.3). If agile methods and tools, such as the morning stand-up meeting or a burn-down chart, had been used in the traditional phases or work packages, which Laura Leiter decided against after consulting with Emil Expert, a TA-AM would have been followed additionally (Traditional Approach with Agile Methods).

Once the decision has been made for a hybrid project management approach, the hybrid procedure model should be determined or designed. Here, either a hybrid standard procedure model (► Sect. 5.4.1) can be chosen, or the procedure model can be individually designed (► Sect. 5.5). The design of a hybrid procedure model is fundamentally a case-by-case

Table 5.1 Structuring of typical hybrid project management approaches

Typical hybrid approaches	Type of structure
TA-AM (Traditional Approach with Agile Methods)	distributed sequentially
TA-AP s (Traditional Approach with Agile Phases serially)	distributed sequentially
TA-AP p (Traditional Approach with Agile Phases parallel)	distributed parallel
TuAA (Traditional and Agile Approaches)	distributed sequentially and distributed parallel
AA-TM (Agile Approach with Traditional Methods)	distributed sequentially
"Freestyle"	Integrated and distributed sequentially and distributed parallel

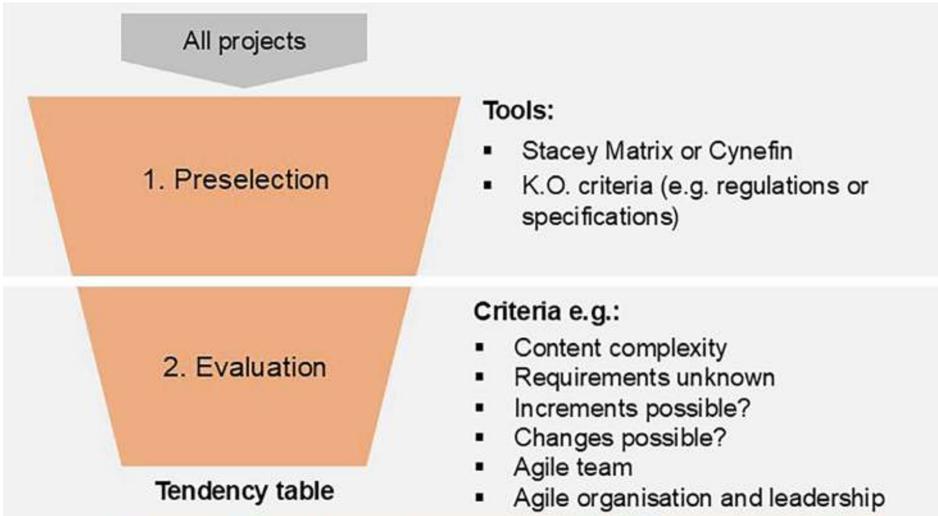
decision due to the uniqueness of a project and depends on several criteria. The choice of a corresponding project management approach (► Sect. 5.2) supports the design of a procedure model.

In practice, various models have crystallised, which are described in ► Sect. 5.4.

5.3 Selection of Hybrid Approaches

This section presents a procedure that helps to identify a tendency in the selection of the appropriate approach. It should be emphasised that this procedure is merely a support in the selection of one of the presented approaches. There is currently no data-based procedure for selecting the approaches presented in ► Sect. 5.2 Consequently, there are no calculations where one uses key figures from the initial situation to collect and calculate which approach is the most suitable. Figure 5.10 illustrates the procedure for selecting a hybrid approach.

In a **first step** (preselection), the Stacey Matrix, the Cynefin Model or other knockout criteria from the project context are used to estimate whether a project should be purely agile, purely traditional or hybrid. The knockout criteria could be customer requirements or regulatory requirements for the



criteria	value	Tendency towards hybrid approach
Content complexity	low	TA-AM
	medium	TA-AP s, TA-AP p
	high	TuAA, AA-TM, Freestyle
Requirements unknown	low	TA-AM
	medium	TA-AP s, TA-AP p
	high	TuAA, AA-TM, Freestyle
...	...	...

Fig. 5.10 Procedure for selecting a hybrid approach

project management that prescribe or exclude a certain approach. For example, a customer may demand a purely traditional approach from a supplier, even if the project can be handled agilely or hybridly. The preselection step is carried out to determine whether a project can and should be implemented in a hybrid manner in principle.

In the **second step** (evaluation), the analysis and evaluation of various criteria (► Sect. 2.2) for these projects is carried out using a scoring table or a spider diagram. To make the evaluation quite simple and efficient, the relevant criteria (► Sect. 2.3.1.3) should be selected from the typical criteria and estimated using a fairly simple scale (e.g. low/medium/high). Useful criteria include:

- Project type in terms of content complexity
- Project type in terms of familiarity with the requirements

Criteria area	Criteria	Value	Tendency towards hybride approach
Project type (content-related view)	Complexity of content	low	TA-AM
		medium	TA-AP s, TA-AP p
		high	TuAA, AA-TM, Freestyle
	Requirements unknown	low	TA-AM
		medium	TA-AP s, TA-AP p
		high	TuAA, AA-TM, Freestyle
	Increments possible?	low	TA-AM; TA-AP s, TA-AP p
		medium	TA-AM; TA-AP s, TA-AP p
		high	TuAA, AA-TM, Freestyle
	Changes possible? (Iterations)	low	TA-AM
		medium	TA-AP s, TA-AP p
		high	TuAA, AA-TM, Freestyle
Culture and competence	Agile team	low	TA-AM; TA-AP s, TA-AP p
		medium	TA-AM; TA-AP s, TA-AP p
		high	TuAA, AA-TM, Freestyle
	Agile organization and leadership	low	TA-AM; TA-AP s, TA-AP p
		medium	TA-AM; TA-AP s, TA-AP p
		high	TuAA, AA-TM, Freestyle

Key:
- **TA-AM** = Traditional Approach with Agile Methods
- **TA-AP s** = Traditional Approach with serial Agile Phases
- **TA-AP p** = Traditional Approach with parallel Agile Phases
- **TuAA** = Traditional and Agile Approaches
- **AA-TM** = Agile Approach with Traditional Methods

Fig. 5.11 Trend table for estimating the hybrid approach

- Project type in terms of forming increments
- Project type in terms of the possibility of changes to the project deliverable
- Culture and competence in terms of the team
- Culture and competence in terms of the organisation

In principle, other criteria can be used here that are useful for evaluation (see also Timinger, 2021, p. 202ff.; Hellbeck, 2023, p. 67ff.).

The evaluation of the projects helps to assign and exclude, to determine one or more suitable approaches. (see also Hellbeck, 2023 p. 70ff). The selection can be made using a so-called trend table where the characteristics of the criteria from step 2 are assigned to possible approaches (Fig. 5.11).

In addition to the table or as a supplement, further criteria can serve, which further narrow down the choice of a suitable approach through trends. For example, the type of project in terms of the industry or in terms of the content can provide information as to whether it is more likely to be a TA-AP s or TA-AP p approach (see examples ► Sects. 5.2.2 and ► 5.2.3).

5.4 Hybrid Procedure Models

The design of the approaches presented in ► Sect. 5.2 lead to a project management procedure model.

Both several existing procedure models or existing and/or new approaches can provide the basis for a hybrid procedure model. Ultimately, all project management procedure models, i.e. traditional, agile and hybrid consist of the following four dimensions

- Structure
- Function
- Method and
- People

The four dimensions with the various elements are described in more detail in ► Sect. 5.5.

5.4.1 Standardised Hybrid Approaches

The typical approaches presented in ► Sect. 5.2 have led to the establishment of the following standardised hybrid approaches in practice.

5.4.1.1 Water-Scrum-Fall

The hybrid Water-Scrum-Fall model is an approach that combines agile and traditional project management methods. It was developed to take advantage of the benefits of Waterfall and Scrum methods while minimising the disadvantages.

In the hybrid Water-Scrum-Fall model, the project is traditionally divided into phases, similar to the waterfall model (► Sect. 1.3.1). Individual phases are implemented agilely using Scrum. The events, artefacts and roles used can also be adapted. For example, Sprint Reviews, Retrospectives and Backlog Management are used to monitor progress and ensure that the customer's requirements are met. Furthermore, the roles of Scrum can be adopted. The project leader can slip into the Product Owner role to apply the agile role understanding and the agile principles.

Another important aspect is the planning and control of the project. The hybrid Water-Scrum-Fall model requires careful planning to ensure that the agile and traditional methods work seamlessly together. The control must ensure that the project stays on track and problems are quickly resolved.

In which phase of the traditionally planned project agile Scrum is used, depends on the corresponding project type. For projects where the requirements are not clear at the beginning and the project deliverable does not allow for an incremental approach (e.g. construction projects), Scrum is started to define the design.

The Water-Scrum-Fall model is based on the TA-AP s (Traditional Approach with Agile Phases serial) due to its sequential structure (► Sect. 5.2.2).

5.4.1.2 Scrumban

As the name suggests, Scrumban is the combination of the two agile approaches Scrum and Kanban. It thus combines the agile development process according to Scrum, with the principles and elements according to Kanban. Although this hybrid approach is quite common in practice, it is not completely standardised in terms of the various project management elements.

Scrumban adapts to the respective project and context. In almost all Scrumban models, the following elements of the two models are found:

- Roles, such as Product Owner and development team
- Sprints
- Kanban boards
- Dailys
- Retrospectives

Scrumban also relies on the visualisation of work progress through the Kanban board, to create a better understanding of the status of tasks and to quickly identify bottlenecks. An important element of Scrumban is often the "WIP limit" as in Kanban, i.e. the limitation of tasks being processed at the same time. This is intended to prevent too many tasks from accumulating at once and thereby extending the throughput time.

Compared to Scrum, Scrumban does not always rely on fixed Sprint cycles. Also, the roles and events of Scrum are handled more flexibly in Scrumban and can be adapted to the specific needs of the team.

Another advantage of Scrumban is that it can be relatively easily integrated into existing processes and systems. Companies that already work with Scrum or Kanban can use Scrumban as an extension to combine the advantages of both methods. However, like Scrum and Kanban, Scrumban also requires a high level of discipline and self-organisation of the team to ensure successful implementation.

The Scrumban model is assigned to the freestyle approach due to its purely agile and integrated application (► Sect. 5.2.6).

5.4.1.3 V-Scrum

The hybrid V-Scrum model is a combination of the traditional V-model (► Sect. 1.3.1) and the agile Scrum model (► Sect. 4.2) and aims to combine the advantages of both approaches. As with the V-model, the hybrid V-Scrum model has a clear structure and forward and backward traceability of artefacts. At the same time it allows for an iterative and incremental approach like Scrum. To take advantage of Scrum and the V-model, two types of combinations of the two models have crystallised in practice.

In the first type of combination of the hybrid V-Scrum model, the V-model is run incrementally in sprints. That is, each sprint includes a planning, development and testing phase, each of which is carried out within the sprint. After each sprint, there is an acceptance and feedback phase in which the result of the sprint is accepted by the customer or client. The sprints are usually longer than in pure Scrum model. In practice, sprints can be applied up to several months in duration to achieve an increment within the framework. to develop the V model.

A special feature of this combination of the hybrid V-Scrum model is the integration of tests into the development process. Each Sprint phase is completed with a test that ensures that the developed increment meets the requirements and is functional. This ensures that the product at the end of the project meets the requirements of the customer or client.

A second way of combining the V model and Scrum is the application of Scrum within the implementation phase, i.e. the left branch of the V model (concept) and the right branch (testing) is traditionally carried out in the corresponding phases. The middle or lower part of the V model (implementation) is then iterative and incremental according to Scrum.

The hybrid V-Scrum model is particularly suitable for projects that require a clear structure and forward and backward traceability, but at the same time allow for an iterative and incremental implementation.

5.4.1.4 Overview and Summary

◘ Table 5.2 summarises the three standardised hybrid approach models again and compares them with their essential features and the hybrid approach.

Moreover, there are many other combinations of project standards, which occur sporadically in practice (cf. Königbauer, 2021).

Table 5.2 Overview of standardised hybrid approach models

Hybrid Approach Model	Essential Features	Type of hybrid approach (Approach)
Water-Scrum-Fall (incl. Scrum/PMI and Scrum Stage Gate)	Linking of traditional and agile standards (Waterfall and Scrum)	Distributed sequential form (TA-AP s)
Scrumban	Integration of the two agile standards (Scrum and Kanban)	Integrated form (Freestyle)
V-Scrum	Linking of traditional and agile standards (V-Model and Scrum)	Distributed sequential form (TA-AP s)

5.5 Design of Hybrid Models

In many cases, a hybrid model must be developed or at least adapted. Reasons for this are:
- There is no suitable hybrid project management standard for the project,
- The project context requires an adaptation of the standards,
- The standard model is not very detailed and is more at the level of an approach

Basically, when developing or describing project management standards, various elements that are presented in this book must be taken into account. These elements can be bundled into the four dimensions of structure, function, method and human presented at the beginning of ► Sect. 5.4.

Figure 5.12 shows the four dimensions of a project management approach model with the relevant elements that need to be designed according to the project or project type.

Each of the dimensions contains corresponding elements. These are then described in the following sections (► Sects. 5.4.1 to ► 5.5.1).

In practice, a separate approach model is not developed for each project. Instead, an attempt is made to assign similar projects, i.e. the same project types, to an approach and to find an approach model that is suitable for the company.

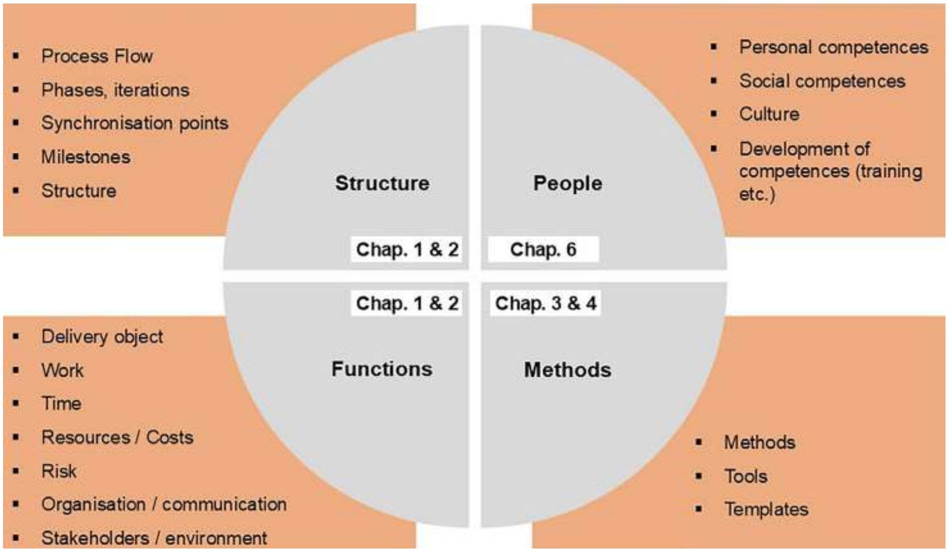


Fig. 5.12 Dimensions of hybrid approach model

5.5.1 Structure

■ **Procedure**

The procedure should be described as the basis for every approach model. The procedure largely corresponds to the project management approach. In a model, the project phases or iterations are further detailed. Depending on the approaches described in sections ► Sect. 5.2.1 to ► Sect. 5.2.6, the model is structured into the corresponding phases or iterations. The design or detailing of the phases is carried out within the framework of the Project structuring through work packages (► Sect. 3.1.3) and the temporal structuring through the application of the temporal planning methods milestone plan, network plan, bar plan (► Sect. 3.1.5).

■ **Synchronisation Points**

An important element in the creation of a hybrid process model, which is characterised by a parallel approach, are synchronisation points, to ensure a suitable handover of information, partial deliverables and/or increments between the different phases, work packages and iterations. Synchronisation can be achieved through the following elements:

- Milestones (see Def. Milestone, ► Sect. 3.1.5.1)
- Phase transitions and Quality Gates
- Reviews (see Def. Milestone, Sect. 3.5.1)
- Acceptance criteria and Definition of Done

- Sprint lengths
- Work package durations
- Key figures
- Structuring of the project deliverable into modular partial deliverables and increments

(see Timinger (2021), p. 99 ff.)

- **Structure**

The organisational structure is largely defined by the type of collaboration defined. That is, depending on the leading approach it is determined in which form the collaboration of the various project participants takes place. In a hybrid approach, where the traditional PM is leading (TA-AM, TA-AP s, TA-AP p) a hierarchical organisational structure with roles such as steering committee, client, project manager, sub-project manager/work package manager (► Sect. 1.7) is established. In the AK-TM approach, where agility is leading, a self-organised team will form the organisational structure, which is embedded in a leading company network or a leading instance. In the remaining approaches AK-TU and Freestyle, the organisational structure has no tendency, but must be determined individually based on the project type and the framework conditions.

The typical roles associated with the organisational structure are a functional element and are already described in traditional project management (► Sect. 1.7) and in agile project management (► Sect. 4.2.1).

5.5.2 Functions

In ► Chaps. 1 and ► 2 the essential functional elements have already been described.

These include:

- **Stakeholders and Environment**

Due to the influence of stakeholders (who) and the environment (what), the design of the structure-giving, further functional elements, methods and cultural elements can be designed. So for example, communication and reporting to critical stakeholders should be improved through regular and active reporting.

- **Quality**

In the context of quality management, it is particularly important to select the quality-assuring methods. Depending on the leading project management approach and thus the decision whether to think in terms of modular partial deliverables (traditional) or increments (agile), the following methods can be used:

- Quality Gates and milestones for checking deliverables and partial deliverables at specified times
- Reviews and acceptances for
- Verification and validation
- Acceptance criteria and Definition of Done
- Quality key figures
- Audits for validating project management (see also Timinger (2021) "Modern PM", p. 90 ff.)

▪ Organisation and Communication

This element is particularly characterised by collaboration and is described by the topics, roles, communication structures and medium (who communicates with whom and how). These questions are considered in the structure dimension (organisational structure) and designed within the methods dimension (methods and tools).

▪ Time

Depending on the leading approach, it should generally be determined whether the duration of the project is fixed (timeboxed), which corresponds more to a purely agile approach. As soon as you want to estimate or calculate the duration of a project with its structure-giving instances (phases, milestones, iterations etc.), a more traditional approach is required. Here the methods presented in ► Sect. 3.1.5 are applied. A combination is also possible depending on the hybrid approach.

▪ Resources/Costs

Analogous to the leading approach, the resource or costs estimation behave. For setting certain project teams over a certain duration of a project or over the entire project, one is more on the agile side of the continuum in ◘ Fig. 5.2. When the human resources are calculated or estimated depending on the workload, the traditional side and the corresponding hybrid approaches are leading.

▪ Risk

The handling of risks and thus the design of risk management can initially depend on the tendency towards agile or traditional approach be built up through an active risk management or rather agile with the risk-relevant methods, such as Dailys, retrospectives, iterations.

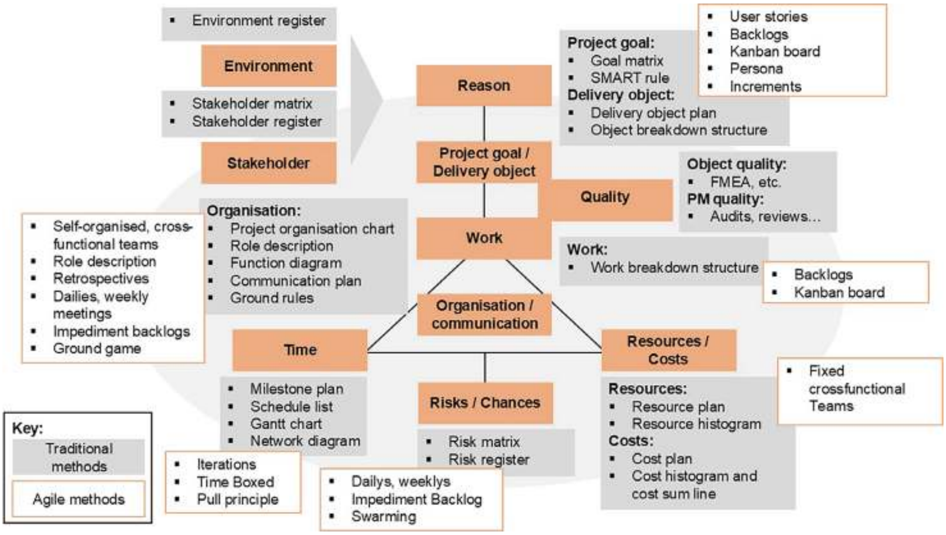


Fig. 5.13 Overview of traditional and agile methods

5.5.3 Methods

Within this dimension, the applied methods, the used tools, which are often IT supported, and the templates to be used, are described.

Methods

The common and essential methods used in the context of project management are described in s. ► Chaps. 3 and ► 4 described and summarised again in Fig. 5.13.

Tools, Especially IT Tools

There are numerous IT-supported tools. A distinction is often made between:

- **Planning and Controlling Systems**
- Planning and controlling systems in project management implement the above-mentioned methods in IT systems to ensure the success of projects. Planning includes the definition of project management elements, while controlling involves the systematic monitoring of project progress and the deviation analysis from target to actual states.

Planning and Controlling Systems

- **Task Management Systems**
- Task management systems are IT systems that serve to organise tasks, responsibilities and deadlines within a project and to track them. These systems enable a clear assignment of tasks to team members, the setting of priorities and the monitoring of progress in real time. With task management systems, project teams can work more effi-

Task Management Systems

ciently, improve collaboration and successfully and timely complete projects.

- **Online Collaboration Systems**
- Online collaboration systems in project management are usually web-based IT systems that enable team members to work effectively together, regardless of their location and time zone. These systems offer features such as file sharing, real-time communication, task management and collaborative editing of documents. By using online collaboration systems, teams can seamlessly collaborate, share information, conduct discussions and transparently track the project progress, which increases efficiency and facilitates project implementation.

Online Collaboration Systems

- **Communication Platforms, especially Video Systems**
- Communication platforms, especially video systems, play a crucial role in distributed project organisations as they promote virtual collaboration and personal exchange between team members. Video conferences allow project participants to see each other in real time, which improves communication and understanding. By using video systems, project teams can hold meetings, discuss problems, exchange ideas and make efficient decisions, even if they are at different locations. This helps to accelerate the project implementation and strengthen the team dynamics.

Communication Platforms, especially Video Systems

- **Document Management Systems**
- Document management systems in project management are IT solutions that enable project documents and information to be systematically organised, stored and managed. These systems offer features such as versioning, access rights and the ability to collaboratively edit documents. By using document management systems, project teams can work more efficiently, keep documentation centralised and improve transparency in the management of project information, which in turn supports collaboration and project success.

Document Management Systems

■ Templates

To enable efficient and effective project management, it makes sense to create templates that can be used within each project.

Templates in project management are pre-made documents or patterns that serve as a guide and tool throughout the entire project process. They facilitate the structuring and planning of projects as well as the execution of recurring tasks. Typical templates include project orders or project briefs, schedules, cost plans, risk lists, status reports, and communication plans. Templates can be created both on paper and digitally.

By using templates, project managers save time and minimise the risk of errors, as they can use proven formats and methods. Templates also promote uniformity and consistency in project documentation, especially in larger organisations with many projects. In addition, they enable efficient communication within the project team and with stakeholders, as everyone uses the same structure and terminology.

However, it is important to emphasise that templates can and should be adapted to the specific needs of each project. Flexibility is crucial to ensure that the templates meet the unique requirements and circumstances of each project. Therefore, project managers should regularly review and update the templates to ensure that they meet current project requirements and best practices. Overall, templates in project management are valuable tools that can increase efficiency and contribute to the success of a project.

5.5.4 People

▪ Personal and Social Skills

The personal and social skills required in the context of project management are described in detail in ► Chap. 6.

▪ Mindset

A successful mindset in the context of project management includes a variety of positive attitudes, ways of thinking, and behaviours that help a project organisation to work effectively, efficiently, and also satisfactorily, to overcome challenges and ultimately make a positive contribution to the project. Here are some characteristics of such a mindset:

1. Flexibility:
Projects can change and unforeseen challenges can occur. A successful mindset means being able to adapt and find alternative solutions when plans need to change.
2. Proactivity:
   The entire project organisation acts proactively and takes the initiative to identify and address risks early on before they become larger problems.
3. Team orientation:
   Successful project management requires strong collaboration within the team, and not just in agile project management. A successful project manager or a self-organised team promotes a positive working environment where everyone communicates openly and supports each other.

4. Risk-taking: Projects always involve a certain degree of uncertainty and risk. A successful mindset does not mean avoiding risks, but consciously recognising and assessing them in order to develop appropriate measures.
5. Willingness to learn: A successful project organisation is open to continuous learning and development. The project management field is constantly evolving, and it is important to stay up-to-date and integrate new insights.
6. Self-management: The human being is the most precious and important resource in project management. Therefore, self-management is an important building block of the mindset (► Sect. 6.1).
7. Communication: Clear and effective communication is crucial for the success of a project. A successful project team actively communicates with all stakeholders and ensures that information is correctly conveyed.

A successful mindset in project management goes beyond the mere application of methods and tools. It is about developing a positive way of thinking and having the right attitude to master the challenges and inspire the project organisation to give its best.

▪ Culture

Closely linked to the mindset is a positive project management culture. Culture in project management encompasses the totality of values, norms, attitudes, and behaviours within the project organisation that influence the way projects are planned, executed, and controlled. A positive project management culture is characterised in particular by open communication, teamwork, trust, flexibility, and willingness to learn. Such a culture promotes the acceptance of changes, the assumption of responsibility, and the willingness to develop innovative solutions.

A healthy culture enables team members to work effectively together and overcome challenges, which ultimately leads to better results. A cultural framework that views mistakes as learning opportunities promotes an atmosphere of experimentation and improves risk-taking. An appreciative and inclusive culture strengthens the commitment and motivation of team members.

In international projects, it is crucial to consider cultural differences to avoid misunderstandings and promote effective collaboration. A global project management culture is characterised by intercultural sensitivity and adaptability.

A culture of knowledge exchange and continuous improvement promotes the development of innovative procedures and the use of best practices in future projects. This enables better project performance and increases the efficiency and effectiveness of overall project management.

To create a successful culture-promoting environment in project management, there are various measures that can contribute to the development of a positive project management culture:

1. Promote open and transparent communication:
   (a) Regular meetings,
   (b) Feedback rounds,
   (c) Dailies and
   (d) Retrospectives

2. Strengthen teamwork and cohesion:
   (a) Team-building activities
   (b) Teamwork training

3. Establish a learning and error culture:
   (a) View mistakes as learning opportunities from which the team and the organisation can gain valuable insights.
   (b) Do not punish mistakes, but see them as an opportunity for improvement,
   (c) Encourage project participants to experiment and innovate.

4. Show recognition and appreciation:
   (a) Communicate the recognition of achievements and successes
   (b) Praise and appreciation should be expressed regularly to create a positive working climate.

5. Promote intercultural sensitivity:
   (a) Respect differences in work styles, communication and business practices.
   (b) Intercultural training
   (c) Awareness-raising measures such as short lectures or digital formats

6. Share knowledge exchange and best practices:
   (a) Create space for experience exchange in meetings and platforms.
   (b) Establish tools (IT tools) for knowledge management

7. Professionalisation of project management through training and further education

These measures can contribute to creating a positive project management culture that significantly influences the efficiency, collaboration and success of projects. It is important that the leaders and the entire project team actively live and support these values and principles.

Competence Building

Competence building in project management refers to the development and improvement of the skills and knowledge of individuals or teams to plan, execute and complete projects more efficiently and successfully. Project management competence is crucial in many professional fields and industries as it helps to achieve project goals, use resources effectively and minimise risks.

Here are some important aspects of competence building in project management:

1. Training and further education:
   Participating in training, workshops and certification programmes in project management allows participants to learn basic concepts, techniques and best practices. Common certifications include the Project Management Professional (PMP) certification from the Project Management Institute (PMI) or the PRINCE2 certification.
2. Gain experience:
   Practical experience is crucial for developing project management skills. Participating in real projects, whether as a member of a project team or as a project leader, allows participants to tackle challenges and learn from mistakes.
3. Mentoring and coaching:
   Experienced project managers can act as mentors or coaches and share their knowledge and experience with others. This informal knowledge exchange can help solve specific problems and provide a broader overview of project management. Convey.
4. Best Practices and Lessons Learned:
   The documentation of best practices and lessons learned from past projects is a valuable tool for building competence. By drawing on the experiences of others, mistakes can be avoided and proven methods can be adopted.
5. Developing Soft Skills:
   Project management requires not only technical skills, but also pronounced soft skills such as communication, teamwork, leadership and conflict management. Building these skills is important in order to effectively interact with stakeholders and team members.
6. Project Management Methods and Tools:
   Familiarity with various project management methods and tools, especially software solutions, supports efficient planning, tracking and control of projects. Knowledge of such tools is an important part of competence building.

7. Continuous Improvement:
   Project managers should always strive to improve their skills and adapt to new challenges and developments in project management. This can be achieved through exchange with other experts, reading professional literature and participating in industry events.

Building competence in project management is an ongoing process that requires time, commitment and a willingness to continuously improve. By constantly developing their skills, project managers and their teams can achieve successful results and contribute to the long-term success of organisations.

5.6 Requirements and Success Factors of Hybrid Project Management

The application of hybrid approaches in project management increases the efficiency and effectiveness of project management through a methodology adapted to the project's conditions. The benefits can only be realised if the following requirements for hybrid project management, which simultaneously represent the success factors, are met.

- Clear Goals and Expectations: It is important that all project participants and stakeholders are clear about the goals and expectations of the project.
- Flexible Model Architecture: The combination of structures, functions and methods of project management requires a flexible and adaptable model architecture to ensure that the elements work smoothly together.
- Transparency: High transparency is important to ensure that the project organisation and stakeholders are informed about the progress of the project and can quickly respond to problems.
- Communication: Good communication is crucial to ensure that the project organisation and stakeholders are on the same page and can support each other.
- Flexibility and Adaptability: A hybrid approach requires flexibility and adaptability from all participants in order to quickly respond to changes.
- Regular Review: Regular reviews are important, to ensure that the project stays on track and the desired results are achieved.
- Collaboration: Effective collaboration is crucial for the success of a hybrid project. The project team should regularly come together to discuss progress and problems.

- Competence of Project Management: The project team should have experience in dealing with both traditional and agile approaches and methods.

5.7 Optional Project Management Elements and Adjacent Disciplines

5.7.1 Procurement

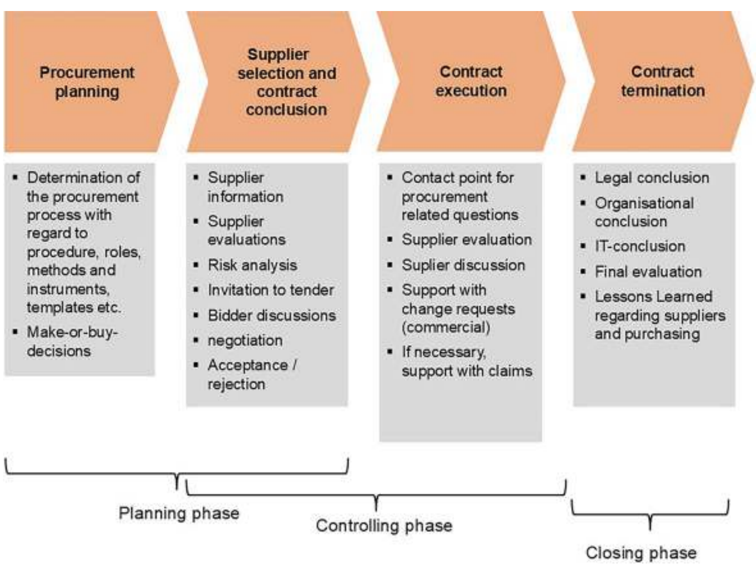
The management element *Procurement* is a topic within project management that does not have to be considered in all projects. There are projects without the purchase of material resources and/or personnel. As an example, almost all conceptual projects can be mentioned, where the deliverable consists of a document, e.g. a new marketing concept or a corporate strategy also internal software development projects sometimes do without procurement of external resources.

Thus, the management element *Procurement* is optional.

Procurement Management

Procurement management in projects encompasses all roles, processes, methods, tools, templates, needed for the selection of suppliers and the procurement of products or services outside the project organisation.

Procurement management proceeds in four phases in most projects (◻ Fig. 5.14).



◻ **Fig. 5.14** Procurement process in projects

Procurement Planning

In the first phase of procurement management, procurement management as such is planned for the project (processes, roles, methods & tools, templates etc.). In addition, it is determined what needs to be procured externally at all. This is not just about materials, e.g. a PC for an IT project. Partial deliverables of entire work packages can also be purchased, e.g. the development of a database, which is a partial deliverable in the context of a large IT project, can be procured.

The decision whether to produce a partial deliverable at all or to purchase it is called a *Make or buy - decision.*

Supplier Selection and Contract Conclusion

In the second phase, suitable suppliers are selected and the corresponding contracts are concluded. The aforementioned database development for a project is not a standard product, but a so-called system solution that must be developed individually by a supplier. Therefore, tender documents for potential suppliers must be created. The creation of the tender documents is usually done by the project manager with the appropriate experts under the advice of the purchasing department. The documents contain all essential requirements for the delivery object. Based on the tender documents, suppliers submit offers. Using the offers and possibly some discussions with the potential suppliers, the organisation selects a supplier and concludes a contract. There are different methods used in the supplier selection process:

- Bidder conferences, where some pre-selected providers present their possible solution to the client (e.g. project client, project manager, purchasing department),
- Scoring tables (► Sect. 2.8.4) for the evaluation and selection of different providers,
- Expert opinions,
- Procurement negotiations.

In this phase, project management and procurement usually work closely together. If it is a system solution, it is also a project for the supplier, which must be closely coordinated with the customer, usually in the person of the project manager of the procuring organisation.

From the perspective of project management, these activities can take place both in the planning phase and in the controlling phase, in which the project is processed.

Contract Execution

The third phase of the procurement process includes all activities necessary for the execution and administration of contracts. These include the following tasks:

5

- Filing, monitoring and maintenance of contract documents,
- Supplier coordination, i.e. contact person for all questions about delivery processing on the part of the organisation,
- Checking and support in complying with standards and regulations in the context of procurement,
- Preliminary invoice inspection
- Clarification of invoice differences,
- Implementation of discount agreements,
- Release of payments,
- etc.

■ Contract Termination

The termination of the contract has as its main tasks to legally, organisationally and IT-technically terminate the procurement contract. The legal termination of the procurement contract may involve the creation and exchange of corresponding documents, such as final reports, final protocols, invoices etc. The organisational termination usually involves the termination of tasks of the purchasing department's employees. In the IT-technical termination of a supplier contract, all necessary activities should be carried out in the corresponding IT systems to record the contract as terminated.

In addition, a supplier evaluation should always be carried out.

Ei-Ti AG Christmas party – Procurement.

From last year, Sabine Schein still knows how difficult it was to commission the right caterer. She tells Laura Leiter that there was a lot of discussion. She had to learn that everyone likes to have a say when it comes to food. Laura Leiter suggests to Sabine Schein that this year she should select the caterer using a scoring table (► Sect. 2.8.4) should select. However, she asks again in the purchasing department, which also recommends a scoring table to her and immediately offers help, as the whole thing ultimately runs as procurement through the purchasing department. Together with the purchasing department and Sabine Schein, the following table is created and gradually filled with the data from two potential caterers.

Criterion	Weighting	Caterer A		Caterer B		Metrics
		Points (0–3)	Weighted	Points (0–3)	Weighted	
Price	50%	1	0.5	2	1.0	Meal price per guest: 0: >30 € 1: 20 € < x < =30 € 2: 10 € < x < =20 € 3: <= 10 €

Criterion	Weighting	Caterer A		Caterer B		Metrics
		Points (0–3)	Weighted	Points (0–3)	Weighted	
Variety of options	20%	2	0.4	2	0.4	Number of main courses 0: one main course 1: 2–3 main courses 2: 3–4 main courses 3: >4 main courses
Experience with large events	30%	3	0.9	0	0	0: no 3: yes
Result	100%		1.8		1.4	

Thus, the choice falls on Caterer A.

5.7.2 Contract Management

External projects are usually based on contracts between legally independent organisations (e.g. companies, public law corporations, associations etc.). Even within a group between the legally independent subsidiaries, contract law applies.

Contract

A contract is an agreement of at least two parties (individuals, institutions, authorities, associations, companies etc.) to fulfil services. The rules and conditions for service fulfilment are recorded in a contract.

A contract is concluded by the declarations of intent of the parties. This creates obligations of the parties involved, usually in the form of deliveries of products or services on one side and a payment on the other side.

Contracts occur in project business between various legal organisations. There are usually three actors in project business from a legal perspective. The project customer commissions the project. The project provider (project contractor) carries out the project. And for many projects there is a subcontractor who supplies material, personnel, partial solutions etc.

Internal project without suppliers

Basically, one can distinguish between internal and external projects from the perspective of the project provider

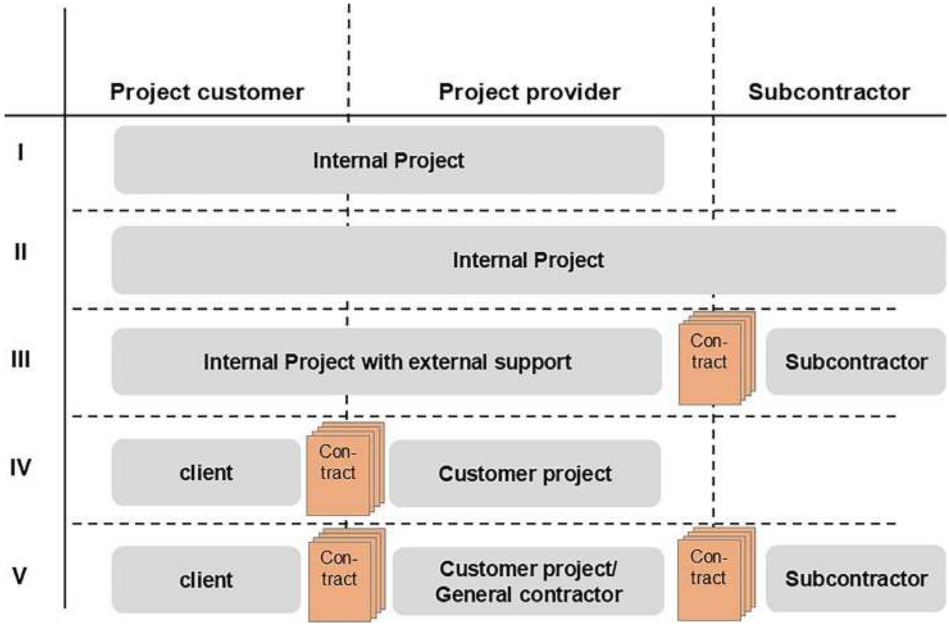


Fig. 5.15 Legal constellations in project business

(project contractor). The in Fig. 5.15 shows Alternatives I–III, which are internal projects that differ in the involvement of a subcontractor.

Internal project with internal suppliers

Alternative I is an internal project where no further procurement is necessary, e.g. the sales department of a company develops a new sales concept. The project client or project initiator is, for example, the sales board and the project provider or project contractor is the sales manager with selected employees.

Internal project with external suppliers

Alternative II additionally includes deliveries (resources) from other departments of the same organisation. In the example given, the company's IT department could develop a sales database that is then used as part of the new sales concept. The database is a partial delivery object that is not provided by the sales department itself and is developed within the company by the IT department.

External project without further suppliers

Alternative III reflects an internal project (project client and project provider from the same organisation) with external commissioning of a partial service. In the example given, an external IT company is commissioned to develop the database. A contract is then concluded between sales (project client) and the IT company regarding the development of the database.

External project with further suppliers/general contractor

In **Alternative IV** the constellation is represented where the project client and the project provider come from two legally different organisations. Then a contract is concluded between the project client and the project provider. In our example, the company's board could commission a management consultancy to develop a sales concept.

In **Alternative V** the project client, project provider and subcontractor come from different legal organisations. In relation to the example, the board of a company commissions a management consultancy to develop a sales concept and the IT technical implementation of a database. Since the management consultancy does not offer database development, it commissions an IT company. Thus, two contracts are concluded, one between the project client (company) and the project provider (consulting company), and another between the project provider and subcontractor (IT company). A general contractor is spoken of when the project supplier takes responsibility for the services of the subcontractor towards the project client and controls all subcontractors within the framework of a project.

A contract forms the basis for legal transactions and the legal framework. The specialist departments are usually responsible for the content in terms of services, deadlines and costs (magic triangle).

Contract Management

Contract management provides the processes, roles, methods, tools and/or templates to negotiate, conclude, process and terminate contracts.

Contract management within the framework of projects is part of project management and is supported by experts in the organisation (purchasing and legal department).

5.7.2.1 Types of Contracts

In project business, three types of contracts are usually used, which are regulated in the Civil Code (BGB).

- **Purchase contract**

Purchase contract

The purchase contract is based on § 433 of the Civil Code (BGB) and contains the following relevant paragraph:

"(1) By the purchase contract, the seller of a thing is obliged to hand over the thing to the buyer and to transfer ownership of the thing to the buyer. The seller must provide the buyer with the thing free from material and legal defects.

(2) The buyer is obliged to pay the agreed purchase price to the seller and to take the purchased thing." (Excerpt from the Civil Code § 433)A purchase contract is about the sale of products or Rights, i.e. granting of ownership and possession

in exchange for agreed remuneration. The product or the right is usually visible before the purchase and can therefore be checked. There is no additional value creation on the products or rights.

- **Contract for Work**

Contract for work

  - The contract for work is based on § 631 of the German Civil Code (BGB) and contains the following relevant paragraph:
  - "(1) By the contract for work, the contractor is obliged to produce the promised work, the client to pay the agreed remuneration.
  - (2) The subject of the contract for work can be both the production or modification of a thing as well as another success to be brought about by work or service." (Excerpt from the German Civil Code § 631)
  - Thus, a contract for work regulates the production of a *work* (delivery object) with the contractual properties and without defects against an agreed remuneration. The immediate success (not e.g. the economic consequential success) is owed in a contract for work. The transfer of possession and approval of the success, take place through one or more acceptances.
  - The contractor owes the client the production of a work.
  - Examples of *works* are:
  - Production of a plant or factory,
  - Production of an IT system (hardware and/or software),
  - Delivery of concepts or drawings.
  - On the other hand, the project customer owes the project provider the remuneration. The remuneration is money or material remunerations (e.g. compensation business).

In a contract for work, the success is owed.

  - Therefore, the contract is considered fulfilled when the *work* has been produced according to the definition in the contract. The *work* must therefore be precisely specified and defined in the contract. Examples of the specification of a work are:
  - technical specifications,
  - requirement specification,
  - data sheet,
  - Definition of performance criteria that the *work* has to provide, e.g. production performance/capacity, product quality of the products produced by the *work*.

- **Service Contract**

The service contract is based on § 611 of the German Civil Code (BGB) and contains the following relevant paragraph: Service contract

"(1) By the service contract, the one who promises services, is obliged to perform the promised services, the other party to grant the agreed remuneration.

(2) The subject of the service contract can be services of any kind." (Excerpt from the German Civil Code § 611)That is, in a service contract, the provision of a (qualified) service is regulated against agreed remuneration.

In a service contract, the service is owed (not the success).

- **Letter of Intent**

So-called *letters of intent* are to be distinguished from contracts, e.g. *Letter of Intent* (LOI) or *Memorandum of Understanding* (MoU). These documents are usually drawn up and signed during the negotiation phase. They are not contracts and therefore have no or only minor legal binding and are rather important from negotiation psychological or marketing points of view. Characteristics of these documents are usually that words like contract, obligation, subject matter of the contract, consideration, default or warranty do not appear. Formulations are deliberately formulated as intentions and not as obligations. Letter of intent

Exemplary difference in formulation:

- LOI: “The signing parties intend to develop the product 4711 in the foreseeable time.”
- Contract: “The signing parties will develop the product 4711 in the foreseeable time.”

5.7.2.2 Contract Content

A contract is divided into at least three parts: the preamble, a substantive and a legal part.

- **Preamble**

The structure of a contract often starts with a so-called preamble, which describes the initial situation and contains the objectives. Preamble

- **Substantive Part**

The substantive part describes the subject of delivery and performance or the service and the resulting obligations for the customer and provider. In addition, the substantive part can contain the following topics: Substantive Part

- Delivery exclusions,
- Packaging,
- Storage,
- Inspections and monitoring,
- Commissioning and tests,
- Technical documents,
- Standards and regulations.

The commercial and organisational part also mentions the price and payment conditions. In addition, other topics, such as e.g. discounts, taxes, bank guarantees, delivery position, licensing fees, financing, risk and insurance, contract dates etc. can be described.

Legal Part

- **Legal Part**

  The legal part contains topics, such as

- Entry into force of the contract,
- Contract interpretation (document priority, which document is superior and which is subordinate),
- Performance guarantees,
- Confidentiality,
- Termination,
- Patents, protected rights,
- Warranties and guarantees,
- Jurisdiction,
- Penalties,
- Disclaimers and liability limitations,
- Handling of contract deviations,
- Exclusion of consequential damages,
- Contract termination (Termination),
- Handling of changes (change management),
- Force majeure,
- Applicable law.

5.7.3 Claim Management

Claim management means (post-) demand management in German. It is closely linked to contract management.

Claim

A claim *(German demand)* is a financial, timely and/or factual demand of a contract partner as a result of actions, omissions, deviations and/or difficulties in connection with the fulfilment of the contract. Claims are made to a contract partner.

Thus, a claim is a demand made to the contract partner, which is based on a contract change.

Claim Management

Claim management means the planned and controlled anticipation, observation, recording, documenting and asserting or defending of not originally agreed demands between the parties, which only arise when the actual deviates from the envisaged contract course.

The task of claim management is to convert own unsecured claims into legally secured claims and enforce them (Own claims) or to fend off unsecured opposing claims (Foreign claims).

The goal of claim management is thus to ensure that one gets what one is entitled to (no more and no less), to protect oneself against unjustified demands and claims, to limit damages if they cannot be avoided and above all to avoid conflicts with To avoid, reduce or limit as much as possible to clients and other (contractual) partners.

5.7.4 Change Management

Change management deals with handling changes in organisations and in people.

The deliverable of many projects is directly linked to a change in an employee's environment. This can, in the simplest case, be the development or introduction of new software that an employee must first get used to, up to a company merger where employees lose their jobs. The impact of the change has different intensities and is perceived differently by each person (► Sect. 6.2.2, Perception). There are also projects that cause little or no change in employees, such as development projects that aim to create a new product.

Change management attempts to shape the projects that cause a change in people in such a way that the affected people can handle it well.

Change Management

Change management is the shaping of change processes in organisations that have an impact on people.

There are a number of approaches, methods and tools for this, which are intended to enable the best possible handling of the change process and are presented in ► Sect. 5.7.4.2.

However, first of all, the understanding and behaviour of people in the face of change needs to be explained in more detail.

Basically, four major deficits (◘ Fig. 5.16) can be identified in a person in the context of changes (Komus & Putzer, 2017, S92 ff.).

Motivation Deficits

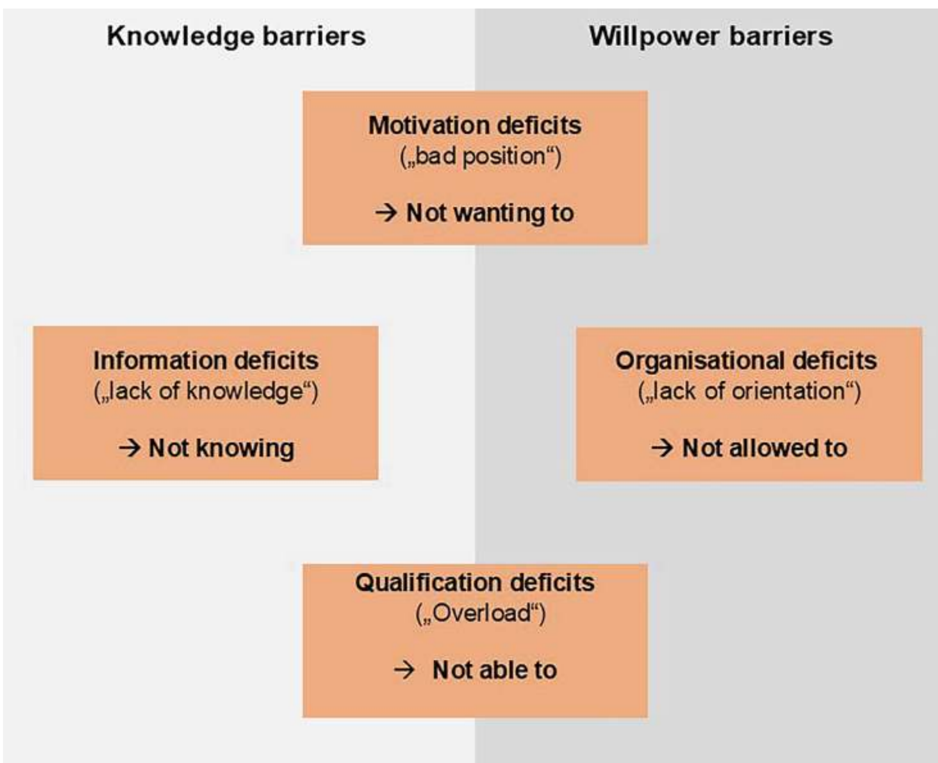
Motivation deficits arise in each employee in different ways (► Sect. 6.1.3). They are often associated with the fear of a worse position, of extra work, of diminished reputation etc. Motivation deficits correlate very strongly with performance (one does not want to work anymore).

Information Deficits

Information deficits originate from the perception of insufficient information about the change, especially with regard to one's own person. The employee does not feel properly informed. This ignorance can also result in motivation deficits.

Organisational Deficits

Organisational deficits often concern the uncertainty of the organisational position in the organisation. Many people need structural support, especially in times of change. At the very least, they need the certainty of a structure and their own roles at the end of the change. Here, role conflicts can arise, as the roles during and after the change are not transparent.



◘ **Fig. 5.16** Four deficits in the context of changes

Qualification deficits arise from a lack of competence. That is, the employee feels overwhelmed with new tasks, especially when there is no appropriate explanation or competence development for the new tasks or none is planned.

Qualification Deficits

The extent of these deficits varies with each project and with each person affected by a change. Therefore, the extent of the deficits must first be determined.

Change management addresses these four areas of deficit and tries to balance them as much as possible.

5.7.4.1 Models of Change Management

To respond appropriately to changes in the interests of employees and the organisation, there are various models and approaches to dealing with change. Some well-known models are presented below.

- **Seven Phases of Change According to Kübler-Ross**

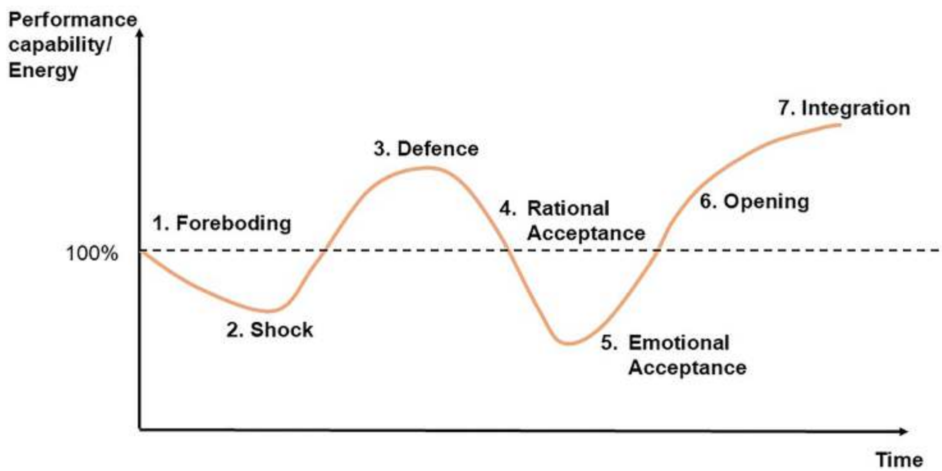
Seven phases of change according to Kübler-Ross

For changes that have an impact on people, there is a typical emotional course depending on the time, which is shown in ◘ Fig. 5.17. This course is based on research by the psychologist Edith Kübler-Ross (Dobiey & Wargin, 2001; in reference to Dobiey & Wargin, 2001, 30 f.).

Each change is divided into seven phases. Each phase is experienced differently by each employee. This depends very much on the respective personality and the associated perception of the change.

Foreboding

After the announcement of the change or rumours about a change the phase of **foreboding** causes initial uncertainty among the affected employees.



◘ **Fig. 5.17** Phases of change

Shock phase

After the uncertainty, affected employees go through the so-called shock phase, in which some employees experience a certain shock paralysis due to fears, as something unknown is coming their way.

Defence

The next emotional reaction is the defence against the change, in which a lot of energy is released. Attempts are made to fend off the "threatening" change.

Rational acceptance

After recognising the advantages and disadvantages and possibly the influenceability of the change, the so-called rational acceptance usually occurs, in which the employee is frustrated on the one hand, but on the other hand, understanding also begins. Here, the employee often tries to negotiate.

Emotional acceptance

After rational acceptance follows emotional acceptance, in which the affected employees emotionally accept the change. This phase is associated with grief, which has a very low energy level. Against this background, this phase is also very far down on the emotional reaction scale.

Opening

After the grief, curiosity begins, in which the affected employees open up (phase of opening).

Finally, the affected employees gain self-confidence or even see opportunities in the change and integrate themselves (integration).

Integration

Based on the emotional reactions to changes in ◘ Fig. 5.17, the project manager or the respective manager can through their behaviour and possibly appropriate methods and tools try to limit the negative effects of the phase and/or shorten the duration of the phase. ◘ Table 5.3 provides some behavioural options.

▪ Three Phases of Change According to Levin

Three phases of change according to Levin

According to Levin, the change should be carried out in three phases, in which attempts are made to counteract the aforementioned deficits (motivational, informational, organisational and qualification deficits) and emotional reactions as best as possible.

The three phases are called:

- Unfreezing,
- Moving,
- Refreezing.

The aim of the Unfreezing phase is to generate a willingness to change among the affected employees. The goal is to create transparency for the current situation and to communicate the importance of the change with all its advantages and disadvantages.

The Moving phase attempts to integrate the employee in the sense of the change and above all to compensate for the four deficit areas.

Table 5.3 Seven phases of change with the corresponding behavioural options for the project manager

No.	Phase	Emotion	Behaviour of the project manager
1	Foreboding	Worry, Hope	Take seriously – have an open ear for the employees
2	Shock	Fear, Paralysis	Openness – talk as openly as possible about the situation – take the concerns of the affected employees seriously – show understanding for their fears – signal readiness for communication
3	Defence	Anger, Resistance/ Defence, Overestimation of oneself	Communication – Signalling willingness to talk – Giving employees the opportunity to express themselves – Giving space to employees' emotions
4	Rational Acceptance	Frustration, Beginning of insight	Encouragement – Showing understanding – Signalling willingness to discuss future perspectives
5	Emotional Acceptance	Grief	Understanding – Giving employees time to say goodbye to the past – Offering support in shortening the "mourning period" (e.g. through individual or team discussions)
6	Opening	Curiosity, Opportunities are seen	Support – Making the future intriguing – Offering support and ideas – Letting employees feel that you have confidence in them and their future – Demonstrating that making mistakes when learning something new is normal and tolerated
7	Integration	Self-confidence	Confirmation – Stabilising and implementing successful behaviours

The Refreezing phase serves to establish the change among the affected employees.

The contents in the phases are described in more detail in the following model by Kotter.

Eight Phases of the Change Process According to Kotter

Eight phases of change according to Kotter

Kotter divides the three phases of Levin in more detail and comes to eight phases that should be considered in the context of change management:

Unfreezing
1. Making problems visible and conveying urgency,
2. Building a change team,
3. Defining the vision of change,
4. Communicating the vision,

Moving
5. Empowering employees,
6. Celebrating short-term successes,

Refreezing
7. Continuing change processes,
8. Anchoring change firmly in the corporate culture.

5

- **Phase 1: Making problems visible and conveying urgency**

The first phase aims to create a need among employees to want or need to change something. It should become clear that the current status cannot or should not be maintained and that it makes sense to change something.

Within the framework of projects, numerous reasons become apparent that lead to a change. Here, situation analyses can be used to evaluate the current status. Scenarios can help to make the future situation transparent.

- **Phase 2: Building a change team**

Changes are initiated and driven by motivated people. Against this background, every successful change management project needs a core team that wants to shape and be a role model for the change (change core team). Therefore, it is important in this phase to assemble the right team. An important factor in team formation is the sufficient number of people with enough power in the organisation to make a change.

In an existing project organisation, members of the steering committee should primarily be integrated into the *Change - Core team* .

- **Phase 3: Define the vision of change**

In this phase, the Change Core Team develops visions, strategies or messages in the case of existing objectives, to make the change transparent and plausible. Above all, a picture of the future must emerge that the affected employees can orient themselves towards. Ideally, visions, strategies and messages serve as inspiration and guidance for others.

In a project, the objectives and possibly the presentation of benefits already provide essential arguments. These often need to be prepared and emotionally packaged with the help of project marketing (► Sect. 5.7.5).

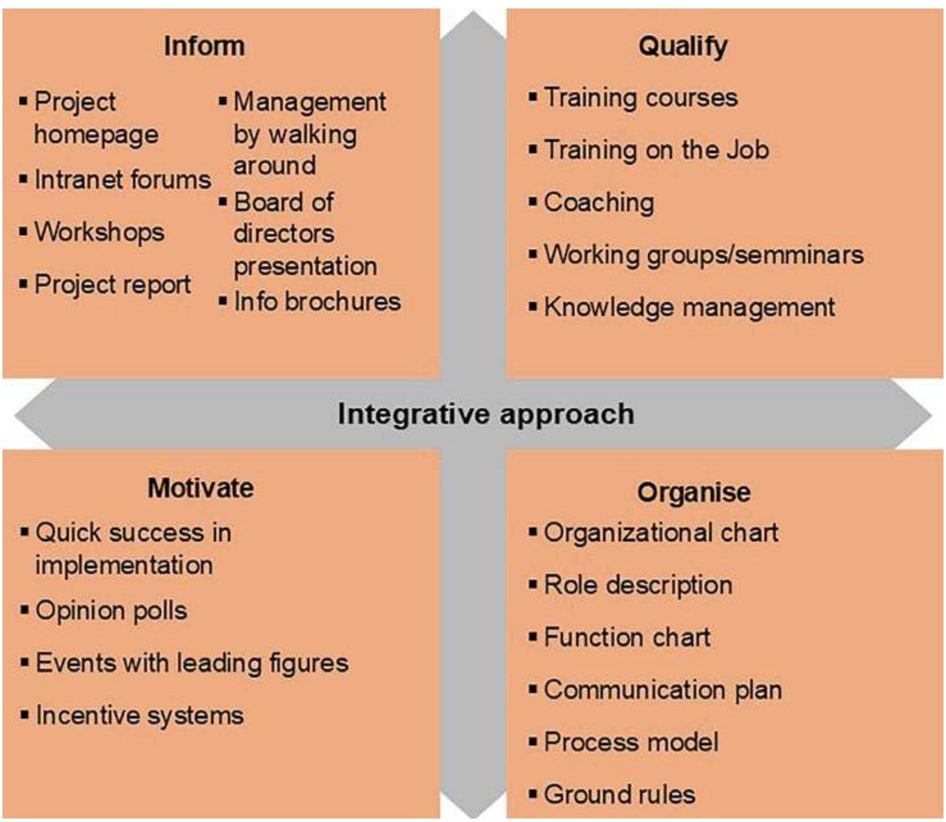
- **Phase 4: Communicate Vision**

In the fourth phase, the topic of *Communication* is in the foreground. Acceptance is a key objective. Against this background, on the one hand, the benefits must be conveyed sensibly, on the other hand, it is important to identify the needs of the different stakeholders with the existing barriers. Communication and other measures to ensure acceptance should be targeted at specific groups.

In this context, reference should also be made again to project marketing in ► Sect. 5.7.5.

■ Phase 5: Empower Employees

In the first four phases, the focus is on unfreezing in the sense of the Lewin model. The aim is to reflect on the existing situation, describe the future, break up existing structures and create a mood for departure. In the fifth phase, measures to ensure and promote acceptance should be used to compensate for deficits in motivation, information, organisation and qualification (◘ Fig. 5.16). In addition, the valleys of the change curve (◘ Fig. 5.17) should be passed through quickly. The methods and tools presented briefly in the next section serve this purpose ► Sect. 5.7.3 as well as ◘ Fig. 5.18).



◘ **Fig. 5.18** Methods and tools in the context of change management

- **Phase 6: Celebrate Short-Term Successes**

The sixth phase aims at the motivation of the affected employees. Short-term successes that occur during the project duration should be identified, communicated and confirmed.

- **Phase 7: Continue Change Processes**

In the seventh phase, further measures for change are planned and implemented based on the short-term successes from the sixth phase in order to achieve the overall objective formulated in the third phase.

The extent of this phase depends on the change itself. In a company integration, where two corporate cultures meet, it certainly makes sense to take far-reaching measures. In a small change project, such as equipping sales with new software and thus changed processes, the need for far-reaching measures is certainly not as great as in the first example.

- **Phase 8: Anchor Change Firmly in the Corporate Culture**

The eighth phase can be seen as a consolidation phase. The aim here is to firmly and sustainably anchor the successful change in the entire organisation. This is often a difficult phase, as people often tend to fall back into old patterns of behaviour without further energy from outside. This means that even after the change project, suitable measures must be taken to ensure that the changes take hold sustainably. A continuous improvement process, in which the individual employees are heavily involved, certainly also serves this purpose.

5.7.4.2 Methods and Tools in Change Management

In the context of change management, there are numerous methods and tools that can be used for different objectives and approaches. ◘ Table 5.4 provides an overview of frequently used methods and tools in connection with the four deficit areas.

◘ Table 5.4 additionally shows which elements, methods and instruments of project management can support change management.

The selection of instruments can never be made universally and should always be adapted to the project context.

Change management can either be an integral part of the triggering project or run as a separate project in parallel or in coordination with the triggering project.

Table 5.4 Methods and Instruments for Compensating the Four Deficits

Deficits	Change Management Approach	Methods and Instruments within the Project
Knowledge Deficit	Inform	– Project Assignment – Project Canvas – Delimitation and Context Analysis – Employee and Team Discussions – Information Management
Motivation Deficit	Motivate, Compensate, Stimulate	– Stakeholder Management – Successes – Feedback – Involvement in the Project (Project Role) – Employee Discussions – Situational or Emotional Leadership
Organisational Deficit	Organise, Structure, Integrate, Clarify Rights and Obligations	– Organigram – Role Description – Function Diagram – Communication Plan – Ground Rules
Qualification Deficit	Qualify, Develop	– Training – Coaching – Involvement in the Project (Learning on the Job)

5.7.5 Project Marketing

The success of a project is largely dependent on its quality and its acceptance (cf. Patzak & Rattay, 2017, p. 177). The quality is described in ► Sect. 3.1.2. The acceptance of a project can be particularly increased through project marketing.

5.7.5.1 Fundamentals of Project Marketing

Project Marketing

"Project marketing includes all activities that serve to make projects better known in their environment and to increase the acceptance of their processes and results." (Patzak & Rattay, 2017, p. 104).

Deficits in the perception and interpretation of the project can impair the achievement of objectives.

The goals of project marketing are:
- Increase or ensure the level of awareness and acceptance of the project and the project results,
- Target group-specific information and communication policy,
- Contribution to differentiation in the "project competition",
- Support of necessary change processes in the company,
- Contribution to the consolidation of the project culture or to the motivation of the project staff.

These points lead to ensuring project success and thus to increasing customer and employee satisfaction.

Project marketing can be distinguished from traditional marketing in permanent organisations by the following criteria:
- Limitation to planning, coordination and control of activities in alignment with the relevant stakeholders (target groups),
- Limitation to communication policy in the broader sense,
- Consideration of the temporal limitation (company over time).

Delineation of project marketing from change management

It is also useful at this point to distinguish project marketing from change management, as there are overlaps. Project marketing has project success and thus acceptance of the project in focus. It mainly uses the methods and instruments of communication. Change management focuses on the change of individual employees and the organisation through the newly created project deliverable. However, it also uses numerous communication methods and instruments, which are also taken into consideration in change management. Here, a strong overlap can be seen.

To generate or increase project acceptance, the three thematic fields of attractiveness, transparency and orientation within project management are important.

- **Attractiveness**

Project attractiveness

An attractive project highlights the benefits for individual stakeholder groups, focuses on development opportunities for the participants of an organisation, the benefit orientation of the deliverable as well as the perception of the project.

- **Transparency**

Transparency

Transparency is created through communication/information/documentation as well as traceability of the individual project management elements (e.g. services, deadlines, resources/costs).

- **Orientation**

The topic of orientation is shaped by the goals, the deliverable, the project phases (planning, controlling, completion) and the individual project management elements (especially here the environment, the stakeholders, the project organisation). Orientation

5.7.5.2 Project Marketing Process

The project marketing process is a part of the project management process and essentially comprises the phases shown in ◘ Fig. 5.19 with the associated tasks.

- **Initiation**

Within the target group identification, the following questions should be clarified:
- Which groups and individuals do we need to address?
- How well do we know the target group?
- Do we know what the target group says about our project?
- How often do we communicate with the target group?
- Why is the target group important for our project?
- What does the target group want to know?/What is the target group interested in?

◘ **Fig. 5.19** Tasks of project marketing within the project management phases

- Whose/which language do we need to speak?
- How can we best reach the target group?

■ **Planning**

In the planning phase, the following questions about the project identity are answered:

- Identification of team members with the project (Big Project Picture),
- Promotion of the we-feeling in the project team,
- Contribution to the creation of a positive project image,
- Conveying a sense of coherence internally and externally (motivation internally, legitimation externally),
- Differentiation from other projects,
- Clear/unambiguous/holistic basis for communication measures,
- Building a project culture (e.g. by conveying values such as *errors allowed/not allowed in the project,* different perceptions of punctuality, establishing personal contacts; expression of norms in the project, such as project rules).

■ **Controlling**

The controlling phase of project marketing checks the measures planned in the previous phase and, if necessary, steers by adjusting or further measures. For this, the following conditions must be met:

- The status and result of the measures within the framework of project marketing must be measurable.
- Success criteria must be defined or known, by which the success of a measure in terms of benefit is recognisable.
- A cost-benefit analysis should be carried out (each measure requires money, effort or time).
- New measures should be reconciled with existing measures.

■ **Conclusion**

In the final phase, the success of the entire project marketing is evaluated and Lessons Learned for the next project or for the next measures are worked out.

5.7.5.3 Methods and Instruments of Project Marketing

Based on the different requirements of the target groups in organisations, a corresponding communication portfolio can be compiled: The communication portfolio consists of different communication methods and instruments, some of which

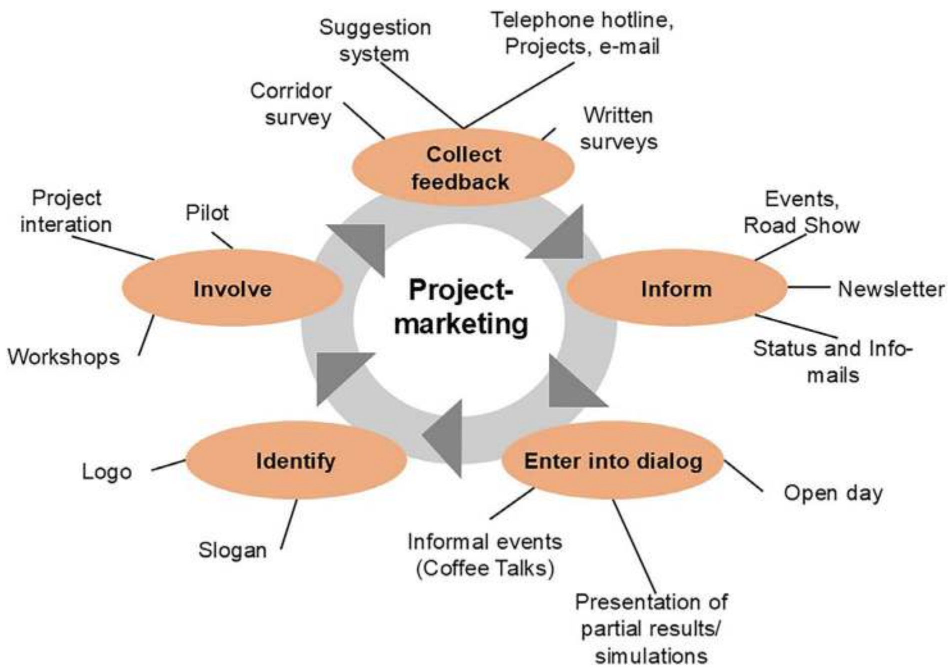


Fig. 5.20 Communication methods and instruments in the context of project marketing

are exemplified in Fig. 5.20. The communication methods and instruments are structured according to their purpose (Informing, entering into dialogue, identifying, involving and obtaining feedback).

Informing

Methods and instruments of the category *Informing* are primarily unidirectional, i.e. here employees are informed, but there is no direct return channel as to whether the message has been received. Therefore, these methods and instruments are very well suited to reach a broad target group. In critical projects, however, these methods and instruments should always be supplemented by other instruments and measures from the category *Entering into dialogue*.

Entering into Dialogue

Entering into dialogue means establishing a bidirectional communication where direct feedback from the target group can be requested or is desired. The methods and instruments are suitable for medium group sizes. In the context of digitalisation, however, it is also possible to reach larger groups, for example, using videos and setting up the return channel via chats or similar. For critical issues, however, personal communication is still the most sensible (▶ Sect. 6.2.3).

Identifying

The category *Identifying* tries to convey messages using identity-creating instruments based on the values/norms of the project. This typically includes the project logos and slogans shown in ◘ Fig. 5.20.

The following things should be considered with these methods and instruments:

- project-specific selection,
- addressing the emotional level of the target groups,
- cooperation with the communication department of the organisation,
- coordination with corporate design when it comes to posters etc.

Involving

Involving means bringing the affected employees close to the project or directly involving them in the project.

Obtaining Feedback

The category *Obtaining feedback* aims to provide a standardised return channel into the project from outside the project organisation. With the help of these methods and instruments, many employees of an organisation can be reached.

The selection of instruments and measures can again be made using a scoring table. ◘ Table 5.5 provides an overview of possible measures in a project and evaluates them, so that the most promising instruments for the project can be selected relatively easily.

The estimation of effort and duration should include preparatory and follow-up activities.

The feasibility is the product of effort and duration and describes a combination of feasibility and meaningfulness of the measure.

◘ **Table 5.5** Overview and evaluation of marketing instruments

Method/ Instrument	Target group	Benefit/Effect	Effort (Work)	Duration	Feasibility (Effort * Duration)
Name of the method or instrument if necessary with a short description	Target audience of the method/ instrument (e.g. all employees, managers, process participants)	Assess the benefit/effect on a scale, e.g. from low – high	Assess the effort on a scale, e.g. from low – high	Assess the duration on a scale, e.g. from low – high	Product of effort and duration

Ei-Ti AG Christmas Party – Project Marketing
From last year, many of the stakeholders, especially the project team around Sabine Schein, know how poorly the Christmas party went in the preparation and partly how poorly it was received by some employees. Therefore, Laura Leiter had the idea to advertise for acceptance of the this year's Christmas party with a few simple project marketing tools.

Overview and evaluation of marketing tools for the Christmas party at Ei-Ti AG

Instrument incl. Short description	Target group	Benefit/ Effect	Effort (Work)	Duration	Feasibility (Effort * Duration)
Intranet article with agenda	All employees	Medium	Low	Medium (due to approval)	Medium
Survey regarding the employee app and suggestions for the Christmas party	All employees	High	Medium	Medium	Medium
Status report	Executive employees	Low	None (is created anyway)	Medium (is created anyway)	High (is created anyway)
Informal conversations to gauge mood	Selected employees	Medium	Low	High (over entire period)	Medium

Note on feasibility: the evaluation over the values "low, medium, high" is inversely proportional to the product of duration and effort, i.e. if duration and effort are low, the feasibility is high

These measures do not require any additional budget, but they do increase the effort of the core team by a few days. Laura Leiter has estimated the entire effort with three additional days. Against this background, Laura Leiter presents the measures to Paul Perso and suggests to include an additional work package *Project Marketing* into the subproject *Project Management*. Paul Perso is thrilled by this proposal and wants to lobby for approval with Laura Leiter at the next steering committee meeting.

5.8 Summary

- **Hybrid Project Management**

Hybrid project management has the following characteristics:

- Hybrid project management is a combination of different project management standards and approaches from the traditional and/or the agile area.
- It includes both hybrid approaches and hybrid models. Approaches are a simplified form of models.

- The hybrid approaches can be divided according to the type of structuring into distributed and integrated approaches, whereby the distributed approaches can run sequentially or in parallel.
- Furthermore, the hybrid approaches can be structured according to the type of composition (agile/traditional elements) into six different approaches.
- (Hybrid) approaches are composed of the competencies Structure, Function, Method, and Human

5.9 Review Questions

Questions on hybrid project management

1. What is understood by hybrid project management and how can different approaches to hybrid project management be structured? (*Solution* ► Sect. 5.1)
2. Briefly explain the six different approaches to hybrid project management? (*Solution* ► Sect. 5.2)
3. Briefly explain a way to choose a hybrid approach? (*Solution* ► Sect. 5.3)
4. What are typical hybrid approaches in project management? Explain these briefly. (*Solution* ► Sect. 5.4)
5. How are project management approaches structured and what elements does an approach contain? (*Solution* ► Sect. 5.5)

Questions on the optional project management elements

6. Briefly explain the procurement process in projects with its most important methods and tools. (*Solution* ► Sect. 5.7.1)
7. What are the three essential types of contracts in projects and what distinguishes them? (*Solution* ► Sect. 5.7.2)
8. What is the goal of claim management? (*Solution* ► Sect. 5.7.3)
9. Why is change management important in many projects? (*Solution* ► Sect. 5.7.3)
10. What models, methods, and tools are there in change management? (*Solution* ► Sect. 5.7.3)
11. What are the differences between project marketing and change management? (*Solution* ► Sects. 5.7.4 and 5.7.5)
12. What are useful methods and tools of project marketing and how can these be selected? (*Solution* ► Sect. 5.7.5)

Check for updates

Personal and Social Competencies in Project Management

Contents

A. Dechange, *Project Management*, https://doi.org/10.1007/978-3-662-71462-1_6

Learning Objectives of this Chapter

After reading this chapter …
- you will know relevant competencies as well as their significance and characteristics in the personal and social area.
- you will learn methods and tools to assess and develop personal and social competencies.
- you will know the essential models, tools and methods for communication in project management and can apply these.
- you will know relevant leadership models in project management and can assess your leadership competency.
- you will know the most important models, methods and tools in the area of team management including virtual teamwork.
- you will know the approaches and methods for conflict management.
- you will learn to implement your personal and social competencies effectively and efficiently in practice.

The sixth chapter has the structure shown in ◘ Fig. 6.1.

Based on the competence-based standard of the Individual Competence Baseline (ICB, ► Sect. 1.4) the first five chapters of this book primarily described traditional and agile approaches with methods and tools that can be assigned to the competence areas *Context and Technology* of the Individual Competence Baseline. These two competence areas can also be referred to as hard factors *(Hard Skills)*. The third compe-

◘ **Fig. 6.1** Structure ► Chap.6

6

tence area, *personal and social competencies,* of the Individual Competence Baseline includes the so-called soft factors *(Soft Skills)* of project management. They are becoming increasingly important in project management, as many of today's requirements for project management (▶ Sect. 1.8) fall into this competence area.

This chapter is based on the competencies of the ICB of the competence area *personal and social competencies (People)* (IPMA, 2015) and summarises the relevant competencies in five competence fields together:

1. Self-management,
2. Communication,
3. Leadership,
4. Team management,
5. Conflict management.

The competence fields are examined in more detail below and various models, methods and tools within these competence fields are presented.

6.1 Self-management

A good project manager is often also a good temporary leader and possesses the necessary leadership and team skills. These in turn require good self-management (Collins & Jackson, 2015). For only those who can lead themselves can also lead others well.

Self-management means, in addition to coping with work requirements, a conscious control of the associated psychological and physical processes.

Self-management competencies

Self-management can be structured into several competencies that a project participant should manage for themselves in order to have a positive influence on themselves and thus on the project (◘ Fig. 6.2):

- Self-perception and self-knowledge (Where am I?),
- Goal management (Where do I want to go?) and self-development (How do I get there?),
- Motivation (What drives me?),
- Organisation and time management (Which methods and tools support me on my way?),
- Health and stress management (What helps me and how can I avoid risks?).

Especially the project manager, but also the various roles in the team, are subject to a high level of complexity and performance pressure more than ever today. To be able to deal with

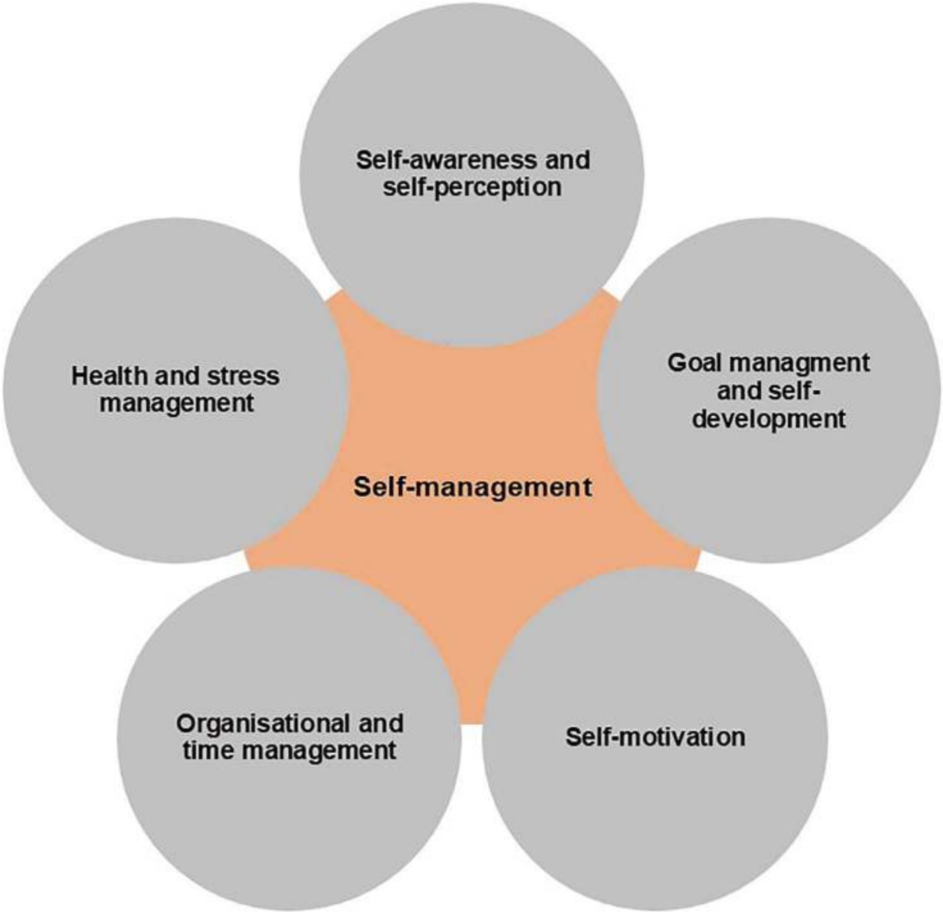


Fig. 6.2 Self-management competencies

this successfully, project participants must manage themselves with all their challenges.

Some of the competencies mentioned above are relevant both in the context of self-management and in the other four competency areas of communication, leadership, team management and conflict management.

6.1.1 Self-perception and Self-knowledge

In order to manage and develop oneself, as with any management discipline, a kind of starting basis must be known, on the basis of which one can manage and develop oneself. This can be considered, for example, in the form of a strengths-weaknesses analysis. This analysis should be based on both a self-assessment and an external assessment. To make the exter-

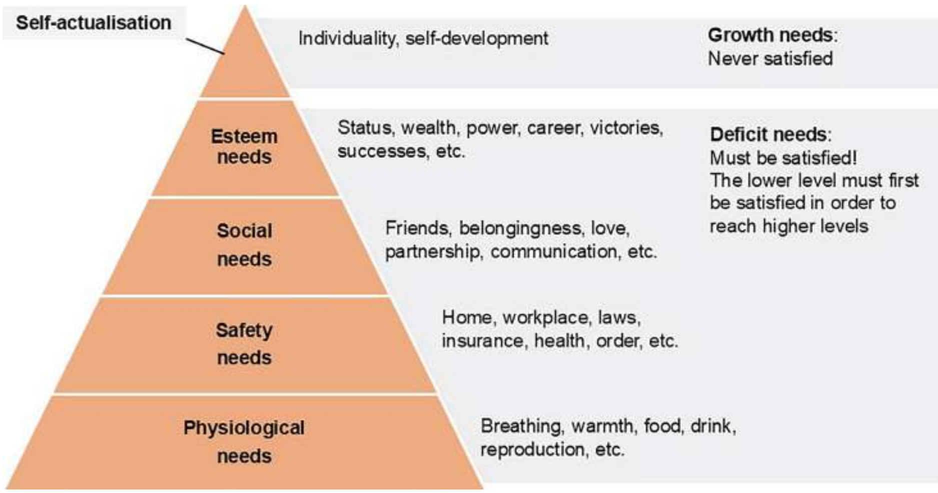


Fig. 6.3 Maslow's hierarchy of needs

nal assessment as comprehensive as possible, people from different areas can be consulted, for example stakeholders in project management, friends or the partner, or also professional coaches.

Different levels of perception

Perception takes place at different levels. The following abilities should be pronounced at the different levels:

- Body awareness: Develop body feeling and be able to perceive and resolve somatic disturbances,
- Emotional level: Be able to perceive and regulate feelings,
- Mental level: Be able to reflect and change one's own value system,
- Behavioural level: Reflect and expand one's own possibilities for action.

Especially in conflict situations, this self-perception competence can contribute to conflict resolution. This sounds easier than it is for some people, i.e. it is about identifying one's own strengths, weaknesses, potentials, abilities, values, needs and feelings. Self-knowledge includes a perception ability that can be exercised during a situation, and a reflection ability that is carried out after this situation as a kind of analysis of what happened on the factual and emotional level. If, for example, one is angry and perceives this feeling quite quickly, one has the possibility to choose an appropriate reaction. After the anger, one can critically question oneself as to how it came about and possibly derive development measures from this. A good project manager can only continue to work on himself if he knows where he stands and has a high level of reflection ability. This competence also has a positive effect on other competences, such as communication, leadership, team management and conflict ability.

Self-knowledge

In the context of self-knowledge, so-called personality models can help to identify one's own personality. Personality models describe people based on various generally valid personality traits. In this process, certain groups of traits or character traits of a person are assigned certain proportions. That means, the person is not completely sorted into a single personality group, but has different proportions of each group. Personality models have their limitation in the formation of stereotypes. That is, being assigned to a certain "type" can lead to consciously and unconsciously behaving as the model prescribes. This can lead to a distortion of one's own personality and thus to a hyper-identification with the corresponding personality type. These models can help in leadership and team management to better assess each other and to use the different competencies correctly.

6.1.2 Goal Management and Self-development

Project leaders, like all employees and managers in an organisation, should actively and consciously develop themselves. This is facilitated by personal and professional goals that are set and should be worked towards.

■ Goal Management

Setting goals is not only a critical success factor in project management, but also in personal life and in self-management a crucial component. Goals give people important orientation in the short term as well as in the long term. Goals have a function of regulating action.

Based on the recognition of one's own strengths, weaknesses, values and feelings, personal and professional goals can be developed. Each person has goals from various contexts that they want to implement.

The goal should be defined according to the SMART rule in order to be able to track the progress of personal development, however, the path should only be roughly outlined.

■ Self-development

Self-development

Self-development means that individuals acquire new behaviours, change attitudes, expand competencies, seek and embark on new career and development paths. Lifelong learning is an important prerequisite for this.

The topic of self-development is a rather medium to long-term project for all project participants. Every person develops automatically through *ageing,* socialisation and their environment. But there is also a part that can be self-determined. And this is what the self-development of a project leader should be about. Certainly, topics such as further and continuing education are in focus. However, personal development (e.g. through getting to know other cultures, support in social projects) can also contribute to professional development.

Self-responsibility

Self-development also has something to do with self-responsibility. In particular, a project manager or a temporary leader is expected to act responsibly towards themselves and others (health management, ► Sect. 6.1.5).

Self-responsibility means standing up for one's own needs, values, strengths, weaknesses and goals in the personal and professional environment and taking over one's own life design. Self-responsibility is not delegable.

Self-development also includes, as in project management, a controlling phase. This phase is called self-control and self-regulation. In this phase, one's own behaviour is controlled in such a way that the set goals are achieved and thus development takes place.

Self-control

Self-control corresponds to monitoring and self-regulation to control. However, the methods and instruments are not identical. Self-perception plays a major role in self-control (► Sect. 6.1.1).

For self-control, as well as for self-perception, the answers to the following questions are of interest for all project participants in the context of reflections:

- Am I aware of my thoughts and actions?
- Can I focus and possibly increase my energy? Can I relax?
- How did I feel in certain project situations?
- How did I deal with my feelings (joy, fear, anger, despair etc.)?
- Have I achieved my personal goals and the project goals? Were they present to me?
- Have I fulfilled my professional role within the project? Do changes need to be made?
- Have I taken on social roles within the project and have I recognised them?

Self-regulation

In the context of self-regulation, abilities and skills are more important in order to counteract existing distractions from within (emotions, feelings, thoughts, sensations etc.) and from outside (private and professional environment, environmental influences etc.) and to regulate emotions specifically.

6.1.3 Motivation

Within the context of self-management, motivation is another important factor. Fundamentally, motivation can be divided into self-motivation (How do I motivate myself or what motivates me?) and external motivation within the framework of leadership (What can the leader do to ensure that those being led are motivated?).

Motivation

Motivation is the willingness to exhibit a certain behaviour in order to achieve a goal or fulfil a task.

Thus, motivation justifies a person's behaviour. It determines the intensity and type of behaviour. Within the field of motivation research and teaching, the reasons for the willingness to behave and the behaviour itself are an important component. The reasons represent the motives for the willingness and the behaviour itself. Therefore, motivation is often referred to as the totality of motives that lead to a willingness to behave. The motives are triggered by a specific situation (incentive). The process of motivation takes place in three steps.

Three Steps of Motivation

Motivation arises when a person perceives incentives in a certain situation (1st step). These perceptions activate motives (2nd step), which lead to a certain behaviour (3rd step). Motivation is thus an interplay between a person, their motives, and a situation in which an incentive is perceived (cf. Weibler, 2016, p. 179 ff.).

Fundamentally, a distinction is made between intrinsic and extrinsic motivation.

Intrinsic Motivation

In the case of intrinsic motivation, the motives are triggered by the person themselves, i.e. from within, i.e. the incentive comes from the person themselves. The behaviour is determined by what the person enjoys, leads to satisfaction, is interesting or is seen as challenging.

Extrinsic Motivation

Extrinsic motivation means that the incentive for the willingness to behave comes from outside. This can mean both the desire for positive incentives, such as a pay rise or bonuses, a special task, as well as the avoidance of negative incentives, such as threats, holiday bans etc., which lead a project participant to a certain behaviour.

Fundamentally, intrinsic motivation works more intensely and is more sustainable. Therefore, a good project leader should know the intrinsic motivation of his members. This way, he can create the right conditions to motivate the employees more intensively and sustainably.

Motives are to be distinguished from goals. Motives are unconscious, whereas goal setting is a conscious process. The congruence of goals and motives is important for satisfaction and can lead to suffering, i.e. illness, in case of incongruity (cf. Roth, 2017, p. 243 ff.).

Sources of Motivation

Important sources of motivation are:

- **Belonging:** People want to belong to a group and be recognised by it, with the need for security, comfort and friendship.
- **Power:** People want to exercise control. They value status and influence highly.
- **Achievement:** People want to achieve something themselves and be successful for themselves. Typical personality traits of this basic motive are also creativity and curiosity.

Intrinsic and extrinsic motives do not necessarily exclude each other. A project participant can, for example, work on his work package both for the fun of the work and the desire for praise, recognition or success.

The Motivation Crowding Effect

The aforementioned overlap of intrinsic and extrinsic motivation can lead to the so-called Motivation Crowding Effect (corruption effect) when the extrinsic motivation displaces the intrinsic. This can happen, for example, when a project employee enjoys his work (fun in the task), but an additional bonus for certain performances is introduced (timely completion of the project). Now the employee will work more towards the bonus. In the next project without a bonus, the employee is intrinsically not as motivated, as the extrinsic motivation has corrupted the intrinsic. This means that for intrinsically self-motivated work, motivation through rewards does not increase beyond a certain limit and can even displace inner motivation. Furthermore, it applies that any motivation from outside (extrinsic) is only sustainably effective if it becomes self-motivation (intrinsic).

Within the framework of project management, it is important to know which motives lead to which work performances in the employees and how these motives can be influenced. In contrast to drives, motives are usually neither directly observable nor a permanent part of a person. They are usually learned and subject to the environment and cultural influences.

Further motives in the form of needs are provided by the model according to Maslow, and Herzberg's Two-Factor Theory.

Maslow's Hierarchy of Needs

The American psychologist and motivation researcher Abraham Maslow developed a model around 1950 to explain various levels of human needs that build on each other. Figure 6.3 shows these levels and corresponding examples.

According to Maslow, a person's motivation is thus due to the lack of need satisfaction in the first four levels. Needs are prior to motives, i.e. they are of higher importance to a person and describe an imbalance. The important statement by Maslow is that one only finds satisfaction at one level of the four deficit needs when the underlying levels are fulfilled. Conversely, this means that a person who has financial worries (security need) does not or less care about social needs.

Herzberg's Two-Factor Theory

Herzberg's Two-Factor Theory (Fig. 6.4) is essentially a theory of job satisfaction, which, like Maslow's Hierarchy of Needs, can be used to derive motives in the context of motivation. According to Herzberg, there are two independent dimensions that influence job satisfaction in different ways. The hygiene factors influence a person's dissatisfaction, i.e. they can be on a scale from *dissatisfied* to *not dissatisfied* and do not lead to satisfaction. The dimension of motivators influences satisfaction on a scale from *not satisfied* to *satisfied or motivated.* Motivators primarily come from the content of the work. Motivators thus change satisfaction, but their absence does not necessarily lead to dissatisfaction. The motivators in

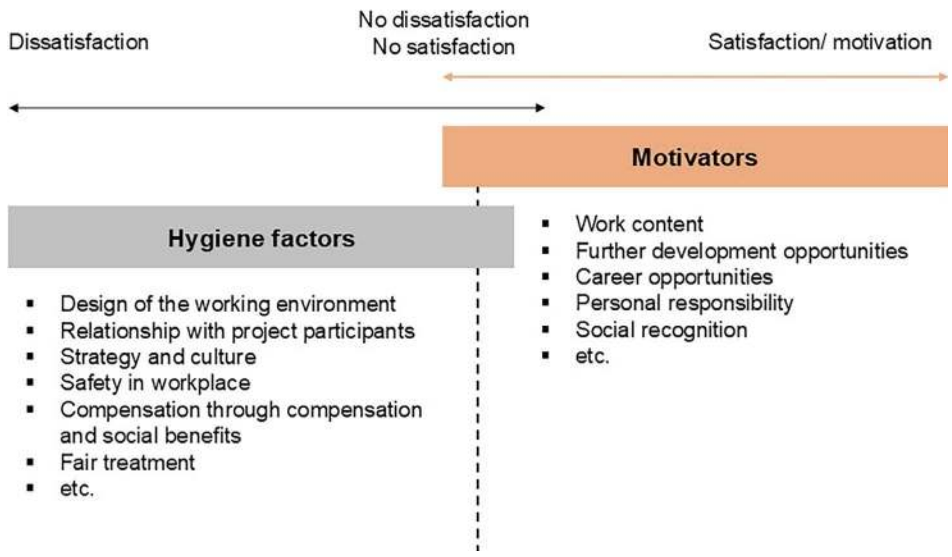


Fig. 6.4 Herzberg's two-factor theory

Maslow's Hierarchy of Needs can be compared with growth motives.

Hygiene Factors

Examples of hygiene factors in project management include:
- Remuneration including bonus for project success,
- Provision of work tools, methods and instruments as well as standardised project management templates,
- Clarification of project organisation including tasks, competencies and responsibilities,
- Enabling access to project documents,
- Uniform and central document storage.

Motivators

Motivators in project management include:
- Appreciation by project participants,
- Feedback,
- Activities and contents perceived as creating value and meaning,
- Taking on responsibility in the sense of work package manager, sub-project leader or project leader,
- Self-organisation (as in agile project management).

A study from 2010 shows the following order of motivating factors among employees (both managers and employees):
1. Feeling of satisfaction,
2. Working climate, joy and good mood in the department,
3. Independent action, freedom, active participation in the decision-making process,
4. Secure job,
5. Personal visions and life goals,
6. Challenge of the activity,
7. Purpose of the task, its significance for personal or professional development,
8. Personal experiences that I can utilise,
9. Feedback from superiors or colleagues,
10. The set goal, the task itself ('Motivation', 2010, p. 18).

Critical appraisal of motivation theories

Ultimately, it should be noted that there is not a universally valid theory on the subject of motivation. The aforementioned theories serve as explanatory approaches and hints for all project participants who deal with this topic. In all matters relating to self-management and social competence, it must not be forgotten that the human being and his personality is a unique and very complex system, whose actions, values, motivations, feelings etc. cannot be explained by a universally valid theory even today.

Practical Tip

Motivation

- Motivating means satisfying a need.
- For successful and sustainable motivation, the goal in view must correspond to the motives of the person to be motivated. This means that extrinsic and intrinsic motivation are identical.
- The project leader should know the motives of his team, i.e. he must know in which *motivational state* (need satisfaction) the person concerned is in.
- The assignment of tasks to the project participants, especially the work package assignment, should also take into account the interests of the project participants.
- The following interventions can promote motivation:
  - In the context of motivation, it is important not only to delegate work, but also responsibility and authority,
  - Introduction of a feedback culture,
  - Maintenance of the relationship level (informal meetings, corridor talks, personal addresses instead of email traffic etc.).

Ei-Ti AG Christmas Party: Motivation

Laura Leiter is very satisfied with her project of organising the Christmas party. She enjoys working on it and comes to the office every morning with joy. However, the situation is different for her colleague Anna Anders, who shares an office with her. Anna Anders has been working at Ei-Ti AG for 12 years and has never changed her position in cost accounting since then. The grin with which Laura Leiter comes into the office in the morning is very rarely seen on Anna Anders. Today, Laura Leiter particularly notices that Anna Anders is sitting a bit tired and listless at her office. She starts to ponder what could make this big difference. Could it be due to a lack of motivation? That could be it, because Laura Leiter is often also described by her other colleagues as always motivated. This cannot necessarily be said of Anna Anders. But why is it that Laura Leiter is so highly motivated? Laura Leiter remembers a coaching course on motivation that she attended last year and immediately finds the sources of motivation in her stored documents: belonging, power and performance. This makes sense to her so far, because by being entrusted with the "Christmas party" project, she has significantly more responsibility than before and also notices this in her dealings with others, because in this sense she also has more power regard-

6

ing the project. Through the project, she also feels extremely appreciated, both in her performance and in her belonging to the team and the company. All of this leads to Laura Leiter receiving positive incentives from the outside that motivate her. It seems quite different for Anna Anders, who is visibly dissatisfied. Laura Leiter remembers the so-called two-factor theory according to Herzberg. In it, she thinks she recognises the reason for Anna Anders' lack of motivation. The theory states that so-called hygiene factors and motivators have a strong influence on satisfaction and motivation. The hygiene factors seem to be similar for both. They share the same work environment, maintain relationships with the same colleagues and are similarly remunerated. However, the motivators seem to be the decisive point for Anna Anders. Because unlike Laura Leiter, she has hardly benefited from development opportunities in recent years. Accordingly, her career opportunities stagnate and social recognition, both in private and in professional circles, has been the same for years. Laura Leiter recognises that Anna Anders clearly lacks motivators. She concludes that definitely better conditions must be set for Anna Anders, which motivate her and thus also increase her satisfaction. She also knows that Anna Anders has often already wished to participate in further training. This would certainly motivate her intrinsically! Because it's clear: lack of motivation can often be traced back to specific reasons and therefore can be changed.

6.1.4 Organisation and Time Management

The competence of organisation and time management is a practical skill that leads to more satisfaction and less negative stress and is an important basis for most set goals. A crucial prerequisite for successful organisation and time management is the awareness and assessment regarding the importance and priorities of tasks. Also, the use of available time is an important prerequisite for successful time management. This competence helps the project leader and the core team members to carry out the necessary organisation and time planning in the project (i.e., for others). Time management is in project management an important success factor and one of the project management elements. Efficient time management in the project is based on one's own competence to successfully deal with time allocations, time specifications and deadlines.

- **Eisenhower Matrix**

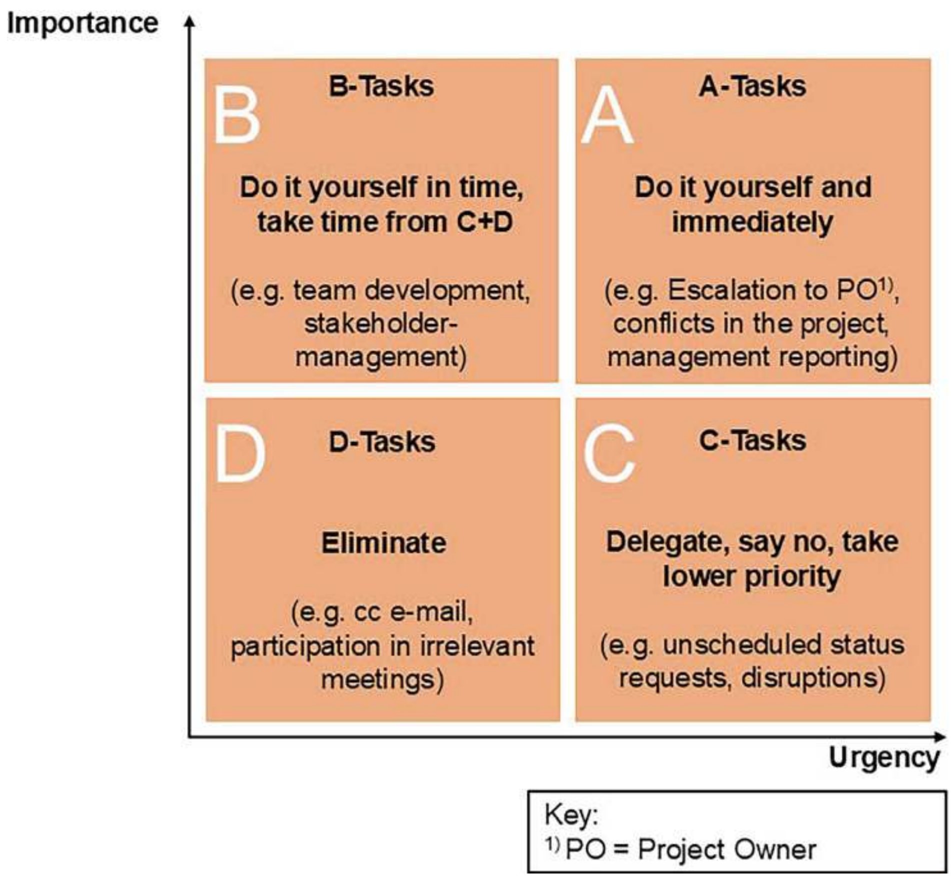
A widely used method is the prioritisation of tasks according to the so-called Eisenhower Matrix. In this, tasks to be completed are divided using the criteria of importance and urgency. This results in four categories.

A. Tasks with high importance and high urgency,
B. Tasks with high importance and low urgency,
C. Tasks with low importance and high urgency,
D. Tasks with low importance and low urgency.

Eisenhower Matrix

◘ Figure 6.5 illustrates this matrix and gives some examples.

What is urgent is often determined by others. This is where the cause for lack of self-motivation and poor results lies.



◘ **Fig. 6.5** Eisenhower matrix

ABC Analysis

A simplification of the Eisenhower Matrix is the ABC analysis, in which the activities are simply prioritised according to their importance:

- A-Tasks: very important (do immediately),
- B-Tasks: less important (do later or delegate),
- C-Tasks: hardly important to unimportant (delegate or discard).

ALPEN Method

The ALPEN method is a method for personal organisation and time planning and for creating realistic daily plans. Here one recognises the similarity of task and time management in project management:

1. **A** ktivitäten (German term for **activities**),
2. **L** änge (German term for **length** of activities),
3. **P** uffer (German term for **buffer** times),
4. **E** ntscheidung (German term for **decisions**),
5. **N** achkontrolle (German term for **post-control**).

The initial letters of these five steps have given the method its name. In detail, the steps explained in ◘ Table 6.1 are carried out.

◘ **Table 6.1** ALPEN method

No.	Step	Explanation
1	**A:** activities determine	Listing of upcoming appointments, tasks, unfinished business for the next few days
2	**L:** length of activities determine	Estimate the length or duration of individual activities. A rough estimate based on experience should suffice for this.
3	**P:** reserve buffer times for unforeseen events	The day's workload should only be around 60%. The rest (approx. 40%) is reserved for unforeseen events (60:40 rule).
4	**E:** make decisions	Priorities should be set at this point regarding the activities. The Eisenhower Matrix can be used for this, for example.
5	**N:** perform follow-up control	At the end of the day, the day should be reflected upon. Unfinished activities should be transferred, but the reasons for the unfinished activities should also be determined.

- **Kanban Light**

The project participants can also use the Kanban approach in a private context or for planning tasks during project work. All tasks should be collected and a backlog (to-do list) should be written. This can be done most sensibly with sticky notes. On a calendar that has enough space each day to display the tasks, it is then decided when—i.e. on which day or days—the tasks have to be fulfilled. The task is attached to the appropriate day/days. Completed tasks can be removed and new, not yet prioritised or planned tasks remain in the backlog. The day's planning should take place within a few minutes the evening before or in the morning, and the tasks should be re-planned or rescheduled if necessary.

- **Managing Meetings**

This topic is very closely linked to communication management (► Sect. 3.1.4). Managing meetings can be understood as a general approach for all types of meetings and workshops within a project.

The three phases of a meeting are:

1. Prepare meeting/workshop—This step should be done well in advance of the actual meeting, as an agenda with topics for preparation often needs to be sent out. The project leader or the person inviting to the meeting should take this lead time into account. The following tasks are part of the preparation:
   - Formulate the objective of the meeting and clarify if necessary, if the inviter does not have full responsibility for the meeting.
   - Derivation of topics from the objective. For a typical project planning meeting or a controlling meeting, there is often a standard agenda.
   - Determination of duration and location (possibly virtual appointment)
   - Send invitation to distribution circle (participants) including objective and agenda, possibly hints on topics to be prepared.
   - Possibly point out rules of conduct for meetings (representative rule, preparation, punctuality etc.).

2. Conduct meeting/workshop
   - Depending on the type of meeting, the aids (projector, laptop, flipchart, metaplan wall, moderation case, tables, chairs etc.) must be checked and prepared before the start.
   - The inviter or moderator opens the meeting and refers to the objective, the agenda and the rules of conduct.

- At least all decision-making meetings should be minuted. The responsibility for taking the minutes should be clarified at the beginning of the meeting.
- To separate a decision-making meeting from a working meeting, a topic store can be used. The topic store includes all topics that are not relevant for the meeting, but important for the project, which are distributed at the end of the meeting. Furthermore, topics can be stored that should be discussed in more depth or further discussed at the end of the meeting.

3. Follow up meeting/workshop
   - The minutes should be sent out promptly after the meeting.
   - Open points or agreed topics should also be sent out with the responsible persons and a deadline (Who does what by when).

■ Pomodoro Technique

As part of work techniques for efficient, but also health-promoting work methods, the so-called Pomodoro technique is worth mentioning.

This involves consciously taking short breaks after about 25 minutes of work and then taking a longer break after three or four cycles. The work/break rhythm looks as follows:
1. 25 minutes of work,
2. take a short break (5 minutes),
3. after every three to four half-hour intervals (25 minutes of work + 5 minutes break), a longer break should be taken (15–30 minutes).

Practical Tip

Time and organisational management

Tips for all project participants:
- Do not plan the whole day to 100%, usually 60–80% planning in advance is sufficient. The rest will follow automatically.
- Resolve and clarify unclear organisational and communication structures. These are often time wasters.
- Make realistic estimates without buffer. Always plan buffer as a total buffer for each day (at least 20%).
- Remember the phenomena of estimates (student syndrome, Parkinson's law, Sect. "Limitation of Estimates" in 3.1.5.4).

- Eliminate or reduce "time wasters". There are internal and external time wasters. Internal time wasters are inherent in our personality (e.g. surfing the internet, coffee gossip). External ones come from outside (e.g. unimportant phone calls, inefficient meetings). However, they should be distinguished from break activities or relaxation techniques.

Tips for project leaders:

Avoid typical dangers of project leaders:

- wanting to do everything yourself,
- attention to detail,
- the project leader as an information hub due to his leadership style.

6.1.5 Health and Stress Management

The area of health and stress management has become increasingly important in the context of project management. While in the 20th century the focus was on eliminating or avoiding disease to achieve health (pathogenesis), in recent decades the interplay of disease and health has been deepened and health has been placed at the centre of consideration (salutogenesis) (Antonovsky & Franke, 1997, p. 21 ff.; cf. Lorenz, 2016, p. 21 ff.). This development is particularly relevant in project management, as project leaders often feel more stressed compared to other executives. A study from 2014 by the Technical University of Munich at the Centre for Disease Management (CFDM) examined 965 participants from the project management environment on this topic. It became clear that in addition to the demands of the project, which 89% of respondents stated, the demand on oneself and the project result can lead to overexertion. More than 80% of respondents made this statement (Reichart & Müller-Ettrich, 2014, p. 28 ff.). Against this background, this section will consider positive factors for health promotion and will investigate what keeps and makes project participants healthy.

Various approaches to health promotion have emerged. The essential approaches for project participants will be presented below.

▪ SOR Model

The SOR model can contribute to stress recognition and prevention (prevention) in different phases for all participants of the project organisation within the framework of stress management (◘ Fig. 6.6).

SOR Model
Stressors
Organism
Reaction

The model is based on a three-phase structure. In the first phase, the so-called stressors, i.e. stimuli that can cause stress, are perceived. These are interpreted and evaluated differently by the affected person due to their individual organism in terms of experiences, attitudes, values and predispositions (2nd phase). The subsequent reaction is the response of the affected person to the assessment of the stressor in the organism. The reaction can be cognitive, emotional, vegetative, muscular or behavioural (cf. Litzcke et al., 2013, p. 6 ff.).

Stressors in project management

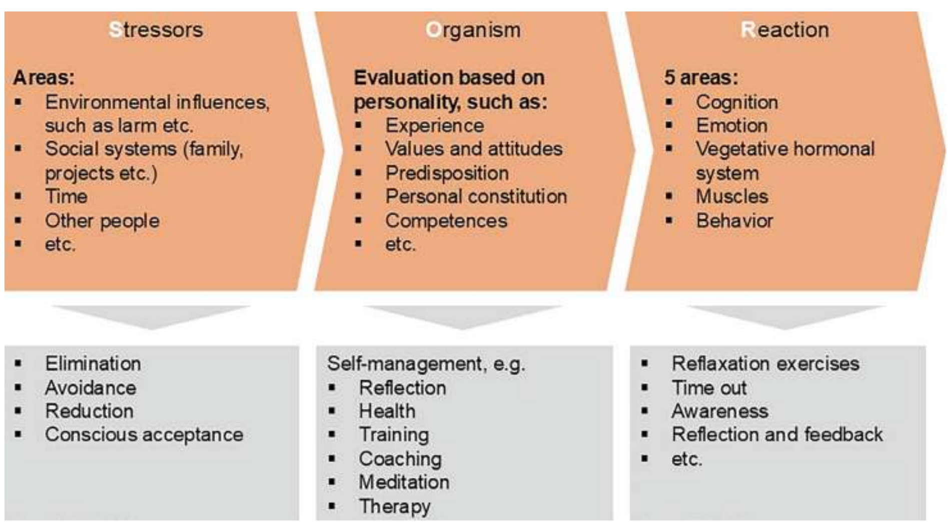
Stressors in project management are primarily conflicts in the areas of project objectives, roles, relationships with stakeholders, overburdening, pressure from superiors and internal goal conflicts due to differing expectations. The specific project stressors are overlaid by those from the general professional and private environment.

▪ Overburdening and Burn-Out

As already mentioned above, overburdening and burn-out in project management is a current issue. Against this background, it is sensible for every manager and every employee in projects to recognise the course of overburdening and that of a burn-out. In ◘ Table 6.2, the phases of increasing exhaustion are briefly outlined to provide project participants with assistance in recognising these states.

Health-promoting measures

The following health-promoting measures can be used in the context of project management:



◘ **Fig. 6.6** SOR model

■ **Table 6.2** Seven phases of increasing exhaustion. (Source: see Lehky, 2011, p. 174)

Steps/process	Characteristics
1. Initial phase (warning symptoms)	Inability to switch off, irritability, beginning exhaustion
2. Reduced (or excessive) engagement	Inner resignation or feelings of guilt ("I must make it")
3. Emotional reactions/blame	Depression, increased irritability
4. Degradation	Degradation of mental performance (concentration difficulties) and motivation ("service by the book")
5. Flattening	Reduction of emotional life (inner emptiness) coupled with a withdrawal from social and intellectual life
6. Physical symptoms	Psychosomatic reactions such as muscle tension, weakened immune system, gastrointestinal or cardiovascular complaints
7. Despair	Hopelessness up to suicidal thoughts

- Sharpen perception and thus recognise conflicts early,
- Recognise signs of the phases of the seven steps of exhaustion (■ Table 6.2),
- Set up sufficient breaks and recovery phases in the project,
- Suggestions for a healthy lifestyle,
- Recognition and reduction of stressful factors and taking the body's warning signals seriously,
- Maintain and establish social controlling ("How are you today?"),
- Offer counselling options for crisis situations,
- Make stress management and health prevention a topic,
- Incorporate the topic of life balance into employee discussions,
- Ask about needs,
- Maintain communication,
- Build a feedback culture,
- Maintain a culture of breaks,
- Say goodbye to constant availability,
- Respect boundaries,
- Do not portray fears as a weakness and allow fear as a feeling.

Procrastination

Also, the already mentioned in ► Sect. 3.1.5.3 delay behaviour, colloquially referred to as student syndrome or procrastination, can be a sign of stress, if it is a pathological delay behaviour. This is then referred to as procrastination. Procrastination is a work disorder that should be taken seriously as a disease.

There are different reasons for postponing tasks, e.g.:

- Problems in the context of prioritisation, which are due to a lack of competence or little experience,
- Competence deficits in carrying out the task,
- Fundamental fear of failure or criticism,
- Misinterpretations of the importance and urgency of the task,
- Over- or underestimation of one's own performance,
- Lack of motivation (no fun or no interest in the task).

Not all reasons are immediately equated with pathological behaviour. There is a difference between whether one pushes tasks ahead of oneself due to behaviour-related dawdling, misjudgements or a competence weakness in prioritising, or whether one does not complete the task out of pure fear of failure.

Ei-Ti AG Christmas Party: Self-management Competence

Laura Leiter slept badly this night. She had an unpleasant conversation with Frank Findus, whom she accidentally ran into in the canteen. Frank Findus took her aside briefly and praised her project and her commitment in the first few sentences, but then made it unmistakably clear that he wanted strong cost control and that the new app was not so important to him as long as it did not make any money.

But what gives Laura Leiter the biggest headache is the fact that she is supposed to come to Frank Findus today to get a few tips and possibly fulfil a few wishes. To make matters worse, she had a big argument with her new boyfriend Lars Laf in the evening. The two have only been together for a few months. She is now very insecure and doubts her abilities in her job, even though she always received encouragement and praise from her colleagues. Moreover, it annoys her that she has taken her problems at work home with her and this ended in a private argument. She remembers the "Seven Phases of Exhaustion" that she once was introduced to in a health workshop and recognises directly the warning symptoms: she can no longer switch off at home, constantly thinks about her project and feels exhausted as a result. When her boyfriend, Lars Laf, addresses her about the project, she reacts directly irritated.

Laura Leiter does not want this to get out of hand and decides to be a little earlier in the office to be at Emil Expert before nine o'clock and ask him if he has a tip for her conversation with Frank Findus. When she finds Emil Expert in his office, she is glad and her mood improves. Strange, she thinks, just because someone is there to talk to, she already feels better. Is she scared?

She briefly explains the situation to Emil Expert and even lets the argument with her boyfriend Lars Laf drop in a subordinate clause. Emil Expert looks at her kindly and thinks for a while before he answers. He starts with a question about how she has been since she started at Ei-Ti AG. Laura Leiter answers very openly, because in Emil Expert's environment she always feels very comfortable. She enjoys her work very much and feels very flattered by the project management. But she admits that dealing with higher management has once hit her stomach.

Emil Expert offers her to always come to him with questions or even personal problems (social controlling). Moreover, he also recommends her to simply talk to the new health manager of Ei-Ti AG about possible techniques on how to deal with these feelings (consultation options). In addition, he advises her to write down any uncertainties about the project that she should address in the conversation with Frank Findus (recognition and reduction of stressful factors). Because often there is a solid reason for points of criticism and in the rarest cases these are based on the other person. Who knows, maybe Frank Findus has worries himself? It could be that he received a budget cut from his superior and now has to make cuts himself, which of course also affect Laura Leiter's project. Or he just had a bad day. It is important to know that we always work with people and that we react sensitively to external influences, which may also show in our dealings with others. However, if one is aware of this, one can better classify things that have gone wrong or were said incorrectly. Laura Leiter already feels much better with this realisation alone and is no longer afraid to speak with Frank Findus, because she is now aware of her own needs and can therefore pass them on to Frank Findus in a targeted manner.

6.2 Communication

Communication is one of the essential tasks of a project manager and a separate area of competence. Moreover, it is a crucial prerequisite for other areas of competence, such as *leadership, team management* etc. Against this background, communication in project management has a special significance.

6

This section aims to explain the basics of communication and the models essential for project management and provide practical tips.

6.2.1 Basics

There are numerous definitions and perspectives on the topic of communication. For this reason, a definition based on common definitions will be provided first.

> **Communication**
>
> Communication is the exchange of information between a sender and one or more receivers. In human communication, personal states (feelings, sensations etc.) can also be transmitted.

Several aspects of the definition are important for project management to ensure effective and efficient communication.

The sender and receiver are usually people. In exceptional cases, human-machine communication can also occur.

Neuroscience provides and confirms important insights into communication. Purely physically and biologically, verbal communication takes place via acoustic signals. The meaning at the receiver depends solely on the meanings already present there. The context of meaning arises consciously or unconsciously from the personality (perception grid) of the receiver. Thus, communication is a construction of the receiver.

Against this background, the topic of perception in the context of communication is also important. Self-perception (► Sect. 6.1.1) is helpful and seen as a basis or supplement to the important external perception in communication. The essential features are explained in ► Sect. 6.2.2.

6.2.2 External Perception

Perception is an important component in the context of self-management, communication, leadership and other social competence areas. Because whenever it comes to social interaction (the happenings between people incl. communication), perception plays an important role.

Self-perception and External Perception

Perception can be divided into self-perception of one's own person and external perception.

Perception

Perception is the biological process of receiving and processing a stimulus using the sensory organs, resulting in a feeling or an image.

The targeted, attentive perception of things (objects, phenomena, processes etc.) on the cognitive level is called observation. Observation is usually a conscious process. In the following, for the sake of simplification, only perception will be spoken of, which includes observation.

Perception is a process that, coupled with the personality of the person, leads to a realisation that determines our actions and behaviour.

The personality, with its thought patterns, value systems, experiences etc., influences the evaluation of perception and thus the derived behaviour. Against this background, situations are interpreted differently and lead to different behaviour and actions in people. Perceptions are therefore subjective and have developed over the course of life, especially through socialisation by parents, school, profession and cultural influences. This insight from neurobiology is important for building successful communication in the project.

This insight is important for all project participants in order to understand different perspectives and thus more easily come to a common view. Especially in leadership, communication and teamwork, this insight is an important building block.

Therefore, it is necessary to communicate perception in order to develop a common view and avoid conflicts.

In the context of perception, there are some effects that influence decisions. This knowledge is also important for the other areas of competence leading, teamwork and conflicts.

■ Halo Effect

In the so-called Halo Effect some characteristics perceived as particularly negative or positive overshadow the overall assessment of a person in the other characteristics. For example, the pronounced helpfulness of a team member in the project is perceived as a particularly positive characteristic and presents this team member to the project manager as positive in all areas, even though this team member may have little creativity, analytical skills and assertiveness and may even hinder the project leader badmouths him behind his back to the other team members.

Halo Effect

■ Primacy Effect

Primacy Effect

Based on neurobiological findings, we know today that the so-called first impression in terms of sympathy/antipathy is formed within fractions of a second. This first impression influences, similar to the halo effect, the subsequent perceptions and observations. That is, the evaluation of these observations is overlaid by the first impression. For example, if a new team member introduces himself to the project manager and is rated negatively based on his *first impression*, even though the team member has not yet worked for the project, some convincing is necessary to counteract this first impression.

■ Recency Effect

Recency Effect

There is also the reverse effect, where people are essentially judged by their last impression that still lingers in the observer's consciousness. This effect is often used in presentations or negotiations where you want to mention an important message at the end that, in the truest sense of the word, "remains in memory".

■ Hierarchy Effect

Hierarchy Effect

In the hierarchy effect, it is not the timing of the perception that plays a role, but rather the objective fact of a person's hierarchical position in the company. For example, a project sponsor is generally rated better in terms of his project management competence than a project employee, although this is often different in reality. However, this effect has been relativised over the years with the establishment of flat hierarchies and agile teams.

■ Leniency/Severity Effect

Leniency/Severity Effect

This perception effect is based on one's own personality traits and describes the different levels of expectation of the evaluator. There are project managers who, due to their own personality (e.g. anxious type), perceive and judge other people rather leniently. On the other hand, there are project managers who perceive and judge everyone else very strictly, as, for example, their own demands on themselves are also set very high. This effect is sometimes found in specialists who have been promoted to managers (e.g. also project managers) and who are sometimes very hard on themselves and others in their new role.

■ Pygmalion Effect (Self-Fulfilling Prophecy)

Pygmalion Effect

Project managers have expectations regarding the behaviour of project participants and their successes or failures. These expectations, whether consciously or unconsciously communicated, can actually have an influence on the performances and developments of the project participants. This effect is called the Pygmalion effect. It is a kind of self-fulfilling prophecy.

Rosenthal and Jacobson experimentally proved this effect in 1966 (Rosenthal & Jacobson, 1976).

▪ Projection

Projection

Based on one's own personality traits, which the evaluator likes or dislikes about himself, a distorted image of the perceived person is created. In the subconscious, the perception goes through the personal evaluation grid, which is shaped by attitudes, experiences, values, etc. It quickly becomes a matter of sympathies or antipathies towards the perceived person. This effect is also linked to the self-esteem anchored in the subconscious. For example, a project participant may quickly feel sympathy if he has something in common with the perceived person (e.g. same car brand, same previous employer, same place of residence). However, it may also be that, for example, a project participant condemns his unstructured way of working in his subconscious, even though he presents it as creativity to the outside world. In this case, he may unconsciously disregard or find rather unsympathetic other project participants who are also rather unstructured.

▪ Stereotype Effect

Stereotype Effect

Stereotype effects are simplifications of characteristics and behaviours of groups of people. They serve for quick and easy categorisation of people and thus for the reduction of complexity in everyday life. Behind the categories are often preconceived opinions. While this categorisation can reduce complexity, it carries the risk of misjudgements due to incorrect or one-sided assignment. The human being as a complex system cannot be described with a single category.

Stereotypes often form in the subconscious and are therefore not always easy to recognise. Here too, good self-reflection skills are required.

Examples of stereotypes in the context of project management, which have been deliberately exaggerated and in practice tend to occur in a more subdued form, are:

- the IT staff who only sit behind the computer, communicate poorly and only have technology in mind,
- the management of the organisation, which is not at all interested in the project and only has its own goals in mind,
- a woman as project manager or client, who cannot assert herself or reacts far too excessively and doesn't understand technology anyway,
- the older project employee, who only thinks about his retirement and is indifferent to the project.

This insight is based on the aforementioned limitation of personality models. Therefore, personality tests are best carried out with professional support.

- **Benjamin Effect**

Benjamin Effect

Also, the age of a project participant to be assessed can have an influence on perception or assessment. That is, the younger a project participant is or the shorter he has been in the project or in the organisation, the stricter or milder the assessments turn out.

- **Fear**

Fear

Fear is a feeling in all humans that is experienced (felt) more or less in certain situations. The feeling of fear leads to different behaviour depending on the personality. Due to the respective personality traits, fear arises in every human in different situations. For example, a project manager may fear rejection and is reluctant to engage in bilateral conversations with the project sponsor when he needs something. He thus perceives these conversations as stress based on his fear and tries to avoid them if possible. On the other hand, there is, for example, the intern in the project, who has no fear of rejections and always goes to the project manager without prejudice, when he needs something. However, the intern is afraid to speak in front of large groups and therefore possibly tries to avoid these situations or perceives them as a threat.

In practice, it is important to know that these effects exist and that our perception and observation ability is subjective. Therefore, it is important for all project participants to reflect on themselves and also to be able to take other perspectives. This is an important characteristic in the context of emotional intelligence (► Sect. 6.3.4).

Project participants should not only be evaluated based on a few particularly striking characteristics.

6.2.3 Models and Insights of Communication

6.2.3.1 Types of Communication

There are several ways to structure communication. A widely used structure is the division of communication based on different parts of the transmission of a message. The three parts are:

- verbal part,
- paraverbal part,
- nonverbal part.

The purely verbal and thus content-related part of the communication can, depending on the communication channel (e.g. personal conversation, phone call, email), account for less than 10%, i.e. the paraverbal and nonverbal part make up the majority of the transmission of a message.

Paraverbal Communication

Examples of paraverbal communication are:
- pitch,
- tone of voice,
- volume,
- intonation,
- sentence melody,
- speaking speed,
- rhythm,
- disturbances in speech behaviour.

Non-verbal Communication

Examples of non-verbal communication are:
- Outer Appearance:
  - Clothing,
  - Hairstyle,
  - Make-Up,
  - Jewellery,
  - Status symbols,

- Body Behaviour:
  - Gait,
  - Posture,
  - Upper body (leaning forward/back),
  - Gestures,

- Facial Expression:
  - Eyes,
  - Forehead,
  - Mouth, lips,
  - Skin (red/pale/dull),

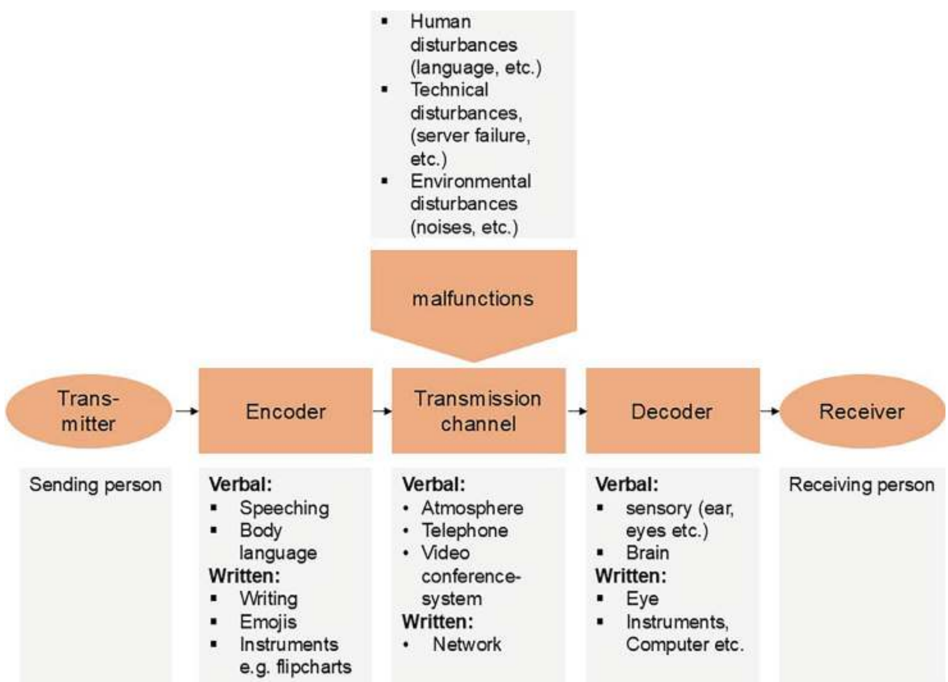
- Other:
  - Social distance (seating arrangement, touches),
  - Smell (perfume, after shave, body odour etc.),
  - Sweating,
  - Trembling,
  - Handwriting, doodles, etc.,
  - Physiognomy = facial shape, stature, etc.

This is why personal communication (verbal, para-verbal and non-verbal part) is always more meaningful than a telephone communication (verbal and paraverbal part). However, telephone communication is still more meaningful in terms of transmitting the message than an email (only verbal, i.e. content part). Against this background, it is certainly useful to work with pictograms in an email, which convey feelings (so-called emojis). But this must be decided on a case-by-case basis and should be done with care. It certainly does not look very professional when the project manager uses emojis in his first official customer email.

6.2.3.2 Sender-Receiver Model After Shannon and Weaver

A simple model to explain communication is the model from Shannon/Weaver. It consists, as shown in ◻ Fig. 6.7, of a sender, who is usually a person, and a receiver. The sender provides information using an encoder (e.g. voice, language, hands, computer etc.) in the form of sounds, gestures, signs etc. The information is transmitted via a channel (e.g. air, data network) and perceived and processed by the receiver using a decoder (e.g. sensory organs, computer).

The key point of this model is the realisation that communication is influenced by several elements. Influences, especially disturbances, can be caused by the sender and receiver themselves, (e.g. project manager and team). In addition, the encoder, decoder and the transmission channel can play a role in disturbances.



◻ **Fig. 6.7** Sender-receiver model of communication according to Shannon/Weaver

The transmission takes place on several levels. There is at least one factual level (rational level) and a relationship level (emotional level) according to the interpersonal model of communication. The following model of the four sides of a message assumes four levels or sides.

6.2.3.3 The Four Sides of a Message

Four Sides of a Message (Schulz von Thun)

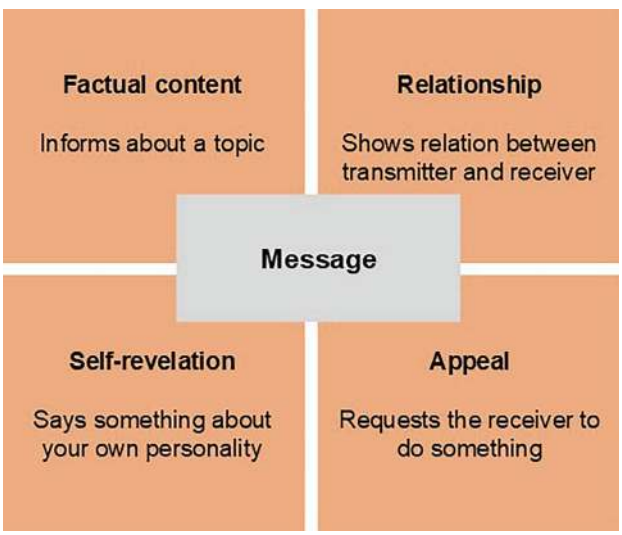
The German communication psychologist Friedemann Schulz von Thun has developed the model *Four Sides of a Message*, which in addition to the factual and relationship level also includes a self-disclosure and appeal level within a message. Thus, each message consists of four messages, which are consciously or unconsciously sent by the sender (◘ Fig. 6.8).

Just as the sender can send four messages, the receiver also has "four ears" with which he receives the message. Depending on which "ear" currently dominates the receiver, this determines the further course of the conversation:

- Fact-ear: What is he telling me?
- Self-disclosure-ear: What kind of person is he?
- Relationship-ear: How does he relate to me?
- Appeal-ear: What should I do?

Problems arise when the receiver and sender communicate on different levels or sides. Because people speak and listen in different ways, i.e. with different weights on all four levels.

The difficulty in all communication processes is to find out with which encoder the sender speaks his message and with which decoder the receiver receives this message.



◘ **Fig. 6.8** Four aspects of a message—Model by Schulz von Thun

6

Ei-Ti AG Christmas Party: Communication

During the planning phase, Laura Leiter had a brief conversation with Martina Mark, who told her the following: "The project structure plan does not fully reflect the Christmas party project." Laura Leiter then excitedly goes into Emil Expert's office and asks him for advice. Since Emil Expert still has an urgent task to complete, he puts Laura Leiter off until the afternoon. When Laura Leiter tells Emil Expert about Martina Mark's message in the afternoon, Emil Expert first explains Schulz von Thun's four-level model to her and analyses the statement with her.

Accordingly, Martina Mark communicates with her statement about the project structure plan on the four levels, which were perceived by Laura Leiter as follows.

Application of the four-level model of a message:

	Sender Martina Mark	**Receiver Laura Leiter**
Fact level	"The project structure plan does not fully reflect the Christmas party project."	The project structure plan is incomplete
Relationship level	"You can't create a complete project structure plan."	Martina Mark criticises me
Self-disclosure level	"I can't work with an incomplete project structure plan."	Martina Mark can only work with complete project structure plans
Appeal level	"Create a complete plan."	Martina Mark wants me to immediately create a complete project structure plan

Depending on which level Martina Mark and Laura Leiter primarily communicate, misunderstandings can arise. Although Martina Mark only wants to give Laura Leiter the hint that the project structure plan is not complete (fact level), Laura Leiter primarily perceives this on the relationship level and feels criticised. Emil Expert then explains this effect to her, so that Laura Leiter is already somewhat calmer again.

6.2.4 Rules, Theses, Principles of Communication

In addition to the models and concepts within communication, there are some theses and principles that are important in project management and are therefore presented here.

■ Watzlawick

The communication scientist Paul Watzlawick has established five so-called axioms, i.e. principles, which can significantly influence communication within and outside a project. The first two are:[1]

1. Axiom of Watzlawick

"One cannot not communicate." (1. Axiom, Watzlawick et al., 2017, p. 61)

For example, if a project manager does not give a verbal answer to a question, he does so with his body language (non-verbal) as well as the Non-response. Here, the aforementioned insight that communication is not just about sending messages, but is interpreted accordingly by the recipient, plays a crucial role. Even if no message is sent, something can still be interpreted.

The second axiom according to Watzlawick states:

2nd axiom of Watzlawick

"Every communication consists of a content and a relationship aspect, such that the latter determines the former." (2nd axiom, Watzlawick et al., 2017, p. 64)

In other words, the more stable the relationship level is, the more messages the project manager or another team member can send during communication.

■ Success Factors of Communication

Good communication consists of three success factors:

1. Self-perception (► Sect. 6.1.1):
   - The sender knows what he wants to achieve.
   - The sender is aware of his current mood.
   - The sender separates his emotions from the factual content.
   - The sender is aware of his strengths and weaknesses and deals with them purposefully.
   - The sender is aware of his expectations and prejudices.

2. Appreciation and respect for the conversation partner:
   - The sender knows that he cannot change the conversation partner and appreciates their individual personality.

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1 The other axioms are not addressed here. They can be read in relevant literature (e.g. in Watzlawick et al., 2017).

- The sender respects the opinion, feelings and needs of the conversation partner.
- The sender takes the conversation partner seriously and communicates with them on an equal footing.
- The sender listens to the conversation partner and tries to understand them without immediately making judgements.

3. Unambiguity and clarity:
   - The sender expresses himself as clearly and unambiguously as possible.
   - The sender asks what the conversation partner has understood.
   - The sender also clearly expresses feelings and desires.
   - The sender addresses inconsistencies and conflicts immediately.

Practical Tip

Communication

- Misunderstandings and misinterpretations can be avoided if both the sender and the receiver perceive their *current levels of communication* and try to synchronise these levels (based on the model of Schulz von Thun, ◘ Fig. 6.8).
- Speaking and listening should be learned on all four levels.
- Asking questions/feedback helps with mutual understanding. One should not assume that the receiver understands the message as the sender intended it.
- Establishment of a connectable communication, i.e. one should adapt to one's counterpart.
- Establishment of regular communication (planned meetings, reports etc.).
- Establishment of relationship levels in the project through rules, events, informal meetings.
- Sharpen and establish the importance of social controlling.
- Brief consideration regarding the most sensible communication path (it is not always the email).
- Sharpen perception of communication barriers and disturbances in communication.

In addition to email communication:
- Emails should have short sentences, clear statements and a recognisable structure.
- Use emojis like :-) or ;-) to compensate for the important non- and paraverbal component.

Christmas Party EI-TI AG: Communication

After Laura Leiter has revised the project structure plan and Emil Expert has also found it to be good, Laura Leiter now feels ready to ask Martina Mark if she would have the chance for a higher position, as she puts a lot of energy and time into the project and thus also creates a special added value for Ei-Ti AG. She asks Martina Mark by email with the subject "Future Perspectives" for a conversation. Laura Leiter is a bit nervous, as she does not know how Martina Mark will react to her request. However, the topic is very important to her, as she had heard from a friend about a similar position in another company, which is better paid and advertises with flat hierarchies. Martina Mark confirms the appointment and arranges for a one-hour meeting for Laura Leiter in the canteen during lunch break next week. Laura Leiter is a bit disappointed that her lunch break has to be used for this and that the conversation that is so important to her will be held in the canteen. Nevertheless, she is pleased that Martina Mark has agreed to the meeting. At exactly 12:00 pm, Laura Leiter is in the canteen. However, there is no sign of Martina Mark. A few minutes later she appears completely out of breath and tells Laura Leiter that she has to be back in the next meeting at 12:40 pm, i.e. 20 minutes earlier. Laura Leiter is disappointed, but just nods. After a short small talk, Laura Leiter starts with her concern, but is immediately interrupted by Martina Mark, who believes that she also deserves a pay raise. She is a bit confused about Laura Leiter's demand and does not understand why she is not satisfied with her position and her project. During the conversation, Martina Mark constantly looks at her mobile phone. When Laura Leiter wants to start with her concern again, Martina Mark's mobile phone rings. She answers it with the excuse that it is very urgent and that she has to take care of the marketing budget urgently. The conversation ends with Martina Mark advising Laura Leiter to just wait, still holding the phone to her ear. And she is already on her way to the next meeting.

Laura Leiter had really imagined this differently. Did that really just happen? Somewhat stunned, she goes to Emil Expert and tells him about it. He smiles a bit and then explains to Laura Leiter that Martina Mark clearly lacks the competence of active listening. In the end, Laura Leiter could not even explain to Martina Mark what she wants and especially why, because Martina Mark was so preoccupied with her own thoughts and wishes that she did not even bother to listen to Laura Leiter.

Emil Expert suggests to Laura Leiter to replay the entire situation. Only with the difference that he takes on the role of Martina Mark and shows Laura Leiter what a big difference small gestures and active listening can make. They both agree: it would have been much better if Martina Mark had invited Laura Leiter to her office. Laura Leiter would then have felt much more taken seriously. A mobile phone on the table during an important conversation is also a no-go. And lastly, Martina Mark should have listened instead of talking about her own problems. Emil Expert clearly shows how much subtleties can influence an entire conversation. Laura Leiter is impressed and definitely plans to do this for her next conversations: it is not that complicated and can make such a big difference. To make sure that what has been said has really been understood by the other person, Laura Leiter can also use targeted questioning techniques, by for example using confirmation questions ("Have I understood correctly that there would be the possibility of a higher position for me if the Christmas party is successful?") or precision questions ("When exactly can I expect a decision?") to prompt Martina Mark to pick up the question herself again.

6.3 Leadership

Leadership in projects has a strong influence on the success of a project. The leadership theme in traditional project management has even greater importance than in the agile environment, as here the focus is on self-organisation and self-management instead of the typical leadership structure of leader and led. The role of the leader is taken over by the team itself in the agile environment.

Leadership should be defined as follows (based on Weibler, 2016, p. 19).

Leadership

Leadership means influencing others through socially accepted behaviour within the framework of a goal setting. The influence leads the led directly or indirectly to a behaviour in the sense of the goal setting.

Essential characteristics of leadership are the behavioural influence by the leader and the acceptance on the part of the led. The acceptance distinguishes leadership from manipulation and also from management.

Management

Furthermore, leadership is defined by its effect, not by the position. This is another criterion that distinguishes leadership from management. Management is the ability to steer, control and optimally use people, processes and resources based on already established values, beliefs and rules. That is, in management, behaviour and acceptance play a subordinate role.

Leadership Model

Leadership models, leadership concepts and leadership styles should be distinguished.

A leadership model is a simplified representation of the leader, the led or the led and their interactions. Against the background of the complexity of interactions between people, a simplified representation using a model is useful.

Leadership Concept

A leadership concept is a general approach (type, guidance) for leading employees, i.e. within the framework of project management for leading project team members and project employees.

Leadership Style

A leadership style describes a certain behaviour of the leader within the framework of leadership.

Leadership in projects is a key competence within project management and is becoming increasingly important due to the complexity and uncertainties in project management.

The following characteristics of a project distinguish leadership in projects from leadership in the permanent organisation:

- content and time limitation,
- cross-organisational composition,
- often part-time employment in the project,
- leading without power (no disciplinary authority).

Lateral Leadership

Because unlike in the permanent organisation, the project manager, sub-project manager or work package manager must always adjust to new employees in new projects and lead them. Since the so-called temporary leader often has no disciplinary authority, this is referred to as so-called lateral leadership or leadership on an equal footing.

The project manager is responsible for the project in terms of cost, time and result. However, he is often equipped with fewer powers than a superior in the permanent organisation. This circumstance can lead to conflicts and demotivation in the project management.

In the context of leadership, the so-called cognitive and emotional competences play a major role (Dulewicz & Higgs, 2005).

Cognitive and Emotional Competence

Cognitive competence or intelligence (abbreviated by the so-called intelligence quotient IQ) is understood to be the general speed and effectiveness with which problems can be understood and solved (see Roth, 2017, p. 27). Emotional competence or intelligence (abbreviated by the so-called emotional quotient EQ) is the ability and skill to perceive, assess and deal with one's own feelings and the feelings of others (see Goleman, 1997, p. 56). Emotional competence is particularly important in lateral leadership.

6.3.1 Leadership Models

Leadership models help the leader in projects (project sponsor, project manager, sub-project manager, work package manager) to simplify the often complex relationships of leadership and to embark on a successful path in leadership in projects. However, it must never be forgotten that people cannot be programmed like machines and that a good leader in projects cannot be created overnight simply by knowing models and theories.

6.3.1.1 Situational Leadership (Hersey and Blanchard)

Basically, there is no best leadership style that is best suited for all led and fits all situations. The leadership style depends on the willingness (Will) and the maturity/competence (Can) of the employees who the leader wants to influence. Thus, the leadership style depends on one on the person or group (focus relationship) that is to be led, but also on the specific situation or the task (focus task).

Situational leadership means that different leadership styles are used depending on the situation (person and task). This means: Situational leadership requires a certain analysis and diagnostic ability on the part of the leader and additionally the ability to use a range of different leadership styles (◘ Fig. 6.9).

Four leadership styles are distinguished in situational leadership (◘ Table 6.3).

Even with the situational leadership model, one recognises the limits of a model, as it certainly does not proceed exactly according to this process in practice and is applicable to every employee. But it is an approach to sensitise the leader to reflect and assess the situation.

Within the framework of situational leadership, in addition to the maturity level, task-oriented and relationship-oriented leadership behaviour, other personal and situational characteristics play a role, e.g. generational differences in leadership must be taken into account, as illustrated in ◘ Table 6.4.

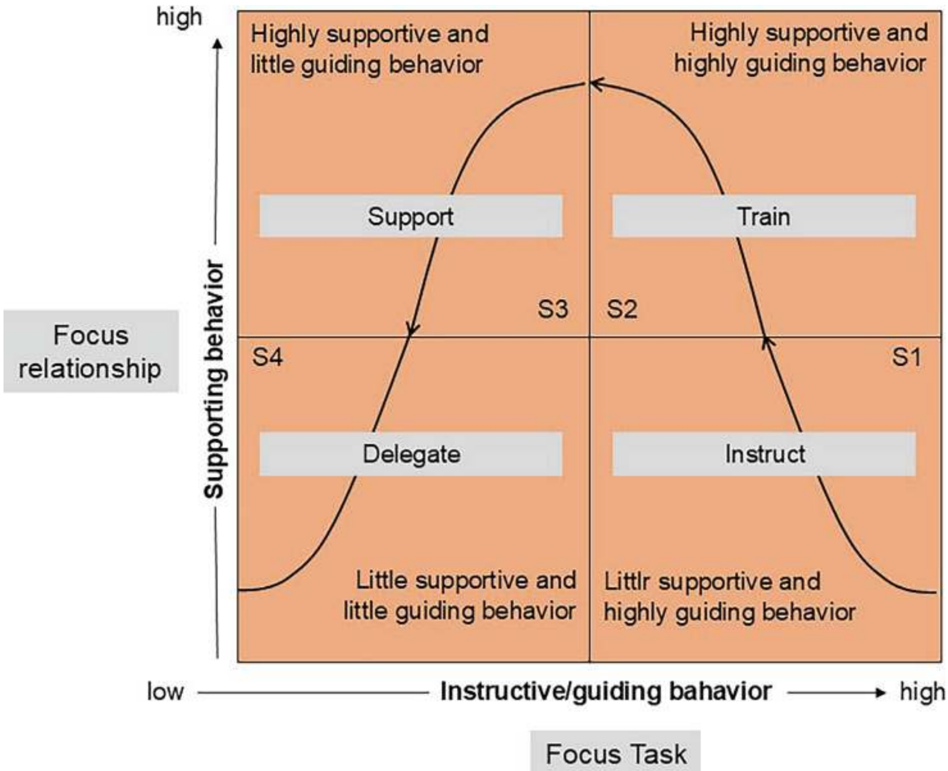


Fig. 6.9 Situational leadership

6.3.1.2 Power Bases (Power Based Leadership)

Power still represents something important and fascinating for humans and is still one of the most important foundations in the context of leadership, both for the leader and the led. The power bases clarify the question of the basis for a change in behaviour of the led by a leader. Especially in lateral leadership, the question of the legitimacy of leadership is very important, as the legitimacy due to hierarchy is not given (power due to legitimacy).

The most well-known and frequently mentioned power bases come from 1959 by R. P. French and Bertram H. Raven:

- **Legitimacy** (legitimate power):
- One is influenced by a person if one believes that this person has the right to determine decisions or behaviours, e.g. due to hierarchical position.
- **Ability to reward** (reward power):
- If a person can reward other people for their results, this is a power base.
- **Ability to punish** (coercive power):
- Conversely, the ability to punish is also a power base.

Table 6.3 Four leadership styles of situational leadership according to Hersey/Blanchard. (Own representation)

Characteristic	**1. Guiding**	**2. Training**	**3. Supporting**	**4. Delegating**
Maturity level	The employee is not capable regarding the upcoming task	The employee is not yet capable, but motivated	The employee is capable, but not motivated	The employee is capable and motivated
Task-orientation	High	High	Low	Low
Employee-orientation	Low	High	High	Low
Explanation of leadership style	Directive leadership style. Precise instructions and strict controls	Explanation of decisions and instructions. Incl. opportunity for clarification questions	Communication of ideas, creation of the basis and encouragement to make decisions	Handover of responsibility for decision-making and implementation
Communication	One-way communication	Two-way communication	Joint decision-making process	The employee is responsible for the implementation. The supervisor monitors the execution and the results

- **Identification or role model** (reference power):
- If someone has a pioneering role or shows behaviours that are worth emulating for others, this is a power base.
- **Expert knowledge and information** (expert power):
- Also a power base is the knowledge that people possess or to which they have access. (Cf. Rattay, 2013, p. 89 ff.)

These power bases occur in different degrees in project management leaders, as especially through lateral leadership (leadership without hierarchical legitimisation) reward and punishment are often more difficult to implement. But the reward does not always have to be monetary. Rather, praise as a form of recognition by the project leader can motivate much more here.

6.3.2 Leadership Concepts

Widely used leadership concepts in practice are the so-called *Management-by* concepts. These leadership concepts have a high practical relevance, as they are based on the experiences of leaders. They are considered “classics” among management techniques, as they are understandable and easy to apply in practice:

Table 6.4 Various characteristics of the Baby Boomer generation, Generation X and Y. (Source: Lehky, 2011, p. 113)

Skill	Baby Boomers (born 1955–1965)	Generation X (born 1965–1979)	Generation Y (born from 1980)
Problem solving	Hierarchically organised	Independent, self-reliant	In a group, rarely alone
Task management	One task at a time	Multitasking, if necessary	Multitasking as a daily routine
Communication	Oriented towards hierarchical structures	Oriented towards personal relationships	Networked and transparent
Leadership behaviour	Hierarchical	Collaboration with subordinate employees	Partnership-based collaboration regardless of location and position
Feedback	Annually or semi-annually	Monthly or weekly	Available on demand, "open ear" and mentoring
Decision making	Independent, team is informed	Independent, with gathering of team opinions	Consensus-oriented, in discussion with the team
Further education	Only when necessary	Occasionally via seminar or on-the-job training	Constant, lifelong learning
Learning style	Knowledge transfer by trainer	Knowledge transfer by trainer or self-study	Self-study or learning in networks
Use of technology	Necessary evil, occasionally useful; direct conversation is preferred	Routine with new technology and in direct conversation	Omnipresent, little understanding for technology refusal, direct conversation is highly valued

- **Management by Objectives**
- Here, the project leader agrees with the employee on a binding, preferably SMART goal agreement (► Sect. 2.4.3). The employee should implement the goals independently. Therefore, the project leader should grant the employee decision-making powers. Independent work can increase the motivation and thus the performance of the employee.
- **Management by Delegation**
- In a similar direction goes the leadership style of Management by Delegation, where the transfer of decision-making powers and responsibility to the employee is central. Important for this is a clear task definition. The manager is relieved by the assumption of tasks and responsibility by the employee on the one hand, on the other hand, it offers the employee more opportunities to shape his work.

- **Management by Exception**
- The concept of Management by Exception (Management in exceptional cases) goes one step further. Here, the decisions that arise are made by the employee. The project manager only intervenes in exceptional cases (by exception). Even with this concept, a essential prerequisite is the regulation of powers and responsibilities. The intervention of the project manager should be clearly regulated be. However, as with agile project management, trust and letting go is necessary from the managers.
- **Management by Results**
- Here, the goals are set by the project manager. The specification of Goals is the main difference from Management by Objective, where the goals are set together. The employee is also free in this concept regarding the path to achieving the goal.

All concepts are about the distribution of powers, responsibilities and tasks. Against this background, the Function diagram can make a valuable contribution (► Sect. 3.1.4.3).

6.3.3 Leadership Style

Leadership styles are an important element in the application of leadership models and in the implementation of the concepts.

The most important leadership styles in the context of project management are shown in ◘ Fig. 6.10 (cf. Rattay, 2013, p. 49 ff.):

The Authoritarian Leadership Style

The authoritarian leadership style requires a clear subordination from the team members. The leadership style is characterised by instructions and controls and no decision-making participation of the team. Initiative and creativity play hardly any role here. The danger with this leadership style is that team members become demotivated or aggressive behaviour patterns develop. On the other hand, the leadership style is characterised by quick decisions.

The project manager

- is performance-oriented and directs every decision in the desired direction,
- communicates clearly in the form of instructions,
- makes significant decisions alone,
- shows little concern for expectations, needs, problems of the employees,

	Authoritarian	Consultative	Cooperative/ participative	Democratic	Delegative
Charac-teristics	Project Manager decides	Project Manager decides, allows questions about the decission	Project Manager decides after the opinion of the team has been heard	Project Manager decides together with the team	Team decides, Project Manager only intervenes in exceptional cases
Analogy Situational leadership	Instruct	Train	Support	Support/ delegate	Delegate
Advan-tages	▪ Ability to act quickly ▪ Clear responsi-bility	▪ Promoting acceptance ▪ Clear responsi-bility	▪ Promoting the own creativity an opinion ▪ Motivating	▪ Promoting team building ▪ Motivating	Personal responsibility leads to increased motivation
Disadvan-tages	▪ Demotiva-ting for those being led ▪ Emotional withdrawal	▪ Possibly frustrating for those being led	▪ Possibly frustrating with different opinions ▪ Longer opinion forming	▪ Can be seen as weakness in leadership ▪ Longer opinion forming	Possible overload of the team
Will-building	Project manager				Employee

Fig. 6.10 Leadership styles of project management

- is rather distant and cool and assigns tasks directly and without discussion,
- explains everything in great detail,
- has own solutions for almost all problems,
- criticises employees (openly or covertly),
- often has a pronounced feeling of superiority.

▪ The Consultative Leadership Style

In the consultative or advisory leadership style, the project manager decides, but allows questions and comments. He sees the team as advisors, who can support him in decision-making, but ultimately have no decision-making power. This leadership style is especially useful with a younger or inexperienced team that should be motivated by the involvement but due to lack of experience cannot yet make solid decisions.

The project manager

- is performance-oriented and directs decisions after consultation in the desired direction,
- involves the team in an advisory capacity,
- makes significant decisions alone,
- allows discussions and supports the team in forming their own opinions,

- explains a lot and gives instructions,
- gives feedback and tries to develop team members.

The Cooperative Leadership Style

The manager takes time to hear the opinions of the team members and involves them in the decision-making process. Ultimately, he makes the executive makes decisions themselves, taking into account the opinions, needs and comments of the team.

This leadership style increases acceptance and motivation within the project team. However, if decisions are often made that differ from what the team suggests, it can also lead to frustration.

The project leader

- involves his employees in the process, thereby increasing their motivation and independence,
- promotes willingness to perform, allows creativity and new ideas,
- passes on important information,
- promotes open communication,
- determines task distribution and schedule by consensus.

The Democratic Leadership Style

In the democratic leadership style, the project leader tries to activate the employees by involving them in the decision-making process and joint decision-making. The project leader is more of a coordinator and coach and actively encourages criticism and ideas.

This increases the sense of responsibility and the independence of the team and the individual team members. However, due to the potentially longer coordination process, this leadership style is problematic in crisis situations.

The project leader

- makes decisions together with the project team,
- involves his employees in the process, thereby increasing their motivation and independence,
- promotes willingness to perform, allows creativity and new ideas,
- passes on important information,
- promotes open communication.

The Delegative Leadership Style

The delegative leadership style involves the least form of interference by the project leader. He completely steps back and lets the team decide. This leadership style leans towards self-management of the team and is similar to the management-by-exception approach.

The project leader
- lets the project team decide,
- completely steps back, thereby increasing the motivation and independence of the team,
- promotes willingness to perform, allows creativity and new ideas,
- only intervenes in crisis situations.

The leadership style also depends on the project management approach. In an agile environment, the delegative leadership style is assumed or is an important characteristic and success factor for agile projects.

Ei-Ti AG Christmas Party: Leadership

Now that Laura Leiter as project leader is also taking on responsibility, she is concerned with the question of how best to lead and guide her team. She is somewhat unsure which leadership style she should choose, because on the one hand her team consists of an experienced IT employee, who has been with the company for several years and is also older than her. On the other hand, the new intern is also part of her team, who is very diligent and committed, but does not have much practical experience yet. If she were to choose the authoritarian leadership style, for example, she would feel uncomfortable in front of the experienced IT employee, who really doesn't need too many instructions. With a delegative leadership style, however, the intern would lack instructions and guidelines. She takes her dilemma to Emil Expert and asks for advice. Emil Expert immediately reminds her of a tabular overview of the leadership styles of project management (► Fig. 7.10). This shows her that there is not one right leadership style for every situation. In Laura Leiter's situation, for example, the individual advantages and disadvantages of the leadership styles must be weighed up, because the fact that such different profiles form this team, a single leadership style cannot cover all needs. He therefore advises her to use the situational leadership style and emphasises that she should behave differently depending on the situation: with the experienced IT employee she should lead a bit more delegatively, while he would recommend a more authoritarian leadership style with the intern. Laura Leiter understands this: that's how she will do it!

6.3.4 Emotional Leadership

Emotional leadership shares the situational character with situational leadership. In contrast to situational leadership, emotional leadership does not focus on the maturity level of the led, but on the emotional intelligence (EQ) of the leader (Goleman, 1997). This allows a project leader to recognise the emotions and personalities of the led and the team and tries to reach the led and the team through their own feelings.

emotional intelligence

Emotional intelligence is the ability to perceive, assess and accordingly deal with one's own and others' feelings (cf. Goleman, 1997, p. 56).

Five characteristics of emotional intelligence

Emotional intelligence is characterised by five features:
- Self-perception,
- Self-regulation,
- Empathy,
- Motivation,
- Social competence (cf. Goleman, 1997).

The insights and approaches are based on the American psychologist and Harvard lecturer Daniel Goleman et al. (2015), who sees six leadership styles within emotional leadership (Goleman et al., 2015).

Four of the six leadership styles of Goleman create resonance (i.e. a positive mood). Two leadership styles create dissonance (i.e. a negative mood). However, all are important within emotional leadership and are also to be used situationally.

The six leadership styles of emotional leadership are briefly explained below:

- **Visionary**

Visionary leaders give a team a vision or a goal. They also give the team and individual employees freedom to determine the path to the goal themselves. This leadership style is similar to or identical with the delegative leadership style.

- **Coaching**

The coaching leadership style focuses on individual team members. Coaching leaders create trusting and close relationships with employees. Coaching leaders work a lot with reflection, feedback and enable employees to develop their optimal performance and be highly motivated.

This leadership style overlaps with the cooperative leadership style and parts of the democratic leadership style.

■ Emotion-Oriented

In the emotion-oriented leadership style, leaders openly deal with their own feelings and the feelings in the team. The focus is on the emotional needs of the team and individual employees. This creates trust and harmony in the team, which in turn increases motivation. The limitation of this style is that it can cause irritation in some people who do not know how to deal with emotions. However, a good, emotional leader can handle this.

The emotion-oriented leadership style is often linked with other leadership styles.

■ Democratic

This leadership style has already been described above (◘ Fig. 6.10).

■ Demanding

The demanding leadership style is usually a temporary phenomenon, where the leader expects a high level of performance from their team. To this end, they exert a certain amount of pressure.

This style is usually found before the completion of a milestone or before project completion.

■ Commanding

This leadership style has already been described above under the *authoritarian leadership style* (◘ Fig. 6.10)

It should be added here that in certain situations (usually emergencies and crises) this leadership style is useful, e.g. when a document needs to be created or a product change developed by the entire team in a very short time.

6.3.5 Decisions

An important topic in the context of leadership is the development and making of decisions.

In this area too, there have been some significant insights in the field of decision science in recent years due to neurobiology.

Emotional decisions and rational considerations

Emotions also play a major role in decisions. No decision is made without emotions. There are purely rational considerations, but no purely rational decisions. This is due to the fact that the human mind cannot cope with complex decision situations. This is where the so-called emotional memory of experience (Roth, 2017) helps. It is the so-called instinct or intuition. Before people have made a rational decision, the emotional level is already active. The emotional reaction is much faster than the rational one. The mind usually only suggests a rational justification for the already made decision in the form of calculations and verifications (Roth, 2017).

Project leaders should be aware of this fact. Project participants should also be aware of this fact in the context of work organisation and daily planning, wherever decisions are made.

Of course, in the case of entrepreneurial decision-making, especially by several leaders, such as in a project planning meeting or a project controlling meeting attempts to make rational decisions in the interest of project success. To this end, methods and tools, such as those presented in ► Sect. 2.8 can be used. Each decision should be rationally coordinated and made collectively.

6.3.6 Delegation

Within the framework of leadership, project managers, subproject managers and work package managers must and should delegate again and again. Delegation is sensible for two reasons. On the one hand, all tasks and activities that arise cannot often be carried out by oneself, or it is more efficient to hand over some tasks (Eisenhower Matrix, ► Sect. 6.1.4). On the other hand, delegation can also be a motivational tool within the framework of leadership (► Sects. 6.3.1 and 6.3.2).

In project management, the focus is primarily on task delegation. However, complex areas of activity or roles within the project can also be transferred to project participants for the duration of the project. Delegation describes the process in which a manager within the project (e.g. the project manager) assigns a task, an area of activity or a function to an employee. In this context, the necessary powers must be granted and it must be ensured that the employee has the necessary competencies and transfers or shares the corresponding part of the responsibility for the completion of the task or role. Finally, the manager must check the result of the task execution.

The advantages of delegation are:

- The manager is relieved and thus has time for other or more important tasks. This can prevent stress.
- The employee is promoted through more responsibility and initiative. Motivation and job satisfaction are increased.
- Tasks are usually completed faster, as they are started earlier. By expanding to multiple perspectives with different competencies, the project can usually be implemented more efficiently.
- The knowledge management of the organisation is further expanded.

Prerequisites for successful delegation are:
- efficient and effective communication, i.e. correctly inform, communicate and also control,
- Ensuring task understanding, e.g. through feedback,
- Transparency of objectives,
- Transparency of the reasons and the situational context of the task,
- Building trust.

6.3.7 Practical Tips

Leadership in Projects

In leadership in projects, the leader (project manager, subproject manager, work package manager etc.) should establish and heed the following topics for themselves:
- **Individuality**—allow individual work habits as well as individual work time and learning design options,
- **Freedom**—promote self-responsibility as well as thinking along, ability to criticise and problem-solving competence,
- **Be a role model**—be decisive and trustworthy,
- **Feedback**—install feedback (in both directions) incl. querying of expectations and coaching,
- **Creativity**—promote decentralised decision-making,
- **Self-organisation**—promote temporary, self-responsible teams,
- **Diversity**—allow and promote diversity in the team,
- **Cooperation**—promote cooperation and team performance,
- **Flexibility**—allow and/or implement flexible structures,
- **Trust**—gain trust and keep promises.

(Further hints can be found in Rattay, 2013.)

6.4 Team Management

6.4.1 Fundamentals of Team Management

First of all, the terms group and team should be explained and distinguished from each other.

Group

A group is a social system that consists of at least three members and has come together for a common reason (common goal; cf. Weibler, 2016, p. 78 ff.). With two members one rather speaks of a dyad or a pair. With more than 30 members, one can also speak of large groups.

Groups pursue their goal or task over a longer period of time. In doing so, a corresponding group feeling *(we-feeling)* develops. The group is in direct communication. Even its own norms, values and roles can develop within the group. The common waiting at the doctor's office in the waiting room usually does not yet meet the characteristics of a group. Unless, group dynamic processes arise due to external occasions, such as e.g. waiting too long or unequal treatment when calling the patients. This can create a temporary group feeling. When people meet in the context of a sporting or social activity, one can speak of a group from the start.

A group can be described by the following three characteristics:

1. the driving forces (goals),
2. the group process (process organisation),
3. the group structure (organisational structure).

Team

The guiding principle is "A team is always a group, a group but not always a team". From this it can be deduced that a team has additional characteristics besides the characteristics of the group.

The additional characteristic of a team is productivity or efficiency, which distinguishes it from a group. The team comes together to produce a result. In the context of project teams, this refers to the deliverable.

Teams show even stronger cohesion and stronger cooperation than groups. Unlike the group, the team does not see the responsibility for the result with individual characters, but with the entire team. It is assumed that the team performance is greater than the individual performances of the members. Thus, a school class is a group and a football team is a team.

Project Team

In terms of characteristics, a project team does not differ from a general team. A project team is a team that has been assembled for a project and works on the tasks assigned to it.

Differences lie in the parallelism of tasks to the permanent organisation and in the temporary character of the project. An employee can e.g. be a member in the permanent organisation (e.g. in the software development team) as well as in one or more project teams be. The temporary character of the project teams represents another special feature. While teams in the permanent organisation often are formed for an indefinite period (collaboration over years), the project team works for a limited period.

▪ Genuine and Non-genuine Teamwork

Furthermore, a distinction can be made between genuine and non-genuine teamwork (◘ Fig. 6.11).

The essential characteristics of non-genuine teamwork are:

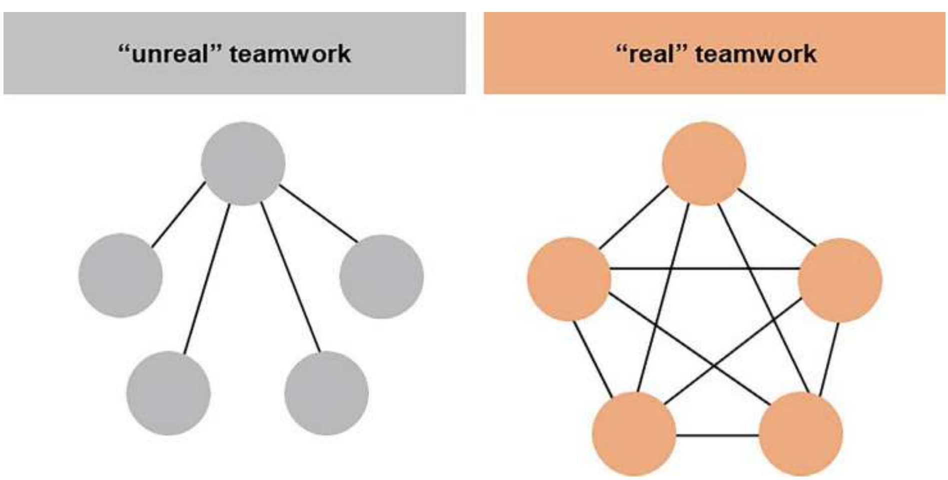
- Addition of individual performances (no synergies),
- only own perspectives (partial perspectives),
- mostly only isolated bilateral cooperation (co-acting).

The characteristics of genuine teamwork are:

- Team members all work together (inter-acting),
- synergies are used,
- common perspectives emerge.

The success of a real team is based on various factors. Particularly important factors are:

- common goal setting, preferably according to the SMART principle (► Sect. 2.4),
- Team motivation,
- Task distribution based on competencies,
- Use of methods and tools (RASCI, ground rules, role descriptions etc.),
- self-organisation if possible.



◘ **Fig. 6.11** Non-genuine and genuine teamwork

6.4.2 Team Assembly

Naturally, the most sensible way to assemble a team is based on professional criteria. However, the social and personal characteristics of project participants should also be considered, depending on the type of project. For example, a business integration, i.e. the merger of two companies, which has a high change management component, requires a different type of project leader than a technical roll-out project of 1000 workplaces with new computers. But not only the personality profile of a project leader should be selected depending on the project, individual project participants should also differ depending on the type of project. In the end, the composition of the entire team within a project counts.

Just like with personality models (► Sect. 6.1.2), there are a number of team models that have identified different team roles. Appropriate tests can be used to determine the role of project participants. However, the same applies as with personality tests: every person has parts of the different roles. The emphasis or shares in the roles are individual.

Role and personality models

In theory and practice, there are a number of role or personality models. The best known are:

■ Role Model of Belbin

Teams work effectively and efficiently when they consist of a variety of heterogeneous personality and role types. Belbin (2010) distinguishes between nine types:

- three action-oriented roles: doer, implementer and perfectionist,
- three communication-oriented roles: coordinator/integrator, team player/participant and pathfinder/switcher,
- three knowledge-oriented roles: innovator/inventor, observer and specialist. (Belbin, 2010)

■ Team Management System (TMS)

The TMS model is based on eight task types that are assigned to people proportionally:

- innovate: think, invent, tinker,
- promote: present, convince, sell,
- develop: analyse, decide, find solutions,
- organise: set goals, create plans,
- implement: do, act, produce,
- monitor: ensure quality, detect errors, evaluate,
- stabilise: support, provide support, service,
- advise: observe, ask questions, collect data.

■ **DISG Personality Model**

The DISG model is based on four personality types:
- D = Dominant: direct and determined,
- I = Initiative: optimistic and open-minded,
- S = Steady: empathetic and cooperative,
- G = Conscientious: thoughtful and correct.

■ **Myers-Briggs Type Indicator (MBTI)**

The MBTI approach is based on four dimensions:
- Orientation of attention—Extraversion (E) or Introversion (I),
- Reception of information—through sensitive feeling (S) or intuition (N),
- Making decisions—through thinking (T) or feeling (F),
- Dealing with the world—through judging (J) or perceiving (P).

6.4.3 Team Development

The development of a group into a high-performance team is expressed through the sense of belonging, motivation and performance. The best-known model of team development is that of Bruce W. Tuckman, which comprises five phases in project management. None of the phases can be skipped. The phases are shown in ◘ Fig. 6.12 and described in bullet points.

■ **Forming**

In the forming phase, team members have different individual goals, interests, and abilities. There is uncertainty, dependency, and a need for orientation. The members begin to "feel each other out". The team tries out behavioural patterns.

■ **Storming**

In the storming phase, conflicts arise between team members and subgroups. Rebellion against leaders is a phenomenon. There is some resistance to other opinions. The roles and commonality of goals are questioned. Boundaries are tested and drawn.

■ **Norming**

In this phase, group cohesion develops. The various interests are subordinated to a common task. Ground rules of the game are established that are accepted by all. One accepts the other and ensures that the team's existence is guaranteed.

6

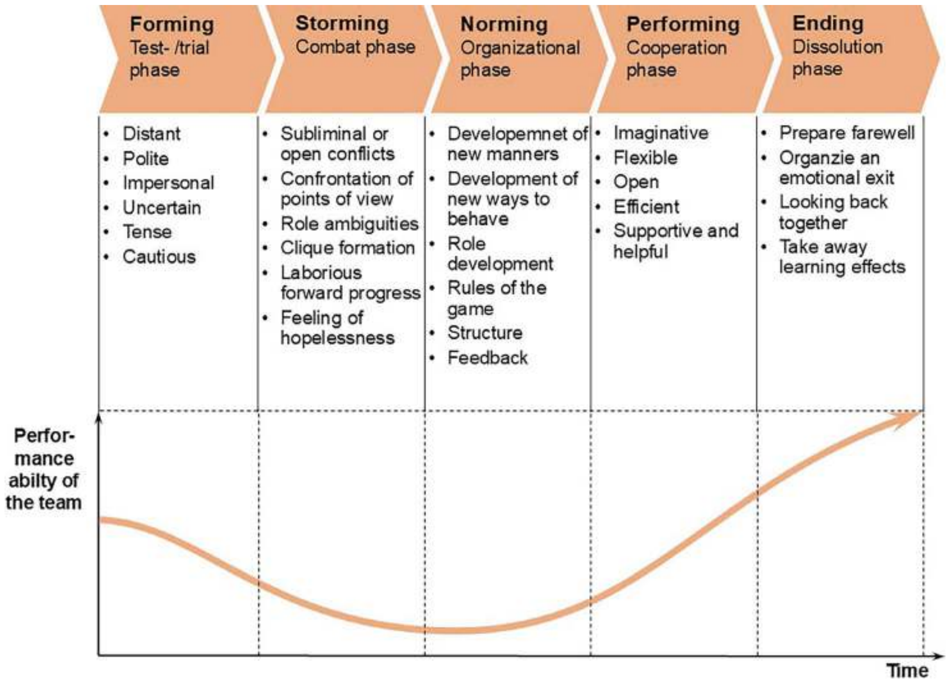


Fig. 6.12 Team development according to Tuckman

- **Performing**

In the performing phase, energy becomes available for the actual task fulfilment. Personal problems among each other take a back seat to work. Role understanding is flexible and functional.

- **Ending**

In this phase, the completion of the project and the dissolution of the team are prepared. The project leader must pay particular attention to an emotional ending and ensure that the team does not fall apart before the end, as other tasks are already waiting.

The challenge and main task in the context of team development for a project leader is to support the team in going through the first three phases in such a way that they are completed relatively quickly and with satisfaction. He must bring in his self- and social competence. Because accelerating the phases certainly requires increased communication and conflict competence.

In the context of team development, the methods and tools of organisational and communication planning can help to develop the team faster and avoid conflicts. These are the organigram, role description, function diagram, ground rules, and communication plan (▶ Sect. 3.1.4). The organigram, role description, and function diagram support the rapid establishment of structures and the distribution of roles in the team. The communication plan supports important exchange, especially at the beginning of a project. The most powerful tool in the context of team development is the ground rules, as these are completely open and can be freely designed by the team.

6.4.4 Virtual Teamwork

In projects today, there is an increasing amount of *virtual* collaboration, i.e., a physical meeting does not take place, instead, various digital media are used (chat systems, video conferencing systems, special so-called collaboration systems). Virtual teamwork takes place at distributed locations. The team members work at different locations and sometimes in international projects in different time zones.

Virtual teamwork arises,

- when different expertise from different locations is needed simultaneously,
- in international projects, where the project team works at different locations and possibly also in different time zones,
- when cost reduction in terms of travel costs/times is required.

Virtual teams place high demands on leadership, as the personal and emotional level, which is important in the context of communication, motivation, and team development, is not present.

Challenges of virtual teamwork

The main challenges of virtual teams are:

- Working in different time zones,
- cultural and linguistic differences,
- dependence on technology-supported communication,
- virtual cooperation in the intercultural team,
- effects of cultural differences on communication and work process,
- utilising cultural differences,
- dealing with language problems,
- trustful cooperation,
- creating a *third culture* in the virtual space,
- few personal contacts,
- lack of rules.

Success factors of virtual teamwork

The success factors of virtual teamwork are (see Rattay, 2013, p. 299 ff.):

- The team members' ability to work in a team is fundamentally present,
- Media competence as a prerequisite is given,
- All project participants should be informed about the project management elements (especially project objectives),
- Various roles are clarified,
- Communication plan (Who informs whom and at what frequency?) is created,
- If possible, a personal kick-off meeting and start workshop at the beginning of the collaboration,
- Suitable technology (intuitively operable and quickly learnable) is available.

6.4.5 Feedback

Feedback is a perception feedback about the behaviour including the communication of a person or group (cf. Majer & Stabauer, 2010, p. 118). It is not the answer to any question. Feedback is a method within self-management, leadership, team management and also conflict management. Feedback has many advantages, but if applied incorrectly, it also has some disadvantages.

In principle, feedback can motivate and strengthen the development of individual project participants or the entire project team.

Success factors feedback conversation

There are a number of factors to consider for a successful feedback conversation:

- Addressing positive and negative topics—The development of a project participant is based on both positive and negative experiences. Both sides should be addressed.
- Separation of perceptions and interpretations—Interpreting means evaluating the employee, and evaluations are rather counterproductive in the context of solution paths.
- Active listening—Active listening ensures a comprehensive picture of the situation and a better understanding.
- Acceptance of different perspectives—Understanding and accepting different perspectives and opinions is more likely to lead to a common solution.
- Agree on a common approach—In the context of identification and leadership style, a jointly developed and coordinated approach is goal-oriented (cf. Rattay, 2013, p. 204 ff.).

Christmas Party Ei-Ti AG: Team Management

Laura Leiter is given the task of thinking about how to improve team cohesion in future projects. She remembers the theory of team development according to Tuckman (◘ Fig. 6.12). Laura Leiter quickly realises that a new team should always be guided through team development measures to ensure that a new team works productively together. She also knows that with Tuckman, teams always go through five phases.

Laura plans for the future in the forming phase a team-building activity where all team members share their interests, skills and work styles and develop a common vision for the future of the team.

In the second phase, the so-called storming phase, the goals and roles of each individual of the project would be presented. Laura recognises that conflicts and disagreements could arise here, as often team members want to bring in their own ideas and opinions. She considers that organising a meeting here could help, where the team members share their different perspectives and work together to find solutions to overcome disagreements.

Laura knows that the norming phase follows, in which all team members should have understood their roles and responsibilities and will work effectively on this basis. In addition, Laura Leiter thinks that a retrospective with the team, where the team members reflect on their successes and challenges and set common goals for the future of the team, would be particularly helpful here.

In the performing phase, collaboration and goal achievement take place. Laura therefore considers how she can acknowledge the team's achievements to maintain the team dynamics. Adhoc, she immediately thinks that it would be good to invite a team to lunch. Once a project is successfully completed, Laura Leiter knows from her own experience that it is important to evaluate the collaboration with everyone and express appreciation to the team in order to motivate them for further projects.

◘ Figure 6.13 summarises the essential success factors for team management and shows the consequences if one of these factors is neglected.

Factors					Result
Define objectives	Distribute competencies	Motivation	Resources	Plan actions	
✓	✓	✓	✓	✓	Progress
✗	✓	✓	✓	✓	Confusion
✓	✗	✓	✓	✓	Anxiety
✓	✓	✗	✓	✓	Delay
✓	✓	✓	✗	✓	Frustration
✓	✓	✓	✓	✗	False start

Fig. 6.13 Success factors team management

6

6.5 Conflict Management

Conflicts exist wherever people work together. In project management, people often work under pressure and are subject to special conditions (frequently changing team, temporary character). The risk of a conflict is particularly high in projects.

Conflict

Process of confrontation due to differing interests of individuals or groups.

There are different types of conflict, such as interest conflicts, relationship conflicts, goal conflicts, power conflicts, role conflicts, cultural conflicts etc. In the context of conflict resolution, it is always important to know the primary reason, i.e. the type of conflict.

Conflicts are fought in different ways. On the one hand, there is the acute *hot* and usually obvious conflict. On the other hand, there is the rather latent *cold* conflict, which can be subtle or "simmering".

The resolution of a conflict is always a process that takes place in several steps:

Phases of Conflict Management

1. **Conflict Perception**—First of all, it is important to perceive that a conflict exists at all. This perception usually works through the observation that a changed situation exists, through inexplicable behaviour patterns and signs of negative feelings in one or both parties.
2. **Conflict Cause**—As already hinted above, knowledge of the reason for the conflict is very important, because only in this way can a sustainable solution be found. The involved conflict parties should clarify their positions by means of subjective situation descriptions (reasons and

feelings). The cause should be sought together, agreements and differences should be identified.

3. **Solution Search and Implementation**—The search for solutions can be carried out in the following sub-steps:
   - Search for alternative solutions,
   - Check for acceptance and feasibility,
   - *Win-Win Situation* is the ideal solution,
   - Decision for an alternative solution,
   - Active implementation.

4. **Solution Assurance:**
   - Evaluation: Has the solution been successfully implemented?
   - Reflection of the conflict resolution; repeated check for acceptance of the solution by both parties,
   - Creation of a solution roadmap to ensure a constructive approach to recurring conflicts (cf. Rattay, 2013, p. 222 ff.).

Practical Tip

Conflict Management

In the context of successful conflict management, the following hints should be considered:

- Do not postpone conflicts,
- Consideration of the emotional level/relationship level, also by expressing feelings,
- Recognise and treat perceptions as perceptions, interpretations as interpretations and feelings as feelings,
- Ask about feelings and motivations of the conflict partner,
- Lead employees through questions and feedback,
- Use I-messages, e.g. “I have noticed that you are having difficulties implementing your work package”, instead of “You have not fully implemented your work package”,
- Understandable and reasonable argumentation and openness,
- Focus on Win-Win solutions,
- Remain authentic.

6.6 Summary

- **Personal and Social Competence**
  - The personal and social competence area can be divided into five competence fields:
    - Self-management,
    - Communication,
    - Leadership,
    - Team management and
    - Conflict management.
  - Self-management is the basis of the other four competence fields and is divided into the five competences
    - Self-perception and self-knowledge,
    - Goal management and self-development,
    - Motivation,
    - Organisation and time management,
    - Health and stress management.
  - Self-perception and self-knowledge occur on several levels (physical, emotional, mental and in relation to behaviour).
  - Motivation is divided into self-motivation and external motivation, into intrinsic and extrinsic motivation.
  - Well-known models within motivation research are the Maslow's hierarchy of needs and Herzberg's two-factor theory.
  - Organisation and time management includes numerous methods for structuring and prioritising work, such as the Eisenhower matrix, the ABC analysis, the Alps method, Kanban light or the Pomodoro technique.
  - Communication is a basic competence for all project participants. Perception and its phenomena play a crucial role here.
  - Important communication models are the sender-receiver model according to Shannon/Weaver and Schulz von Thun's four-sides model.
  - Leadership plays a special role in project management, as the project leader is a temporary leader and usually without direct authority to issue instructions.
  - Essential models, concepts and styles of leadership are situational leadership, the power bases of leadership, the management-by concepts and emotional leadership.
  - Important topics within team management are different roles (models) in the team and the development process according to Tuckman, virtual teamwork and feedback.

- Conflict management is based on a four-stage process with the steps:
  - Conflict perception,
  - Conflict cause,
  - Solution search and implementation,
  - Solution assurance.

6.7 Review Questions

Personal and Social Competence

1. Why is personal and social competence particularly important in project management? *(Solution* ► Chap. 6*)*
2. Why is self-management the basis of social competence? *(Solution* ► *Sect.* 6.1*)*
3. Explain the term motivation and its classification. *(Solution* ► *Sect.* 6.1.3*)*
4. What methods and instruments are there in the context of organisation and time management and what are their characteristics? *(Solution* ► *Sect.* 6.1.4*)*
5. What communication theories are there and why are they important for project management? *(Solution* ► *Sect.* 6.2*)*
6. What perception phenomena are there and how can these influence the behaviour of a project leader? *(Solution* ► *Sect.* 6.2.2*)*
7. Why is leadership within projects challenging? *(Solution* ► *Sect.* 6.3*)*
8. What are relevant leadership models and their characteristics? *(Solution* ► *Sect.* 6.3.1*)*
9. What are relevant leadership concepts and their characteristics? *(Solution* ► *Sect.* 6.3.2*)*
10. What are relevant leadership styles and their characteristics? *(Solution* ► *Sect.* 6.3.3*)*
11. Explain Tuckman's team development? *(Solution* ► *Sect.* 6.4.3*)*
12. What should be considered in conflict management? *(Solution* ► *Sect.* 6.5*)*

Multi-project Management

Contents

A. Dechange, *Project Management*, https://doi.org/10.1007/978-3-662-71462-1_7

Learning objectives of this chapter

After reading this chapter ...
- you will know the characteristics and the importance of multi-project management.
- you can explain and distinguish between multi-project management, individual project management, program management and portfolio management.
- you will know the special features and characteristics of program management.
- you will know the tasks, methods and tools of portfolio management and can also apply them.
- you will know the tasks and roles of a Project Management Office (PMO).

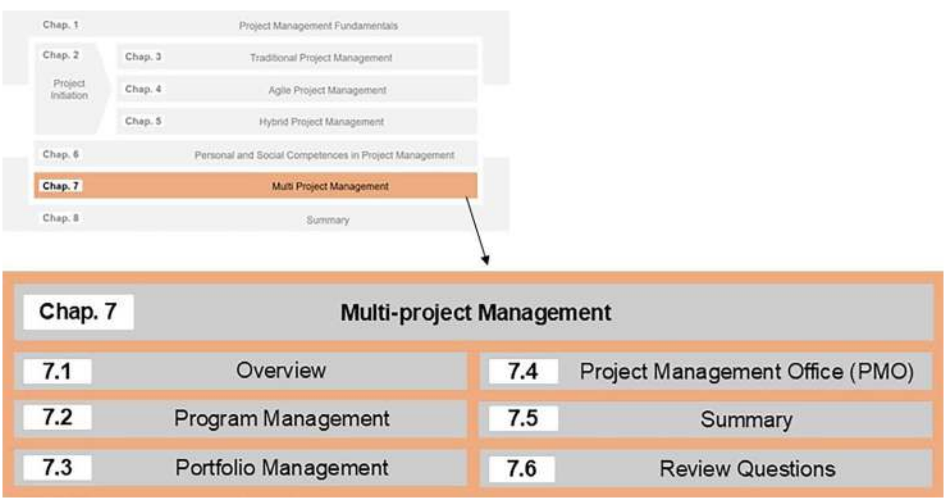
7

The seventh chapter has the structure shown in ◘ Fig. 7.1.

7.1 Overview Multi-project Management

Definition of Multi-project Management

According to DIN69909-1, multi-project management is an "organisational and procedural framework for the management of several individual projects. Multi-project management can be organised in the form of programs or project portfolios. This includes in particular the coordination of several projects with regard to their dependencies and common resources" (DIN, 2013). In line with the terminology of this book, multi-project management is defined as follows.



◘ **Fig. 7.1** Structure Chap. 7

Multi-project Management (MPM)

Multi-project management is an approach for the planning, selection, monitoring and control of several individual projects in an organisation or an organisational unit.

Demarcation of Multi-project Management and Individual Project Management

The essential characteristic of multi-project management is therefore the view on several projects. In contrast, individual project management deals with the initiation, planning, controlling and completion of a single project (► Chap. 1).

In addition, there are the terms *portfolio management* and *program management* directly related to multi-project management.

Program Management

Program management comprises the entirety of approaches, processes, methods, tools and templates as well as the competencies to successfully implement programs.

Portfolio Management

Project portfolio management is a subset of MPM and includes the permanent planning, prioritisation, monitoring and control of all projects of an organisational unit or the company.

Depending on the criterion of distinction, the program management is assigned to single and multi-project management, as shown in ◘ Table 7.1. Portfolio management is part of multi-project management in all perspectives. Project management is part of single project management in all perspectives.

Within the scope of this book, a temporal and methodological distinction is made between single and multi-project management, and thus the assignment of program management to single project management.

The distinction and delimitation of project, program and portfolio management is to be clarified in ◘ Fig. 7.2.

Effectiveness vs. Efficiency

This results in a further difference between single and multi-project management in the basic objective. Multi-project management focuses on effectiveness, i.e. the selection and monitoring of the right projects. On the other hand, single project management pursues efficiency, i.e. carrying out the project correctly (successfully).

Table 7.1 Delimitation and classification of portfolio, program and project management

	Temporal perspective (permanent vs. temporary)	Number of projects (one vs. multiple projects)	Methodological perspective
Multi-project management (MPM)	Permanent: Portfolio management	Multiple projects: Program and portfolio management	Methods of MPM: Portfolio management
Single project management (EPM)	Temporary: Program and project management	One project: Project management	Methods of EPM: Program and project management

Fig. 7.2 Delimitation of portfolio, program and project management (Dechange & Friedrich, 2013, p. 104)

Multi-project management essentially comprises the following elements:

- Portfolio management including schedule management and cost management,
- Standardisation,
- Resource management,
- Risk management,
- Knowledge management,
- Document management/reporting.

Even though the functions have the same name as the project management elements of single project management, they have a different meaning in single and multi-project management. Against this background, the main differences in the project management elements with the same name are shown in Table 7.2.

Table 7.2 Difference between single and multi-project management according to project management elements

Project management element	MPM	EPM
Schedule management	Only the key dates of the projects and the dependencies between the projects are planned, monitored and controlled	Detailed planning and controlling of the work package dates and their dependencies at project level
Cost management	– Planning and controlling of the total budget of the project portfolio or program – Budget shifts between projects	Planning and control of the budget at work package level and consolidation at project level
Resource management	– Resource requirement calculation and capacity matching at portfolio level for all projects/programs – Creation of solution scenarios in conflict situations	Project-specific at work package level (depending on the level of detail per employee, resource type or competence level)
Risk management	– Planning and controlling of the total project portfolio risk – Consolidation of risks (project, program and project portfolio) due to the dependencies between the projects	– Planning and controlling of project risks – Definition of preventive and corrective measures
Document management/ Reporting	– Overall reports and evaluations – Project overviews (traffic light reports) – Selected individual project reports	– Project application – Project plan – Project status report – Decision templates – Change requests – Final report

7.2 Program Management

Program Management

"Program management is a temporary task with the aim of controlling the assigned projects (including possible subprojects) in such a way that...

- the program is realised within the defined schedule and cost framework with the required quality and performance and to the satisfaction of the customers,
- according to the specifications from the reporting system, the information and results from the projects are available in time for the defined milestones, and
- the interfaces from the projects are coordinated with each other, to optimally utilise the synergies." (Dechange & Friedrich, 2013, p. 113)

Areas of responsibility of the program manager

Analogous to the project leader, the program manager has the decision-making authority to shift start and end dates, budget and resources between the projects. The main areas of responsibility of a program manager are:

- Achieving the program objectives according to the order,
- Representative of the program,
- Leading the program team,
- Budget and resources,
- Matching and utilising synergies of all projects in the program,
- Reporting.

In the dependencies of projects within a program, a distinction can generally be made between a project chain and a project network.

Project chain

In a project chain, the projects are arranged linearly, i.e. the next project can only start when the previous project is finished. The projects have a 1:1 relationship, i.e. each project has a predecessor and a successor—except for the first project, which has no predecessor, and the last project, which has no successor.

Project network

In a project network, the projects can run parallel to each other and also have several predecessors or successors.

Benefits of program management

The main benefit of program management is:

- more effective and efficient planning and control of all projects of a program in coordination and alignment with resource availability,
- higher productivity of the resources and budget used (efficiency),
- reduction of the program's complexity by demonstrating interdependencies between the projects and the activities of the permanent organisation,
- utilisation of synergies and consideration of project-specific dependencies and
- improvement of results (adherence to deadlines, costs and deliverables) through a consistent and overarching risk management and timely reporting on all projects of the program.

Program management has the same phases as the project management of a single project and uses the same methods and tools, which are explained from ► Chap. 2 to ► Chap. 5. The personal and social competencies from ► Chap. 6 are identical.

7.3 Portfolio Management

Project portfolio management is a key component of multi-project management, whose main tasks are the planning and controlling of the project portfolio.

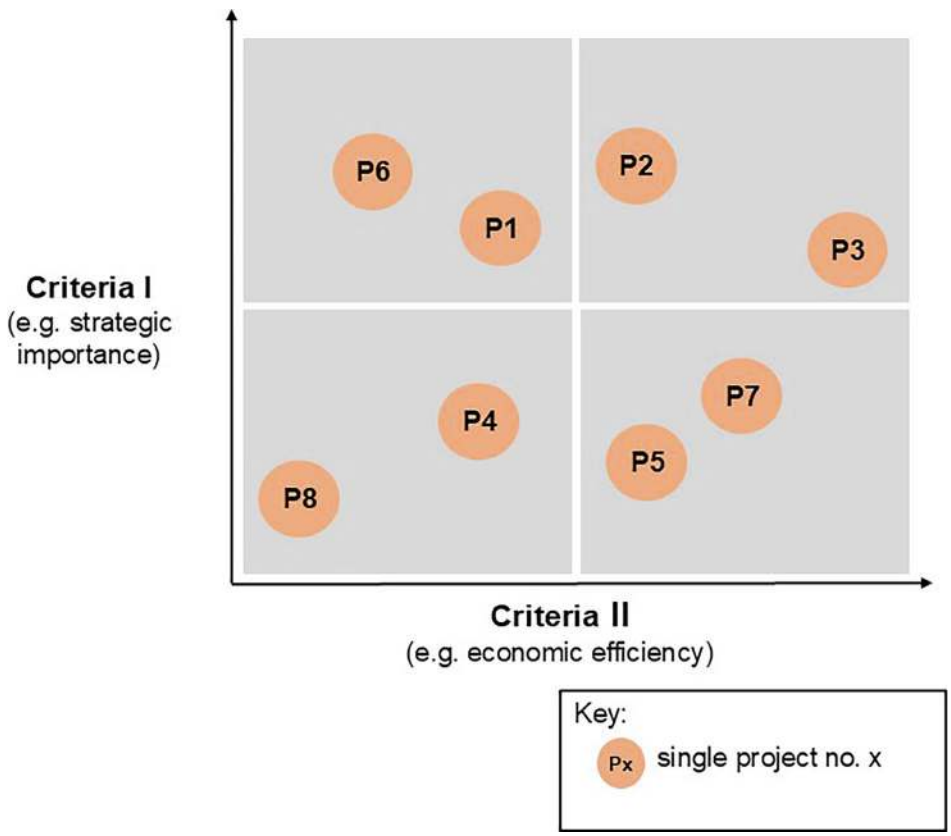
A project portfolio is a kind of *project map,* which shows how "sensible" individual projects are. Its strength lies in the simple and purposeful visualisation of facts and thus serves primarily as a communication tool.

A project portfolio consists of different projects, which are represented and evaluated in a matrix (portfolio) depending on at least two criteria (◘ Fig. 7.3).

Project portfolio management essentially divides into the management phases *preparation, planning* and *controlling*.

The preparation phase aims to define the framework conditions and an initial evaluation.

The planning of the project portfolio focuses on the selection and prioritisation of projects and programs for the imple-



◘ **Fig. 7.3** Example project portfolio mentation of superordinate organisational objectives or company objectives, the assessment of proposed projects as well as the approval, postponement and rejection of project applications and change requests of ongoing projects.

The controlling of the project portfolio includes the continuous monitoring of ongoing projects (project progress, budget, risks, resources, deadlines) from the organisation's perspective as well as the resolution of cross-project conflicts regarding deadlines, resources and budgets.

The three phases with their main tasks are shown in ◘ Fig. 7.4.

Tasks of the preparation phase

The following tasks should be fulfilled during the preparation phase of project portfolio management:

- **Definition of framework conditions**
  - Definition of portfolio objectives (e.g. maximisation of economic efficiency, resource optimisation etc.),
  - Definition of different project portfolios (e.g. internal, external, R&D and/or various OE),
  - Definition of uniform evaluation criteria depending on the portfolio objectives for the different portfolios.

Selection of projects based on the initiation phase of individual project management
- Determination of project worthiness,
- Classification into project classes and project categories,
- Classification into must, should and can projects,
- initial estimation of strategic importance, initial economic and technical estimation (feasibility),
- grouping of projects with the same objective and/or same topics into programs,
- clustering of projects that should be considered together (dependencies, e.g. approval).

Tasks of the planning phase

The project portfolio planning includes:

◘ **Fig. 7.4** Tasks of project portfolio management divided by the phases *preparation, planning* and *controlling*

- **Evaluation**
  - evaluation of the proposed projects based on the project application and the various criteria (economic efficiency, strategic importance, risk etc.) per corresponding project portfolio,
  - re-evaluation of all ongoing projects; the degree of completion of the ongoing projects must be taken into account in the evaluation; mandatory projects are identified,
  - dependencies and risks between the projects are worked out,
  - selection of the projects into “approved”, “stopped”, “postponed” projects.

- **Prioritisation**
  - prioritisation of the approved projects based on the prioritisation criteria (e.g. economic efficiency, strategic importance etc. taking into account dependencies).

- **Balancing**
  - balancing of the various project portfolios taking into account budget and resource availability,
  - adoption of the project portfolios and thus the release of the individual projects,
  - determination and communication of resources and budgets.

Tasks of the controlling phase

The main tasks of project portfolio controlling are:
- collection of the status of the ongoing projects,
- analysis of the individual reports for consistency and impacts on the project portfolio,
- consolidation of the project status reports into a project portfolio report,
- identification, analysis and development of alternative solutions for conflicts,
- re-evaluation of the projects of the project portfolios,
- if necessary, replanning of the project portfolios; in case of significant changes in the framework conditions, the portfolio is replanned in the process step project portfolio planning (optional).

To effectively select, prioritise (multi-project management) and efficiently implement (single project management) projects, projects are classified into project classes, project categories and project priorities during the preparation phase.

The classification pursues the following purpose:

- **Project class (How?)**

Project class

Based on the project class, the procedure model and the evaluation criteria for the selection of projects within the framework of project portfolio planning are determined. The project class is formed from the different types of projects, such as e.g.

- industry of the company (construction, plant construction, IT, pharma etc.),
- location (domestic, foreign),
- content (customer, research, internal, e.g. IT, organisation, marketing, personnel),
- investment phase (study, conception, realisation, relaunch),
- degree of repetition (unique, repeatable),
- customer (internal or external customer).

In practice, the project classes internal projects, external projects and research and development projects are often found.

- **Project category (How much?)**

Project category

The project category determines the necessary qualifications of the project manager, the scope of project management including the methods and tools to be used, as well as the reporting and escalation paths of the project. The project category is usually determined based on the size and complexity of the project.

- **Project priority (In what order?)**

Project priority

The project priority is determined based on the evaluation criteria specific to the project and determines whether and when a project is carried out. The project priority is usually determined based on urgency as well as strategic and economic importance.

Weaknesses without project portfolio management

Without portfolio management, projects in an organisation are usually carried out without official coordination and the following weaknesses often arise:

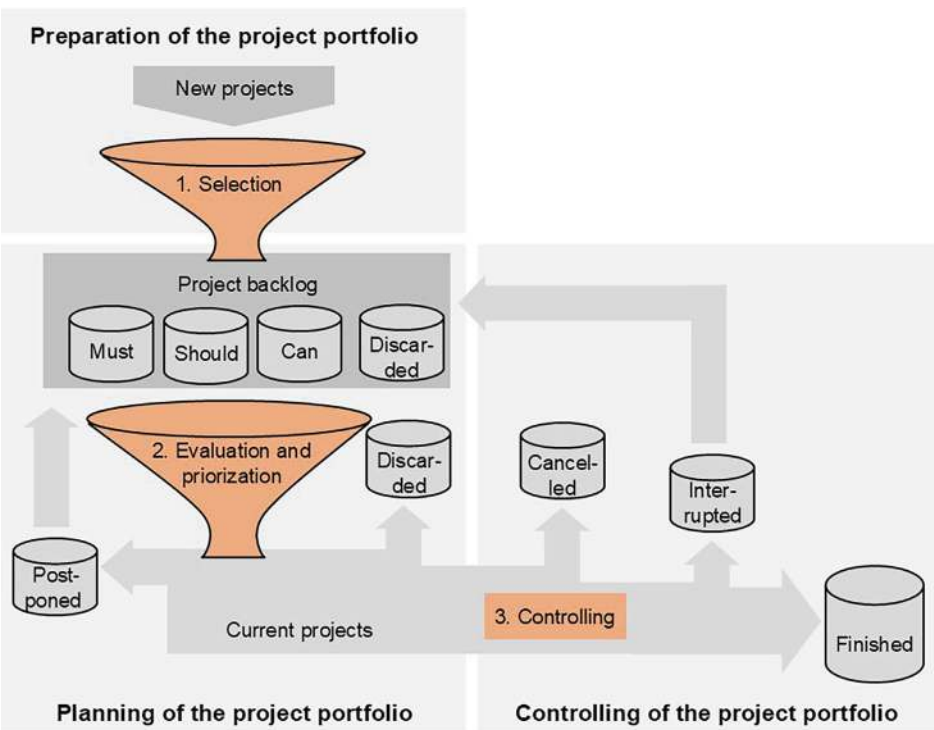
- Some project ideas are not officially identified and implemented, even though they could bring great benefit to the organisation.
- The selection of projects is made at group, department or area level without possibly supporting the objectives of the entire organisation.
- The selection is not transparent, as the selection criteria are not transparent.
- Projects bypass "official channels" (so-called *submarine projects*) or are in the fast lane (departmental egoisms). These projects are then supported by the power of individuals and do not necessarily have to fit the organisation's strategy.

- Project management focuses only on singular project results (no dependencies), leaving synergy potentials undiscovered.
- Influencing factors, such as risk and dependencies between the projects, are neglected.

Thus, portfolio management ensures that all selected projects contribute to the company's success in terms of the chosen portfolio objective (e.g. economic contribution, strategic importance). Moreover, only as many projects are selected as the organisation can handle from a budget and resource perspective. There is improved utilisation of resources and due to the project transparency, decision-making is easily possible.

7.3.1 Process of Project Portfolio Management

Schematically, project portfolio management proceeds in different stages (filter levels), which are embedded in the management phases of preparation, planning and controlling. ◘ Figure 7.5 shows the schematic process of project portfolio management.



◘ **Fig. 7.5** Process of project portfolio management

New projects are selected in the preparation phase.

1. Selection

In the first step of project portfolio management, the projects are evaluated and categorised according to the following criteria:

- **Project worthiness.** The worthiness of the project can also be reviewed again as part of project portfolio management or takes place for the first time at this point.
- Classification into **project classes and project categories.**
- **Type of projects in terms of their importance to the company** (Must-projects, Should-projects, Can-projects, discarded). Must-projects usually have a legal basis, which must be fulfilled or implemented as part of a project. Projects of this category must be carried out. The Should-projects are important projects from an organisational perspective. Here, strategic considerations are usually the basis. The Can-projects are the so-called *Nice-to-have projects*. These projects are usually carried out when there is still money and personnel available.
- **Feasibility.** The feasibility can be determined in advance when creating the project order. Feasibility is usually only applicable to technical projects and requires a greater effort, which is often not feasible during project initiation. For this reason, separate projects are set up to verify feasibility.

2. Evaluation and prioritisation

Criteria for external projects

The selected projects are then prioritised in the second step. Possible criteria are particularly dependent on the type of project client. That is, external projects can be prioritised according to the following criteria:

- Revenue,
- Profit,
- Customer class (e.g. A-, B-, C-customer),
- Risk.

Typical criteria for internal projects are:

- Strategic importance,
- Economic efficiency or efficiency increase (e.g. using the Return on Investment),
- Urgency,
- Risk.

Criteria for internal projects

Risks are assessed and overarching risks are identified.

Subsequently, dependencies should be checked, e.g. whether projects with a lower priority need to be advanced in order to enable dependent projects with a higher priority.

The priority list is balanced in terms of resources.

Feasible scenarios are formed in which ongoing projects with a lower priority are stopped or postponed in order to determine the optimal project portfolio.

The controlling of the ongoing projects includes the regular analysis of the project data from the individual project management as well as the resource situation. Reviews and audits can also be used as a supplement.

The schematic process of controlling the project portfolio and the connection with the planning of the project portfolio is shown in ◘ Fig. 7.5.

In the context of the final project evaluation, there are also a number of criteria in the form of key figures to decide on the quality of a project.

General key figures

Examples of possible key figures for all project classes:

- Comparison of the current planning to the approved planning status (costs, resources, deadlines, risks)
- Comparison of the current degree of completion to the planned degree of completion,
- Punctuality of the projects (proportion of milestones and/or work packages that were completed without time shift),
- Schedule tightness (number of work packages per project that are on the critical path),
- Implementation rate of the work packages (number of work packages that have been completed),
- Error rates in the different development phases,
- Configuration management (number of changes),
- Requirements management (number of changes),
- Employees (turnover rate, absences, satisfaction, overtime),
- Stakeholder satisfaction,
- Overview of external and internal claims etc.

Additional key figures for customer projects could be:

- Customer satisfaction,
- Profit development of the projects,
- Business value contribution of the projects.

7

7.3.2 Selected Methods and Key Figures for Project Evaluation and Prioritisation

In ► Sect. 7.3.1, some criteria for the selection and prioritisation of projects were already mentioned. This section further illustrates the criteria using specific methods and key figures.

■ Economic efficiency analysis

There are numerous methods and key figures for presenting economic efficiency, such as

- Static methods:
  - Cost comparison calculation,
  - Profit comparison calculation,
  - Profitability calculation,
  - Payback calculation;
- Dynamic methods:
  - Net present value method,
  - Annuity method,
  - Internal rate of return method;
- Multidimensional methods:
  - Scoring models or utility analysis,
  - Simulation models,
  - Checklists.

These key figures and methods are not presented here in detail. Please refer to relevant financial literature.

■ Dependency analyses

The topic of *project dependencies* is of great importance in the context of multi-project management. It's not about the significance of a single project for the organisation, but about the dependencies of the projects among each other. There are basically two different types of dependencies.

Active dependency

The active dependency indicates how much other projects depend on this project.

Passive dependency

The passive dependency indicates how much the project depends on other projects.

A dependency analysis is usually carried out using the pairwise comparison method. Each project is compared pairwise with the respective other projects. A table can be used for this, which lists the projects accordingly in rows and columns and then compares the projects pairwise using a numerical evaluation (e.g. 0—no dependency, 1—low dependency, 2—moderate dependency and 3—strong dependency) (◘ Fig. 7.6).

Due to dependencies between the projects, strategically and economically low-rated projects can receive a high priority.

Dependence on	Dependence on				Act. Dep.	Dep. Fac.
	Project 1	Project 2	Project 3	Project 4		
Project 1						
Project 2						
Project 3						
Project 4						
Pas. Dep.						
Dep. Fac.						

Legend:
Act. Dep. – active dependence
Pas. Dep. – passive dependence
Dep. Fac. – dependency factor
Dependence from 0 –3 (not at all depending to strongly depending)

Fig. 7.6 Dependency analysis. Legend: Pas. Dep.—Passive Dependency, Act. Dep.—Active Dependency, Dep. Fac.—Dependency Factor, Dependency from 0 to 3 (not dependent at all to strongly dependent)

Dependencies are given by input/output links of sequentially executed projects, common technical basis, common risks, common resources, common customers and linkage within programs (goals).

The dependencies can also be represented in a matrix or a portfolio and divided into four fields (Fig. 7.7).

- **Critical projects**

Critical projects

Projects in the top right have a high degree of networking. Influences and dependencies are equally high. This increases their complexity and risk.

- **Sucking/Passive projects**

Sucking projects

They are highly dependent on other projects, but themselves have little influence.

- **Radiating/Active projects**

Radiating projects

Projects in the lower right quadrant influence others, but are themselves independent. They therefore receive a high processing priority.

- **Damping/Sluggish projects**

Damping Projects

The lower left quadrant contains projects with a low degree of networking. They are non-critical.

- **Strategic Importance**

The strategic importance of projects can be determined using a utility analysis or scoring table (► Sect. 2.8.4).

Procedure for determining strategic importance

The following procedure is used to evaluate the projects in terms of their strategic importance:

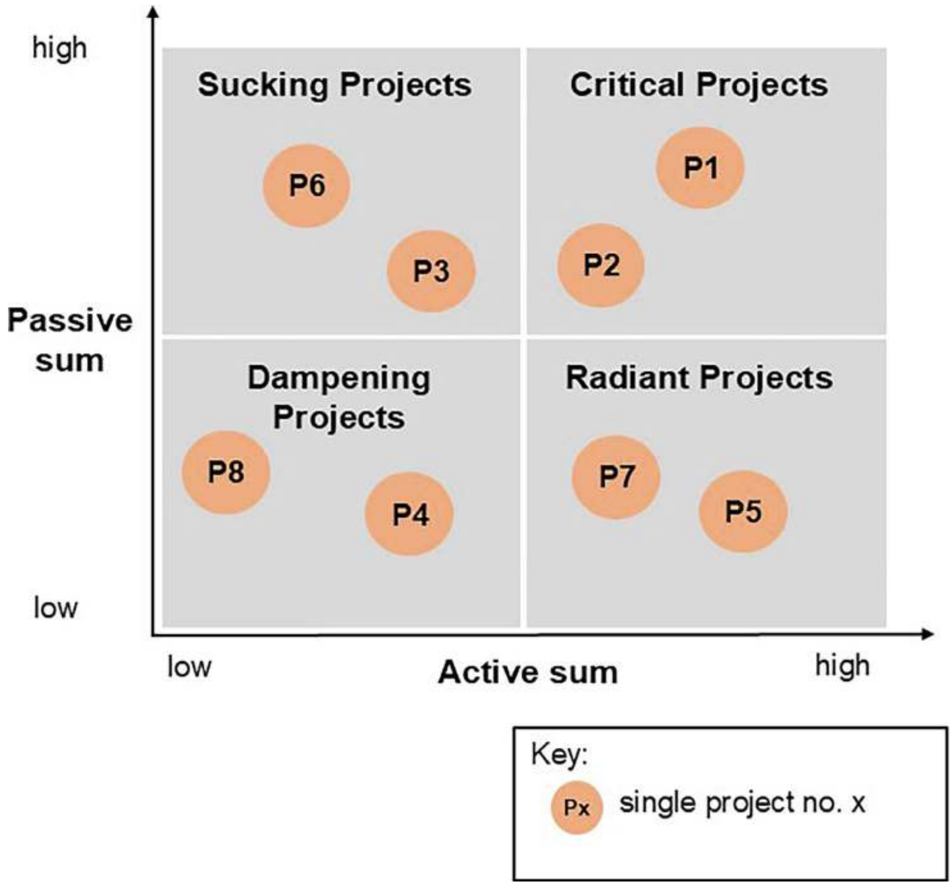


Fig. 7.7 Dependency matrix

1. Definition of strategic objectives,
2. Weighting of strategic objectives,
3. Evaluation of projects according to strategic objective support.

The strategic fulfilment level indicates how much the strategy is supported by the project. Three different strategic fulfilment levels can be determined:

1. Strategic fulfilment level of projects, i.e. that a project supports the strategies,
2. Strategic fulfilment level of portfolio, i.e. that a strategic objective is supported by the project portfolio,
3. Overall strategic fulfilment level, i.e. that the overall strategy is supported by the project portfolio.

The corresponding scoring table is shown in Table 7.3.

The values in Table 7.3 are calculated as follows:

Table 7.3 Scoring table for determining strategic importance

	Strategy 1	Strategy 2	Strategy 3	Strategy 4	Str. Importance	SFL Projects (a)
Weighting	*2*	*3*	*1*	*2*	*Max. 24*	
Project 1	2	0	2	3	12	50%
Project 2	3	2	2	3	20	83%
Project 3	0	1	2	1	7	29%
Project 4	1	1	2	2	11	46%
Total	6	4	8	9	50	
SEG Portfolio (b)	50%	33%	67%	75%		52%

Legend: Str. Importance—Strategic Importance, SFL—Strategic Fulfilment Level

Weighting from 1 to 3 (1—low weight; 2—medium weight; 3—high weight)

Support from 0 to 3 (0—not supportive at all to 3—strongly supportive)

The max. value of strategic importance (here: 24) is calculated from the weightings of the strategies multiplied by the maximum possible value for strategic support (here: 3)

The strategic importance is calculated per project from the evaluation per strategy multiplied by the weighting per strategy, e.g. for the first project $2*2+0*3+2*1+3*2=12$.

The strategic fulfilment level of projects (a) is calculated from the ratio of strategic importance and the max. value of strategic importance, e.g. for project 1 from 12 divided by 24 results in 0.5 or 50%.

The strategic fulfilment level of the portfolio (b) is the ratio of the sum of the individual evaluations per strategy divided by the maximum possible value of the strategy. With four projects with the highest rating of 3, the maximum possible value is 12. This results in e.g. for strategy 1 the strategic fulfilment level of the portfolio to 50% (6 divided by 12).

The overall strategic fulfilment level (c) is the average of the strategic fulfilment levels of the projects. In the example, it has a value of 52%, i.e. the portfolio consisting of the four projects supports the overall strategy (the four strategies) by 52%.

▪ **Urgency**

The issue of urgency also plays a major role in projects. Here, an evaluation can be made using a simple metric, e.g. from

- 0—not urgent at all (no end date),
- 1—low urgency (e.g. completion within the next 2 years),
- 2—urgent (e.g. completion by the end of the year),
- 3—very urgent (e.g. start immediately and completion as quickly as possible)

an evaluation can be made.

▪ **Risk Index**

The risk index from individual project management (► Sect. 3.1.10) can be used to represent the risk strength of a project using a key figure. This key figure can be used when there are strong differences in the risk strength of projects. This in turn has an impact on the order.

7.4 Project Management Office (PMO)

The tasks of multi-project management are often organised in the form of a Project Management Office (PMO). The PMO represents the organisational implementation of multi-project management.

Typical tasks of a PMO are:

- Document management for project-specific documents,
- Management of the project management system (manual, methods, tools, standards, processes, templates etc.),
- Knowledge management (especially Lessons Learned),
- Support in project budgeting,
- Competence development of the project organisation,
- Resource management,
- Project portfolio management,
- Coaching and consulting of the project organisation (e.g. project manager, project team),
- Entrepreneurial decision support through analysed project results,
- Promotion of project culture and project marketing,
- Operational support of the projects, project administration and coordination (Dechange & Lau, 2010, p. 70)

The roles of a PMO are shown in ◘ Fig. 7.8.

▪ **Portfolio Steering Committee**

The Portfolio Steering Committee is the highest approval, escalation, and prioritisation authority of the entire project

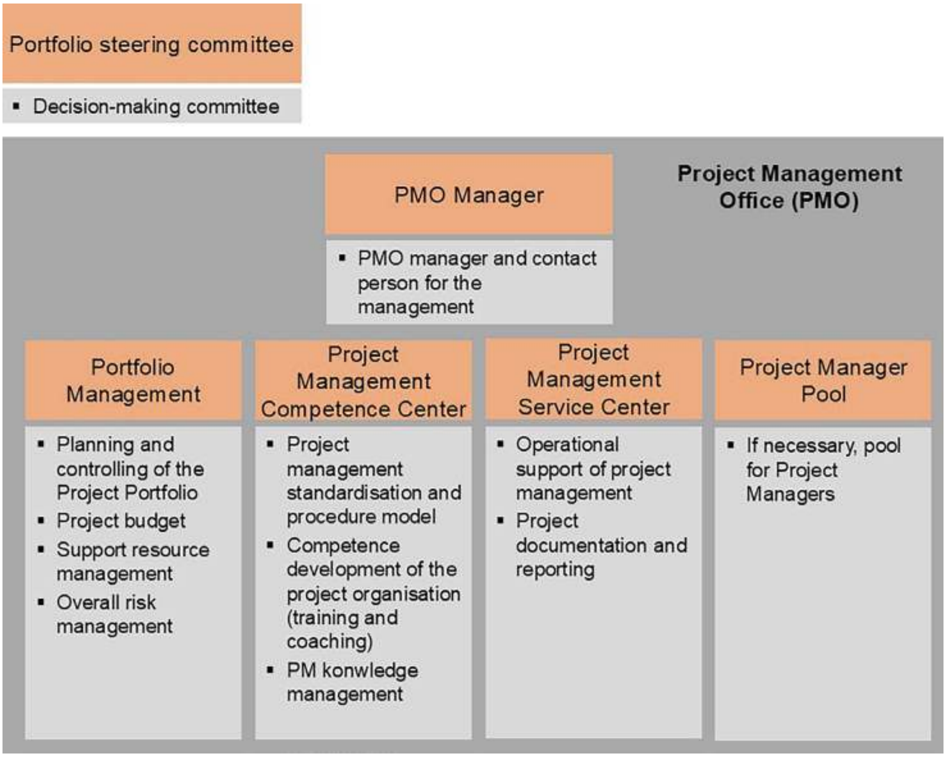


Fig. 7.8 Roles of a PMO

organisation. It is a permanent role within the project portfolio management.

The Portfolio Steering Committee is the central decision-making body for the project portfolio and the approval authority for individual projects and programs. The committee is staffed with the decision-makers affected by the project portfolio. In practice, these are senior management executives.

▪ Portfolio Management

Portfolio management is also a permanent role of project portfolio management and is usually part of a Project Management Office. It takes on the role of a navigator, coordinator and organiser of the entire project landscape and is the central authority for planning, controlling and prioritising the project portfolio.

The project portfolio management is responsible for the implementation and compliance with the strategy and corporate objectives in the projects and programs as well as the application of the agreed criteria for project selection and prioritisation. The project portfolio management prepares the documents for the decision-making process of the Portfolio Steering Committee.

Often within project portfolio management, there is the role of the project controller. They have a consulting service function. The project controller coordinates the project orders, change requests, project status and project completion reports and checks these for formal correctness and completeness. The project controller condenses the information from the individual projects into reports and analyses and monitors the dependencies between the projects. They can also be located in the project management service if there is no separate portfolio management.

- **Project Management Competence Centre**

The Project Management Competence Centre is responsible for the permanent development of project management within the organisation. The competence centre develops and is responsible for the project management approach of the organisation. It is the internal knowledge centre for project management. The Project Management Competence Centre consists of employees with expert knowledge of project management. Furthermore, it has the following tasks:

- Competence development of the project organisation incl. project management training, coaching and consulting,
- Responsibility for the further development of project management, e.g. within the framework of a continuous improvement process and/or the maturity development,
- Development and support of the PM software and PM tools used in the company,
- Development of the project culture.

- **Project Management Service Centre**

The Project Management Service Centre is responsible for the operational support of the employees involved in the project organisation. It is responsible for the technical implementation and availability of the project management methods and tools. The employees master these methods and tools accordingly well and support the project management of a project or program as an individual or in the form of a group role of a so-called *Project Office*.

- **Head of the Project Management Office**

The Head of the Project Management Office has the overall responsibility for project management in an organisation and is the direct manager of the above-mentioned roles in the PMO (except for the project portfolio committee).

7.5 Summary

- **Multi-project management**
- Multi-project management, single project management, program management and portfolio management can be completely distinguished from each other.
- Multi-project management focuses on effectiveness, whereas single project management aims at efficiency.
- Program management essentially uses the methods and tools of single project management.
- Projects within a program can be structured as a project chain or as a project network.
- Project portfolio management consists of the phases *preparation, planning* and *controlling*.
- The main tasks are the selection, evaluation and prioritisation of projects taking into account the budget and resource situation.
- The evaluation of projects is mostly based on economic key figures, dependency analyses, strategic importance of projects, urgencies etc.
- In practice, multi-project management is often organisationally implemented in the form of a Project Management Office.
- The most common roles of a Project Management Office are the Portfolio Steering Committee, Portfolio Management, the Project Management Competence Centre, the Project Management Service Centre and the Project Management Office Leader.

7.6 Review Questions

Multi-project management

1. How can multi-project management, single project management, program management and portfolio management be distinguished from each other? *(Solution ► Sect. 7.1)*
2. What is the difference between program management and single project management? *(Solution ► Sect. 7.2)*
3. What is the purpose and benefit of portfolio management? *(Solution ► Sect. 7.3)*
4. What are the individual steps of portfolio management? *(Solution ► Sect. 7.2)*
5. Which evaluation parameters are useful in the context of portfolio management and why? *(Solution ► Sect. 7.3)*
6. What is a Project Management Office and how can it be structured? *(Solution ► Sect. 7.3)*

8

Summary

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In summary, the methods, tools, and documents relevant to project management are listed again in ◘ Table 8.1.

In addition, all relevant models, approaches, methods and tools of personal and social competence within the framework of project management are summarised in ◘ Table 8.2.

◘ Table 8.2 summarises all relevant models, approaches, methods and instruments of personal and social competence in the context of project management.

◘ **Table 8.1** Overview of the methods and tools of project management

Approach model/Phase	Project management elements	Methods and tools	Reference section
TPM—Initiation	All	– Project Canvas – Delimitation and context analysis – Project order	► Sect. 2.1 ► Sect. 2.7
TPM—Initiation, Planning	Goals	– Goal hierarchy – Goal matrix – SMART rule	► Sect. 2.4
TPM—Initiation, Planning	Environment	Environment register *(Environment tablel - list)*	► Sect. 2.5
TPM—Initiation, Planning	Stakeholder	– Stakeholder register (Stakeholder table/list) – Stakeholder matrix *(Stakeholder Portfolio)*	► Sect. 2.6
TPM—Initiation,	Deliverable	Result plans: – Object structure plan – Requirement list – Specification sheet	► Sect. 3.1.1
TPM—Planning	Work	Project structure plan (phase-oriented, object-oriented or function-oriented)	► Sect. 3.1.3
TPM—Planning	Organisation/ Communication	– Organigram – Role description – Communication plan – Function diagram – Rules of the game	► Sect. 3.1.4
TPM—Planning	Time	– Milestone plan – Schedule – Network plan – Bar chart	► Sect. 3.1.5
TPM—Planning	Resources	– Resource plan – Resource histogram	► Sect. 3.1.6
TPM—Planning	Costs	– Cost plan – Cost trend line – Cumulative cost line	► Sect. 3.1.7

(continued)

Table 8.1 (continued)

Approach model/Phase	Project management elements	Methods and tools	Reference section
TPM—Planning	Risk	– Risk register (Risk list) – Risk matrix *(Risk portfolio)*	► Sect. 3.1.10
TPM—Planning	All	Project plan	► Sect. 3.1.4
TPM—Controlling	Deliverable, Work	Degree of progress (various measurements)	► Sect. 3.2.2.2
TPM—Controlling	Time	Schedule progress, Milestone trend analysis	► Sect. 3.2.2.4
TPM—Controlling	Work, Costs, Time	Earned Value Management	► Sect. 3.2.2.6
TPM—Controlling	Organisation	Social Controlling (Feedback, Flashlight, Mood barometer, etc.)	► Sect. 3.2.2.8
TPM—Controlling	All	Status report	► Sect. 3.2.3
TPM—Conclusion	All	Lessons Learned, Final Report	► Sect. 3.3
APM—Scrum	Organisation	Roles (Product Owner, Scrum Master, Development Team)	► Sect. 4.2.1
APM—Scrum	All	Artefacts (Product Backlog, Sprint Backlog, Product Increment, Impediment Backlog, Taskboard, Burn-down-Chart)	► Sect. 4.2.2
APM—Scrum	All	Scrum Events (Sprint, Sprint Planning, Daily Scrum, Sprint Review, Sprint Retrospective)	► Sect. 4.2.3
APM—Kanban	Work, Time Organisation, Resources,	Kanban Board	► Sect. 4.3

Legend:
TPM—Traditional Project Management
APM—Agile Project Management

Table 8.2 Overview of the models, approaches, methods and instruments of personal and social competences

Competence field	Topic	Models, approaches, methods and instruments	Reference section
Self-Management	Motivation	Maslow's Hierarchy of Needs; Herzberg Two-Factor Theory, intrinsic and extrinsic motivation	▶ Sect. 6.1.3
Self-Management	Organisation and Time Management	Eisenhower Matrix, ABC Analysis, Alps Method, Kanban Light, Pomodoro Technique	▶ Sect. 6.1.4
Self-Management	Health and Stress Management	SOR Model	▶ Sect. 6.1.5
Communication	–	– Types of Communication (verbal, para-verbal, non-verbal) – Perception Phenomena – Sender-Receiver Model – Four-Sides Model of Communication	▶ Sect. 6.2
Leadership	Leadership models	Situational leadership and power bases of leadership: – Legitimacy – Ability to reward – Ability to punish – Identification or role model – Expert knowledge and information	▶ Sect. 6.3.1
Leadership	Leadership concepts	Management-by-concepts: – Management by Objectives – Management by Delegation – Management by Exception – Management by Results	▶ Sect. 6.3.2
Leadership	Leadership styles	Various leadership styles: – Authoritarian leadership style – Consultative leadership style – Cooperative leadership style – Democratic leadership style – Delegative leadership style and emotional leadership	▶ Sect. 6.3.3
Team management	Team composition	Personality and role models: – Belbin role model – Team Management System (TMS) – DISC personality model – Myers-Briggs Type Indicator (MBTI)	▶ Sect. 6.4.2
Team management	Team development	Tuckman's team development model: Forming, Storming, Norming, Performing, Adjourning	▶ Sect. 6.4.3
Conflict management	Conflict resolution	Phase model: Conflict perception, conflict cause, solution search and implementation, solution assurance	▶ Sect. 6.5

Supplementary Information

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