M. Daud Alam · Uwe F. Gühl

Project-Management in Practice

A Guideline and Toolbox for Successful Projects

Springer

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This book is dedicated to Nafisa Alam,
Micha A., our families, and our friendship.

رهرو آن نیست که گه تند و گهی خسته رود
رهرو آنست که آهسته و پیوسته رود

عبدالله انصاری

Foreword

This is an excellent book for everyone who wants to find out more about project management.

Written using the authors' wide-ranging experiences solving real-life problems and their many years training students and lecturing, this book is a well-structured approach, complete with practical steps to facilitate all project management tasks. Each chapter starts with a set of learning objectives and ends with a summary of the relevant findings. In between, you find descriptions of sample problems taken from the automotive and IT sectors as well as content illustrating typical project phases, advice on strategies, practice examples, document templates, checklists to work through, and many well-illustrated solutions and practical tips.

As well as providing an introductory theory on project management, the book also offers the tools readers need to bring their own projects to a successful conclusion. Although an introductory text, more experienced project management practitioners can also benefit from the interesting content, templates, and checklists which will help them to implement their project practices in even more successful ways.

I highly recommend this interesting and neatly constructed book to all beginners who are looking for their first introductory book on project management.

Associate Prof. in Computer Engineering   Arnon Rungsawang
Kasetsart University
Bangkok, Thailand
October 2015

Project management is nothing new. One might even get the idea to ask if the world actually needs another book on the subject of project management.

I believe that the answer to this question is: Absolutely!

Because of the increasingly tough competition and the trend of shortening product cycles, projects in the economy have witnessed major changes. The resources provided (time, money, capacity) have reduced, the participants and stakeholders in a project are spread over different regions around the world, and the desired objectives should be achieved more reliably than ever before.

It is, therefore, essential to know clearly what the expected result of the project is and how it should be measured. A clear structuring into project phases as well as the definition of milestones are required to control the project and its progress. The monitoring or controlling therefore has to focus on the really relevant aspects. The effort to control and the related reporting activities to the budget manager and customer must be in reasonable relation to the effort spent for the functional handling of the project. One way this can be achieved is by being efficient. Another way, which is even more important, is by keeping the people involved in the project motivated.

The goal-oriented monitoring of the progress of the project shows sometimes that the approach chosen was not optimal. Then, on proceeding further, possibly even milestones defined have to at least be questioned and often completely redefined. Addressing and handling of failures or mistakes openly are thus of major importance for the success of a project. The recognition of this situation allows the initiation of steps to analyze the root cause and to modify the project.

Project management today does not only have to cover the necessity of adapting the project to the current boundary conditions in a flexible way anytime, it furthermore has to include measures for the successful achievement of objectives, and all of this in a shorter period of time.

The additional benefit of this book is the practice-oriented approach which provides the project manager flexibly applicable means to manage any project and meet the growing demands successfully.

Director Corporate Audit, Audit Operations, Daimler AG   Dr. Gritt Ahrens
Sindelfingen, Germany
March 2016

Preface

In our daily professional, as well as in our private life, we deal with projects. We work as project managers and impart corresponding knowledge. During our project management training and lectures, for example, at the Chamber of Industry and Commerce Stuttgart, Pforzheim University, at Kasetsart University in Bangkok, Thailand, we noticed that there is a need for a book related to practice that could be used as a toolbox for project management as well.

The objective of this book is not only to introduce the topic in theory but to offer the reader the required tools for practice.

The most important terms and phases of project management are explained following certain standards. The book deals with cross project comprehensive topics and specific contents related to project phases. Tips and hints, examples, templates, and checklists as well as problems and solutions from project practice in the automotive industry and IT complete the contents.

This should enable a good and fast approach to the project management topic, and it should enable the successful execution of the project.

This book is intended for:

- Beginners who would like to acquire initial skills in and understanding of project management
- Participants in further project management training looking for instructional material
- People interested in project management who would like to prepare for their first project in the best possible way
- Project management experts who would like to learn additional aspects and who would like to use templates and checklists for even more successful projects

This book offers the following:

- It is practice oriented.
  This book combines practical experience in projects over many years with relevant theories about project management. This should facilitate the proper use of theoretical knowledge. In addition to extensive explanations concerning relevant topics from project management, practical support is offered in terms of examples, templates, and checklists.

- Examples for methods.
  This book describes methods that could be used in different phases of the project, depending on the prevailing conditions.
- Objectives and results.
  At the beginning of each chapter, the learning targets are listed. At the end of each chapter, the corresponding insights are summarized.

Sindelfingen, Germany   M. Daud Alam
Stuttgart, Germany   Uwe F. Gühl
June 2016

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About the Authors

M. Daud Alam is an economist and was born in 1955 in Herat, Afghanistan. He started his career as a programmer for a subsidiary of Siemens. Before becoming a project leader at the Projektmanagement-Akademie in Stuttgart, he worked as a project manager at the software company Wesser Informatik in Oberaichen. Currently, he is as an IT expert at Daimler AG and holds seminars both in Germany and abroad for MBTech, the Protics Akademie, and the Daimler Bildungsakademie. In addition, he lectures to Daimler AG students at the Baden-Wuerttemberg Cooperative State University (DHBW) and is an assistant lecturer at Pforzheim University in Germany.

Uwe F. Gühl, Dr.-Ing. Dipl. Inform., was born in 1966 in Offenbach am Main, Germany, and works as freelancer in the areas of international on/offshore IT project management, IT quality management, software test management, team building, moderation, research, teaching, coaching, and consulting. After training and working in the field of social security, he studied computer science and did his Ph.D. in mechanical engineering. He has pursued research and worked in companies related to the automotive industry, banking, logistics, and media, as well as in higher education. He has worked in Germany, Switzerland, France, the USA, India, and Thailand.

Introduction

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1

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The significance of project management is growing. Project management activities in the daily working life of an engineer have increased from 9 to 16 % [7, p. 27]. The added value based on projects in small- and medium-sized businesses in Germany is forecast to increase from 2 to 15 % from the year 2007 to 2020 [10]. A US study "Project Manager Staffing Ratios" finds that over a 5-year-period project managers have risen as a percentage of the IT staff. In 2011, project managers made up an average 4.5 % of the IT staff, up from 3.4 % in 2008 [5].

To be able to discuss project management, a common understanding of the basic project management terms is required.

1.1 Definitions

There are diverse project management definitions of different organizations and boards, for example, by the Project Management Institute (PMI) [13], the International Project Management Association (IPMA) [11] with national associations like GPM Deutsche Gesellschaft für Projektmanagement e. V. (GPM) [8], or Deutsches Institut für Normung (DIN) [6].

Additionally, some companies define their own project management standards with a specific project structure and accurately defined project stage names. The terms have been inspected, brought together for easy understanding, and are explained in context, following standards.

Often projects use a special language making the use of a glossary helpful. More information can be found in Sect. 2.3.5. The glossary of this book starts on p. 159.

The basic question to ask is: What is a project?

Project

Following DIN 69901-5 a project is an "intent, characterized by uniqueness of conditions in their totality." A project is distinguished by an aim with temporal, financial, and personnel restrictions [1].

Typically, it is novel and unique and complex and requires a project-specific organization.

Characteristics of a project are:

- Temporal limitation
  There is a beginning and an end.
- Uniqueness
  Typically it is something new.
- Defined objective
  Result could be, for example, a product, a system, or a process.
- Adequate complexity
- Interdivisional
  This is valid for big organizations.
- Limited resources

A project can also be defined as:

- A unique, transient endeavor undertaken to achieve planned objectives [2]
- A temporary endeavor undertaken to create a unique product, service, or result [22]
- An undertaking requiring concerted effort [3]

So, execution of regular work is not a project. Operation of software (and maintenance) is an ongoing task. But if there are releases to be delivered at specific dates, every release, including release planning, preparation, execution, and delivery, could be understood as a project.

The next question to ask is the basic question of this book: What is project management?

Project Management

DIN 69901-5 says: "Project management is the totality of managerial functions, organization, techniques, and instruments to initiate, define, plan, control, and close projects" [1].

Project management covers the coordination of people and the optimal resource management to achieve project objectives.

There are more definitions for "project management" available:

- The planning, delegating, monitoring, and control of all aspects of the project, and the motivation of those involved, to achieve the project objectives within the expected performance targets for time, cost, quality, scope, benefits, and risks [3]
- The complete set of tasks, techniques, and tools applied during project execution [22]
- The application of processes, methods, knowledge, skills, and experience to achieve the project objectives [2]
- The application of knowledge, skills, tools, and techniques to project activities to meet the project requirements [14]

Dr. Martin Barnes, President of the British Association for Project Management (APM) from 2003 to 2012, summarized: "At its most fundamental, project management is about people getting things done."

1.2   Successful Projects

Studies confirm that many IT projects fail and many others exceed time and costs. As shown in Fig. 1.1, the number of successful projects increases from 1994 to 2012 continuously.

But in 2011 the Standish Group changed the definition of "successful." The reason was that even when a project was "on time, on budget, and on target (e.g., scope)," the customer was not always satisfied. So, Standish changed the
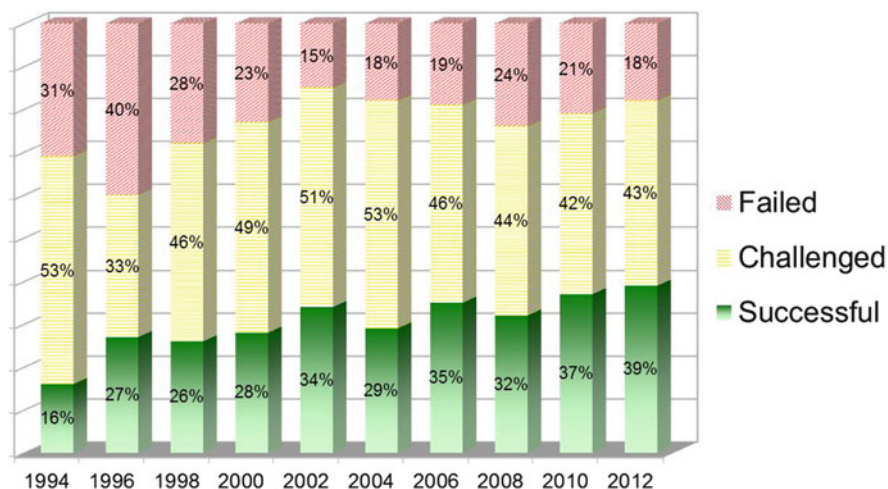
Fig. 1.1 Standish Group—Chaos Report 2013
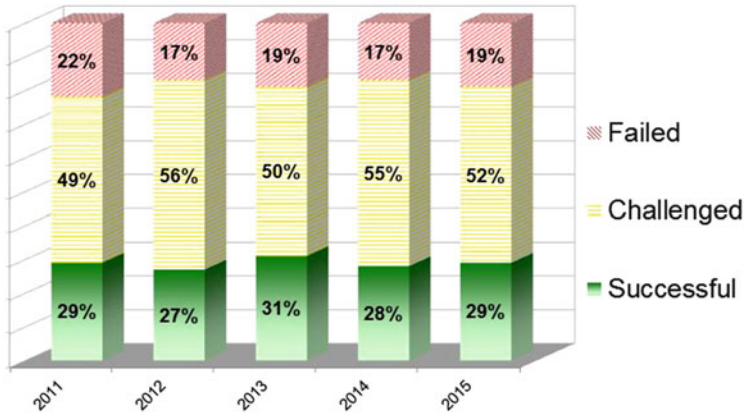
Fig. 1.2 Standish Group—Chaos Report 2015 (following an updated definition of "successful")

definition of "successful" into "on time, on budget with a satisfactory result" to consider customer value [9, 21].

This new definition of successful downgraded the successful rate as shown in Fig. 1.2. In 2012, with the new definition, 27 % of the projects were successful, compared to 39 % following the classic definition. In 2015 there was the following situation [9]:

- Failed
  About 19 % of all projects started in 2015 failed completely.
- Challenged (exceeded time and cost frame)
  Following the Chaos Report, 52 % of the projects in 2015 did at least partially not fulfill the customers' options and requirements.
- Successful (satisfactory result)
  29 % of the projects in 2015 were on time, on budget with a satisfactory result.

Every project manager would like to achieve successful projects. Why are some projects successful, and why do others fail? Success factors in project management are listed in Table 1.1 [20].

These days projects are characterized by focusing on defined target groups, increasing complexity as well as growing expectations, for example, concerning mobile communication and claimed cost-efficiency. Challenging is an increasing international collaboration including onshore, offshore, and nearshore parts,[1] increasing requirements concerning the environment as well as ascending cost and time pressure.

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[1]Onshore = outsourcing in your own country; offshore = any form of services outsourced from one country to another, mainly because of costs; nearshore = like offshore, but relocation within one's own region like Mexico for the USA, and the Eastern part of Europe for European countries.

Table 1.1 Success factors in project management

No.	Success factor	Percent (%)	Link, see
1.	User involvement	15.9	Sect. 2.2
2.	Executive management support	13.9	Sect. 3.1.3, Fig. 2.5
3.	Clear statement of requirements	13.0	Sects. 2.1, 2.3
4.	Proper planning	9.6	Sect. 3.2
5.	Realistic expectations	8.2	Sects. 2.2, 3.1.6, 3.2.8
6.	Smaller project milestones	7.7	Sects. 3.2.4, 3.3.3
7.	Competent staff	7.2	Sects. 2.2, 3.2.6
8.	Ownership	5.3	Sects. 3.1.3, 3.1.6, 3.2.6
9.	Clear vision and objectives	2.9	Sects. 3.1.4, 3.1.6
10.	Hardworking, focused staff	2.4	Sect. 2.2
	Other	13.9	

This book is designed to help complete projects successful. Table 1.1 contains links to sections in this book where the listed success factors are explained.

1.3   Process Models

Different parties developed standards and processes for project management. Below is a selection:

- International standards
  - Guide to the Project Management Body of Knowledge (PMBOK-Guide)
    The PMBOK$^{®}$ is a standard and central reference of the American Project Management Institute (PMI) [13]. Together with the IPMA Competence Baseline and PRINCE2 (see below), it is the leading project management standard in the world.
  - IPMA Competence Baseline (ICB)
    In 2016 the International Project Management Association (IPMA$^{®}$), located in the Netherlands, has more than 60 national member associations. For example, the USA are represented by IPMA$^{®}$ USA [12], Germany is represented by the GPM Deutsche Gesellschaft für Projektmanagement e. V. (GPM) [8]. The IPMA develops and promotes project management and has defined an international project management standard named ICB [11].
  - PRINCE2
    Originally, PRINCE (**Pr**ojects **in C**ontrolled **E**nvironments) was the British Government standard for IT project management. The advanced PRINCE2 has evolved as a de facto standard for project management in Great Britain but is widespread internationally [23]. PRINCE2 defines a project frame that is permanently enhanced using best practice techniques.

- National standards
  As an example for national standards, German project management standards are
  presented here:
  – Deutsche NCB—National Competence Baseline [15]
    The German translation of the ICB (see above) was released in 2008 and
    updated in 2009. The current version 3.0 is the NCB of the IPMA and central
    reference of the GPM.
  – DIN 69900-1 and 69900-2, DIN 69901-1 to 69901-5 [4]
    The project management standard DIN 69900 and DIN 69901 covers funda-
    mentals, descriptions, and terms from the areas of project management and
    network technique.
  – V Model XT [26]
    The V Model XT (German: V-Modell XT) is a project management standard
    concerning the development of IT systems that is mandatory in the public
    sector in Germany. It covers the areas of project management, quality
    assurance, configuration management, system development, and requirements
    concerning the announcement and placing of projects.
- Company-specific standards
  Especially major companies define company-specific project management pro-
  cess models based on standards. Therefore, it should be ensured that company
  projects define coherent boards, use similar processes, and report in a standard-
  ized way. Additionally, projects should be supported efficiently with guidance
  and templates. Examples of company-specific project management process
  models are:
  – ITPM at the BMW Group [16]
  – Houston at the Daimler AG [17]
  – Project Management Excellence at the Siemens AG [19]
- Domain-specific standards
  In IT there are several process models defined for software development, for
  example:
  – Waterfall model
    This is a classic sequential process model that is used in software develop-
    ment even today. Typical phases are analysis, development, implementation,
    testing, and maintenance. Output values of one phase are input values for the
    following phase.
  – V-Model [25]
    This is a project management process for development projects from IT.
    The waterfall model is extended with testing levels. For every development
    activity, there is a corresponding testing activity.
  – Rational Unified Process (RUP) [24]
    The RUP is on the one hand a process model concerning software develop-
    ment, while on the other hand it is a tool of the IBM company. The RUP
    defines four project life cycle phases:
    · Inception
    · Elaboration

- Construction
- Transition

Project execution is organized in workflows, business modeling, requirements engineering, analysis and design, implementation, testing, deployment, configuration and change management, project management, and environment.

– Scrum [18]

Scrum is a framework for an iterative and incremental product development. It is a simple process model with few rules and is based on agile software development. A basic rule is that everything is time boxed. There are three roles defined in Scrum:

- Product owner who focuses on the business goals and who is responsible for the product backlog, especially for prioritization of user stories to be implemented
- Scrum master who is responsible for the processes and who is guiding the team
- Team member who works on the topics to be implemented

Three artifacts are defined:

- Product backlog, containing user stories to be implemented
- Sprint backlog, containing user stories to be implemented during a sprint
- Burndown chart, a graphical representation of the implementation progress of a sprint

Additionally, five activities are the core of Scrum:

- Sprint is the most essential part of Scrum. It is a time box about 2–6 weeks. Goal is to implement a new increment of a product that could be delivered.
- Sprint planning is a meeting at the beginning of a sprint to get an agreement what user stories out of the product backlog should be implemented in the next sprint.
- Daily scrum is a short daily meeting where the team informs about issues and about tasks achieved and planned.
- Sprint review is a meeting where the results of a sprint are presented to the product owner.
- Sprint retrospective is a meeting to learn and to improve future sprints.

These standards help to ensure that projects are executed with a certain quality standard, using a defined process and homogenous documentation. It should be considered that projects are very different in terms of objectives, size, time frame, and scope. Tailoring helps to adapt project process models to specific project needs. Project process models should be helpful for any kind of project.

Indeed, practice shows that defined standards could not be used anytime. For example, in international cooperation projects, different partners could use different project process models, so that it has to be decided which project process model to use or if a compromise needs to be found.

Based on the project experience of the authors, this book identifies comprehensive topics and four project phases. The contents have been aligned with given project management standards.

1.4   Overview

The next two chapters discuss comprehensive topics and project phases.

Chapter 2 explains general topics of the project work. Cross-cutting themes like requirements, project culture, communication, documentation, quality, risk management, and methods are comprehensive. They are related to the entire project life cycle, and not to specific project phases. Project culture may serve as an example: it is important during the complete project duration from the strategy phase to the closure phase.

Chapter 3 refers to the particular project phases, starting with the strategy phase, followed by the planning and implementation phase, and concluding with the closure phase.

Chapter 4 completes the book with an outlook.

In Chap. 5 there are templates that could be used as a project resource.

1.5   Summary

Project management is becoming more and more important in business life. A large number of projects fail, so it makes sense to deal with the topic of project management. Definitions explain the project and project management terms in detail. National and international organizations define project management standards like the PMBOK-Guide or the IPMA Competence Baseline. Beyond that there are company-specific process models and others related to domains.

Problems

1.1 Project

(a) What is a project?
(b) What are the characteristics of a project?

1.2 Success Factors
Name at least three success factors for projects.

References

1. Angermeier, G.: Projektmanagement-Glossar des Projekt Magazins (2016). https://www.projektmagazin.de/glossar/. Checked on 27 June 2016
2. Association for project management (apm): Glossary (2016). https://www.apm.org.uk/glossary. Checked on 27 June 2016
3. Axelos: Best Management Practice portfolio: common glossary of terms and definitions (2012). https://www.axelos.com/glossaries-of-terms. Checked on 27 June 2016
4. Bechler, K.J., Lange, D.: DIN Normen im Projektmanagement. BDU Servicegesellschaft für Unternehmensberater mbH (2005)
5. computereconomics: Project Managers Grow in Importance (2012). http://www.computereconomics.com/article.cfm?id=1719. Checked on 27 June 2016
6. DIN Deutsches Institut für Normung e. V.: Homepage (2016). http://www.din.de. Checked on 27 June 2016
7. Eigner, M., Stelzer, R.: Ein Leitfaden für Product Development und Life Cycle Management. Springer, Berlin, Heidelberg (2009)
8. GPM Deutsche Gesellschaft für Projektmanagement e. V.: Homepage (2016). http://www.gpm-ipma.de. Checked on 27 June 2016
9. Hastie, S., Wojewoda, S.: Standish Group 2015 Chaos Report - Q&A with Jennifer Lynch on Oct 04, 2015 (2015). http://www.infoq.com/articles/standish-chaos-2015. Checked on 27 June 2016
10. Hirschbiegel, K.E.: Die Trends im Projektmanagement - ein Überblick (2014). http://www.tecchannel.de/software/erp/2064194/trends_im_projektmanagement/. Checked on 27 June 2016
11. International Project Management Association (IPMA): Homepage (2016). http://www.ipma.world/. Checked on 27 June 2016
12. IPMA-USA: IPMA-USA Home (2016). http://www.ipma-usa.org/. Checked on 27 June 2016
13. Project Management Institute: Homepage (2016). http://www.pmi.org/. Checked on 27 June 2016
14. Project Management Institute: What is Project Management? (2016). http://www.pmi.org/About-Us/About-Us-What-is-Project-Management.aspx. Checked on 27 June 2016
15. Schmehr, W., Patzak, G., Eysel, D.: ICB - IPMA Competence Baseline Version 3.0 in der Fassung als Deutsche NCB 3.0 National Competence Baseline. GPM Deutsche Gesellschaft für Projektmanagement e.V. (2009). http://www.gpm-ipma.de/fileadmin/user_upload/Qualifizierung___Zertifizierung/Zertifikate_fuer_PM/National_Competence_Baseline_R09_NCB3_V05.pdf. Checked on 27 June 2016
16. Schollerer, M.: Erfolgreiches Projektmanagement auf Basis des Vorgehensmodells "ITPM" der BMW Group. Ausarbeitung im Rahmen der Vorlesung "Juristisches IT-Projektmanagement", LMU München. (2015). http://www.pst.ifi.lmu.de/Lehre/wise-14-15/jur-pm/itpm-ausarb. Checked on 27 June 2016
17. Schüßler Consulting: Houston Projektmanagement und Prince2. (2016). http://www.schuesslerconsulting.de/?page_id=743. Checked on 27 June 2016
18. Schwaber, K., Sutherland, J.: The Scrum Guide (2013). http://www.scrumguides.org/scrum-guide.html. Checked on 27 June 2016
19. Siemens AG, Corporate Technology Office Project-Management: Project Management Excellence (2011). http://www.energy.siemens.com/hq/pool/hq/power-generation/power-plants/power-plant-project-management-excellence.pdf. Checked on 27 June 2016
20. The Standish Group: The Standish Group Report - Chaos. Technical Report, The Standish Group (1995). http://www.projectsmart.co.uk/docs/chaos-report.pdf. Checked on 27 June 2016
21. Weber, E.: Key lessons from Standish's 2015 Chaos Report (2015). http://www.erikweberconsulting.com/blog/chaos2015. Checked on 27 June 2016

22. Wikipedia: Glossary of project management (2016). https://en.wikipedia.org/wiki/Glossary_of_project_management. Checked on 27 June 2016
23. Wikipedia: PRINCE2 (2016). https://en.wikipedia.org/wiki/PRINCE2. Checked on 27 June 2016
24. Wikipedia: Rational Unified Process (2016). https://en.wikipedia.org/wiki/Rational_Unified_Process. Checked on 27 June 2016
25. Wikipedia: V Model (2016). https://en.wikipedia.org/wiki/V-Model. Checked on 27 June 2016
26. Wikipedia: V-Modell (Entwicklungsstandard) (2016). https://de.wikipedia.org/wiki/V-Modell_%28Entwicklungsstandard%29. Checked on 27 June 2016

Comprehensive Topics

2

The objective of this chapter is to give an overview of the crossover topics in project management, independent of project phases.

The following sections discuss requirements, project culture, communication, documentation, quality, risk management, and methods. At the end of this chapter, the reader will have learned about the topics related to all project phases.

2.1   Requirements

If you desire a wise answer, you must ask a reasonable question.
Johann Wolfgang von Goethe (1749–1832)

This section provides an overview of the relationship between projects and requirements. Requirements engineering covers the identification and the management of requirements. Experts who train and certify in this area have contributed to this section [9], and after reading it you should be able to identify requirements and understand how they are managed.

2.1.1   Objective of Requirements Engineering

The aim of requirements engineering is to achieve a common understanding between a principal and a contractor concerning a product or system to be developed [20]. For this purpose the requirements of the rightful stakeholders[1] are identified, analyzed, documented, and validated, preferably to the stage of completion and to a standard of high quality. The goal is to detect and to fix issues as early as possible.

---

[1]A stakeholder is everyone who could influence a project and is concerned by a project or is interested in a project.

2.1.2   Projects and Requirements

Requirements are the basis of expected project results. At the start of a project, it is crucial to identify all requirements concerning the product or system to be developed. Then these requirements have to be aligned with the principal and the stakeholders. Thus, frequently occurring discussions and discrepancies of how to interpret verbalized requirements that are too general can be avoided. Additionally, conflicts and contradictions between several requirements should be identified, and the requests of stakeholders should be clarified. The aim is to achieve unambiguous, solution-independent requirements.

During the course of a project, requirements once registered could change or may be omitted; other requirements may be added. So there is a need, to regularly revise the requirements, to reduce or to extend them on request. They have to be consistent all the time.

> **Requirements Engineering**
> Requirements engineering covers: [14]
>
> - Requirements definition
>   The requirements of the stakeholders have to be identified, documented, and aligned.
> - Requirements management
>   The documented requirements have to be managed and changed in a consistent way if required.

In small projects about 25 % of the requirements change, in large projects up to 50 % [19]. The average rate of change of requirements in software projects is about 2 % per month. Depending on the product context, there is a variance from about 1–4 % [11, p. 372].

Requirements engineering helps to deal with requirements and changes of requirements in a professional way.

2.1.3   Identification of Requirements

To record the requirements, an initial query to get most information from the principal is reasonable. There should be a project order including a project objective; the requests and expectations of the principal should be known.
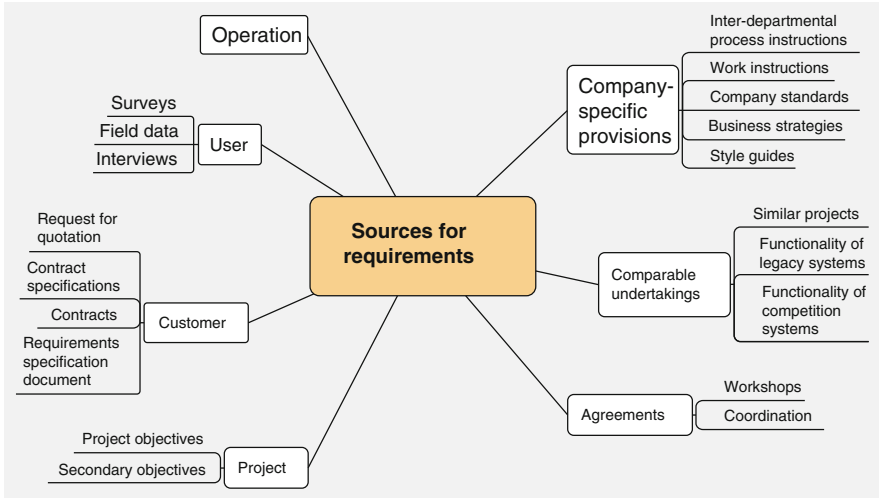
Fig. 2.1   Sources for requirements

In addition to the requirements specified by the project principal, other possible sources should be considered for project requirements (Fig. 2.1):

- Company-specific provisions
  - Interdepartmental process instructions
  - Work instructions
  - Company standards
  - Business strategies
  - Style guides
- Comparable undertakings
  - Similar projects
  - Functionality of legacy systems
  - Functionality of competition systems
- Agreements
  - Workshops
  - Coordination
- Project
  - Project objectives
  - Secondary objectives
- Customer
  - Request for quotation
  - Contract specifications
  - Contracts
  - Tender specification[2]

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[2]See Sect. 3.1.7.

Fig. 2.2 Kano model
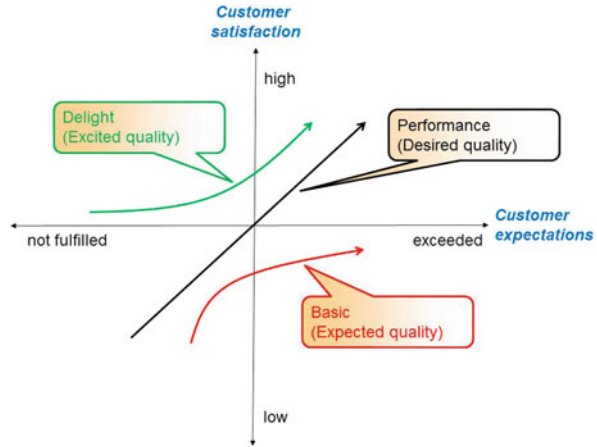
- User
  - Surveys
  - Field data
  - Interviews
- Operation

If the aim of the project is the development of a product or a service, the Kano model as shown in Fig. 2.2 might help in recording requirements.

The Kano model measures customer satisfaction by classifying product features into:

- Basic features
  Implicit expectations of the customer are often not mentioned but taken for granted (e.g., air conditioning in new cars).
- Performance features
  These could be specified and are often distinctive features, if products are comparable (e.g., screen size, resolution, and energy consumption for TVs).
- Delight features
  The "wow effect" is something a customer does not expect and that might contribute to a high customer satisfaction (e.g., user interaction with swipe gestures when introducing smartphones).

Delight features change to basic features in the course of time. For example, in 1978 the highly innovative antilock braking system ABS was deliverable for the Mercedes-Benz S class (type W116), but now ABS is a basic feature of a car. The Kano model teaches that basic features may not be disregarded. Furthermore, it is possible to achieve purposeful delight features, if the particular customer demands are known.

Users or potential customers should always be considered when products or services are being developed. This could be done with surveys, workshops, allocation of prototypes, or participation in testing. Your goal should be to make a person concerned become a person involved. When the project requirements are collected, the documentation of the requirements is needed. This could be done by using natural language or based on a model. At the conclusion the requirements are investigated and synchronized with the stakeholder.

A template to collect requirements can be found on p. 131 of Chap. 5.

2.1.4 Management of Requirements

The management of requirements[3] is a continuous process over the complete project duration. It comprises the following activities:

- Documentation
  Requirements acquire attributes like a name, description, author, criticality, or priority.
- Prioritization
  Prioritization determines the importance and the processing sequence of the requirements. The responsibility of who is prioritizing the requirements depends on the role allocation in the project. Usually, it is the principal but could be delegated to a Change Control Board (CCB) or the project manager.
- Change log
  During the project life cycle, new requirements could be added, and existing requirements could be changed or omitted. The corresponding changes have to be recorded to ensure that all the requirement changes during the course of the project can be understood.
  Then the sources of requirements are known, which stakeholder placed which requirement, and which events or reasons resulted in requirement changes.
- Transparency
  The status of the requirements must be clear for the stakeholders in the project. The stakeholders should have easy access to the requirements.
- Handling changes of requirements
  – Proposals
    In principle, every stakeholder may submit a change request. These should be documented.
  – Analysis
    To be able to evaluate the effort and consequences of a change request, an analysis is required. For this purpose it is recommended that an estimate be made of the expected effort and the opinions of related experts be obtained.

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[3]In the literature occasionally requirements management is used synonymously with requirements engineering.

– Consulting and approval
  A Change Control Board (CCB) as a modification board is responsible for deciding, if change requests are to be accepted, and if so in which priority they should be implemented. The characteristic members of the CCB are the principal, the project manager, the representatives of the client or of the end user, the change manager, and other important stakeholders.

2.2 Project Culture

> If you want to build a ship, don't drum up people to gather wood, divide the work, and give orders. Instead, teach them to yearn for the vast and endless sea.
> *Antoine de Saint-Exupery (1900–1944)*

This section shows the correlation of successful projects with a good project culture. Additionally, it informs how a good working atmosphere can be achieved. There is a close relationship with the domain communication (see Sect. 2.3) and social skills.

Every project develops an individual project culture. It is represented by how the people cooperate in the project, if there is a common understanding concerning project roles, how people deal with failures, which process model is used, and which rules are valid.

Because of globalization the number of international projects is increasing. In international projects, cultural differences should be considered. People from different societies may have different values or religions which have to be respected. A common language should be defined and used.

2.2.1 Objectives of the Project Culture

A good project culture should be achieved, where all team members can strive toward a mutual goal with the best possible conditions. The most important part of the project culture is the respectful and loyal personal interaction in the project.

Project Culture
Following DIN 69901-5 project culture is the "totality of the behavior of the people involved in a project, affected by knowledge, experience, and tradition, and how it is appraised by the project environment." The project culture covers the soft skills in a project, for example:

(continued)

- Identification with the project
- Cooperation within the project and outward
- Fairness and respect
- Ability to communicate
- Ability to manage conflict
- Activity level for the project
- Openness

2.2.2   Outward Effect of a Project

Nothing good happens unless you do it.
Erich Kästner (1899–1974)

A project does not only work for itself. For example, there is a public view for infrastructure projects. For projects in companies, there are departments that are not considered. Often the environment has an influence on a project (compare Sect. 3.1.3); for that reason, a good presentation of the project is recommended.

Below are some tips:

- Look for allies, for instance, inside the organization where the project takes place, who could support the project, for example, as sponsor.
- Make people concerned become people involved. The upcoming tasks could better be solved together.
    - If an end user can participate in a project, it will be easier for that person to accept future changes in the work flow.
    - If the operation is integrated in the development of a software, there will be higher motivation to operate the finished IT product.
  So a selective cooperation is possible.
- Identify possible potentials for conflict or need for action and take corresponding measures.
- Involve the stakeholders in your project, at least with regular information.
- Present results of the project in time and show highlights to interested people who could support your project, e.g., in bilateral conversations.
- Conduct regular events, like a road show or a forum, where exhaustive information about the project is provided. Collect feedback, criticism, or queries, and use them as input.
- Campaign for your project.

The following topics not only help to present a project to the environment but also facilitate the identification of project members with the project:

- Project vision
- Descriptive project name
- Good atmosphere among project members
- Project glossary
- Project logo
- Pair principle
  A project member forms a pair with a person outside the project. For example, with an end user to record requirements and to ask for specialist advice (compare Fig. 2.4).

2.2.3   Inwards Effect of a Project

It is worthier to always be respected by the people than to be admired occasionally.
Jean-Jacques Rousseau (1712–1778)

Something like the most important topic in a project is the responsible and respectful interaction with each other. We work with humans in the project! Good cooperation in the team is the basis for project success.

All project members should be fully in favor of the project and be convinced about the sense of the project. It is a permanent task of the project manager to motivate and to persuade. A good moment to involve all project members is the project kickoff (see Sect. 3.2.9).

An important part of a successful project culture is the responsibility of the individual project members. If the project staff identify themselves with the tasks which they have to solve on their own initiative, then they identify more easily with the overall project. Hence, the project members should be given distinct tasks with measurable goals which should be done independently. In a review working results could be assessed and ideas for future improvement could be developed.

How could project staff be motivated to do good work?

- Define measurable goals to be able to decide when a task is done.
- Prioritize tasks.
- Respect the interests of people when distributing tasks.
  Consider that what a person likes to do is what he will do well.
- Assign well-defined tasks with clear responsibilities.
- Support self-dependent work.
  Do not ask when the task will be done.
  Ask what will be done by a specific date.
- Conflict management.
  Take care that there is a good conflict management. Avoid unnecessary conflicts.
  Assuming, for example, a project member does not want to take on a specific

task. Then it would be better to ask somebody else if they would like to take it on instead of forcing the project member to accept it.
- Ensure the project staff are able to work.
  Unburden the project staff from all efforts that are hindering them, such as avoidable administrative tasks or bureaucratic controls.
- Efficient project meetings.
  Make sure that there are enough but not too many project meetings. Every meeting should have a clear objective that is addressed at the beginning. Only those who can actively contribute should participate.
- Ensure that the given tasks are ambitious.
- Highlight professional perspectives to the project members.
- Inform about the project on a regular basis.
- Eating your own dog food.
  Use programs or tools that have been developed for customers in the project or in the company as well.

Present information about the project and the current status in a prominent way, for example, as a poster with project objectives or project results.

Visualize project rules in meeting rooms on a flip chart. Make sure that there are good working conditions and a good working atmosphere, so that your project staff can work in an optimal way. Examples are:

- Definition of common rules
- Bringing small snacks or buttered pretzel (specialty in Swabia, southwest part of Germany) to meetings
- Offering a fruit bowl
  Here the project members could eat healthy products and discuss and exchange information.
- Project activities like the visit to a cultural event or collective sport activities
- Project breakfast together

2.2.4   Decision Culture

> But at some point you've got to take that leap of faith. First, because even the right decision is wrong if it's made too late. Second, because in most cases there's no such thing as certainty.
> *Lee Iacocca (*1924)*

A project manager has constantly to make decisions. As a rule decisive project managers are successful. But a project manager does not always decide in person; there are dependencies in particular to the principal and to the steering committee. In special situations sometimes a stakeholder will have a wide influence on the project. In addition, the form of the organization (see Sect. 3.2.6) plays a major role concerning the authority of a project manager to decide.

Decisions to be taken because of dependencies are a problem if they are not taken. This situation could disable a project or in the worst case it comes to a standstill, for example, if the budget for a wanted program change has not yet been released. The tests should start, as soon as the program is done—with or without the implemented program change. On the one hand the project manager does not want to take the risk to authorize the changes without a budget acceptance, but on the other hand he does not want to disclaim the program changes. So, he simply waits and the tests are blocked.

Here is a relevant thought concerning a project philosophy: There should be no fear about wrong decisions. It is better to offer an apology than to ask for permission. So, establish a decision culture in your project. This could be achieved with the following measures:

- Empowerment.
  The power of decision-making is delegated to subprojects and work package of responsible persons concerning the area of work. They should act on their own initiative and decide for themselves within their area of responsibility. These work options stimulate the personal responsibility, strengthen the self-confidence of the project members, and make efficient working in the project possible.
- What has been decided will not be discussed again.
  The exception is when new facts become known that have not been considered to date.
- Automatic approval.
  Often important decisions are required but the corresponding people are not available or boards who have the authority to decide do not meet in time.
  In this case—when previously agreed—it could be declared that until the expiration of a deadline, an objection against a decision request is possible. If there is no objection, then a decision is taken even without a separate resolution. This approach ensures that a project is not blocked for days or even weeks because of a missing decision (e.g., the introduction of a specific software tool).
- Decisions taken are documented and are made transparent for all people involved in the project.

2.2.5   Learning in the Project

Two things are necessary for our work: Relentless perseverance and the willingness to throw away something, in which one has invested a lot of time and effort.
Albert Einstein (1879–1955)

Use the capacities in your team to improve in the project; learn all the time on the project! Ensure that knowledge gets shared in your project and that the project members can substitute one another. Avoid an overdependence on several members of the project team. There should not be a bottleneck focused on one person, so that the project fails if this specific person is missing.

Support an open atmosphere where mistakes can be made. Treat mistakes positively:

- Mistakes are legitimate.
  Those who work make mistakes.
- Known mistakes are good—unknown mistakes are not good.
  Known mistakes can be corrected and it is possible to learn from them. It is also possible to take precautions to avoid them occurring again in the future.
- Every mistake that can be fixed now saves subsequent costs and ensures the project's success.
- There should be no blaming, rather working in a solution-oriented manner: How can the mistake be fixed working together?

Establish regular dates to pause for a moment and to discuss with the project staff:

- Where do we stand?
- What went well?
- What could be improved?
- What could we do?

This corresponds to the PDCA cycle with the steps Plan, Do, Control, Act (see Sect. 2.5).

The software development framework Scrum provides retrospectives, where topics are addressed and discussed as to what should be kept or improved. The goal is to establish a culture of continuous improvement and to work better on the project with the implementation of ideas for improvement.

If the project grows dynamically, it is recommended that you introduce a mentor principle, meaning that experienced project members take care of newcomers and accompany them for their first time on the project.

2.2.6 International Projects

As globalization progresses, the cultural aspect in international projects becomes more and more important. If people with different cultural background work together on a project corresponding differences, for instance, concerning values have to be considered. Additionally, linguistic differences are not negligible. The dominant language in international projects is English, but not all members of the project have the same English language level. So, the risk of misunderstanding arises.

In this case it makes sense to execute an intercultural training program to learn about aspects of foreign cultures in an international project and to avoid misunderstandings. Language courses could help to improve communication. Independent from that, respectful treatment is always the right choice.

The internationalization of a project leads naturally to an additional level of complexity because of different languages, cultures, project sizes, and possibly time differences.

2.2.7 Failure

Ever tried. Ever failed. No matter. Try again. Fail again. Fail better.
Samuel Beckett (1906–1989)

A difficult question is how to deal with bad news. If a project fails or is threatening to fail, there is no easy answer that fits any situation. When in doubt, the following rule should apply: Be authentic and frank and accept one's own weaknesses. **Never** blandish your own project. A failure should also be admitted in time.

A responsible management has to be able to understand the current project situation and to take the required decisions. So, in this case one has to talk to the principal or decision-maker. The reasons for why a project is going off the rails have to be named. This offers opportunities for changes or possible improvements to be made.

Instead of criticism and contradiction, one surprisingly often gets help and support. As a matter of principle, an early failure is less expensive than a failure at a later stage.

In this context the corporate culture plays a major role. The more a project environment takes a critical look at failure, i.e., that team members lose reputation, the more stable and self-confident a project manager has to be to admit failure. In the worst case, it leads to very high avoidable costs if a project does not get stopped in time.

2.2.8 Checklist

Figure 2.3 presents a checklist for the project culture.

Checklist project culture

Project name		Project No.	
Responsible			
Version / Date		Status	

Question	Result
1. Is it assured that the project culture will continuously be adapted and improved as and when required?	
2. Is clear, which decisions are taken by the project manager, and which by the project members?	
3. Is it assured that the project members could work on their own responsibility?	
4. Do the project members jointly accept decisions, even if there are single opinions?	
5. Are issues raised and promptly discussed and solved?	
6. Are rules of the game defined, and do all project members follow them?	
7. Is positive or negative criticism jointly accepted to improve?	
8. Is clear, who is supporting whom and who should be asked in case of issues?	

Fig. 2.3 Checklist project culture

2.3   Communication

One cannot not communicate.
Paul Watzlawick (1921–2007)

Communication means the exchange or transfer of information and is essential for projects. That is why only target-oriented cooperation is possible.

It is necessary that information reaches the people involved. So, the key of communication is in its effect, not in its purpose.

2.3.1   Objectives of Communication

The objectives of communication are:

- Coherent transfer of content and ideas, to be able to understand even complex circumstances
- Exchange of different views
- Clarification of interpersonal and objective differences

Good communication in a project leads to the following results (compare to Sect. 2.2 as well):

- Treating others with respect
  Project members listen to each other and let each other speak out.
- Common understanding leading to common action
- Exposing and solving conflicts

> **Communication in the Project**
> Communication in a project stands for information exchange between people involved in a project, especially within the project team, and is a crucial success factor. A communication plan describes who should communicate with whom and how frequently. To be differentiated are verbal and nonverbal communication. Communication difficulties are particularly found in international projects possibly because of cultural differences.

2.3.2   Aspects of Communication

For as long as humans have communicated with each other, they have wanted to be understood. Communication consists of:

- Verbal elements
  This is the linguistic content.
- Nonverbal elements
  This covers facial expressions, body language, and tone of voice.

The nonverbal part of communication extends the language content, for instance, by emotional states as well as by requests and expectations to the conversation partner. The credibility of a statement is mainly indicated by body language and facial expression. Mehrabian and Ferris published in a study concerning presentations in front of groups [13]:

- 55 % of the effects are because of body language like body posture, gesture, and eye contact.
- 38 % of the effects are caused by acoustic impressions like voice and tone.
- 7 % of the effects are because of the content of the presentation.

Concerning communication one must distinguish between:

- Congruent behavior
  Verbal and nonverbal content conform.

- Incongruent behavior
  Verbal and nonverbal content do not conform.
  For example, a project collaborator asserts that he "enjoys" writing the minutes, but his face and gestures show defense and unwillingness. Statement and external behavior do not comply.

The nonverbal part is the much greater portion of the information. A possible conclusion from this fact is if a nonverbal part is felt to be true, the overall information is interpreted as true.

It should be recognized that communication is error-prone. Information could be passed simplified, incomplete, or even incorrectly, which might lead to misunderstandings or rumors. This has to be considered in planning.

Especially challenging in international projects is the consequent use of a common language.

2.3.3 Good Communication

Below are statements about how good communication can be achieved in a project:

- Respect and appreciation
  Respect your dialogue partner and let him achieve.
- Listen actively
  Repeat what you have heard in your own words. Ask when you do not understand something. Ask your dialogue partner to repeat what he has understood.
- Ask open-ended questions
  Open-ended questions show interest in your dialogue partner and make it easy for him to engage in a specific topic.
  For example, "How can we optimize the print?"
- Compliment
  Praising is a particular level of respect: Praise what is concrete and well-founded, for instance, when a project member is strongly involved and has achieved a very good result.
- I-messages
  Reflect clearly your own thoughts and opinions, for example: "I am rather confused by the version you sent." Instead of "You sent the wrong version."
- Address concrete situations/concrete behavior
  No general statements like "You are doing everything wrong," but statements concerning concrete specific facts like "The document you delivered to the customer was empty." Address topics directly and as close in time as possible.
- Stay within the given subject
  Do not digress; try to finalize a discussion on a subject.

2.3.4   Communication as a Task for the Project Manager

> This is the reason why we have two ears and only one mouth, that we may hear more and
> speak less.
> *Zenon, Greek philosopher (about 490–430* BC*)*

From the comments above arises the importance of communication. Efficient information exchange by everyone involved in the project is a significant success factor of the project.

The project manager spends about 90 % of the time in a project in communication [17]. Due to ineffective communication about one-fifth of projects are unsuccessful [16, p. 4].

Tom DeMarco, established project management author and developer of the "structured analysis", wrote: "The business we are in is more sociological than technological, more dependent on workers' abilities to communicate with each other than their abilities to communicate with machines" [5].

Michael Campbell interviewed about 500 project managers. The most important success factor mentioned was communication. Concerning failed projects, poor communication was always identified as a critical factor [3].

So, communication is a (if not the) key to project success. A project manager needs to stay on the ball. He has to have an overview of his project. He has always to know what is going on. To make this happen, a good project culture and good communication are required:

- Be open minded.
  You should always have an open ear for your project staff. Hold personal talks, ask about progress and problems in the project, but ask about their personal situation as well: "How are you?"
- Always be approachable.
  Make sure that people can get in contact with you easily. Offer dates when you are reachable by all means. If the locality permits, the place of work should be chosen directly in the project team, right in the center of the workplace so that you are not left out.
- Set a good example.
  Understand that your behavior as a project manager serves as a role model for the project staff and is a major part in the visibility of the project to the outside world.
- Promote team building with the pair principle.
  Create pairs in your teams. For example, one person is working while another person is reviewing. Mentors take care of new project members. This makes sense as well in communicating to the outside of a project, such as pairing of project members with technical experts or end users. Do regularly combine different pairs. Figure 2.4 presents schematically the pair principle.
- Create a calm atmosphere as well.
  Excessive or permanent communication is not always good. About 15 minutes
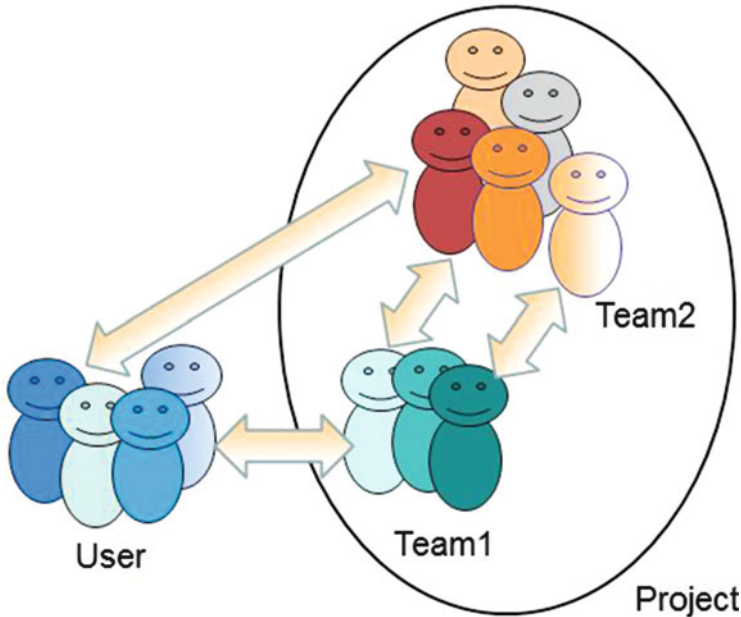
Fig. 2.4 Pair principle

are required to delve into a complex subject. Disruptions at quarter-hourly intervals ensure that there is no productivity. Separate workrooms and measures like working days without meetings or allowing people to work at home might help.

- Take an active part in improving communication.
  It is possible to improve communication through a positive attitude toward the project and empathy and appreciation for all project participants. Increasing the quality of communication means increasing the quality of collaboration in the project. Set rules if required.
- Create a positive mood in the project.
  Good manners, consequent behavior, and open, transparent communication make for a comfortable, productive atmosphere.
- Talk directly to people.
  Engage in a personal conversation instead of doing a status check by e-mail or using written status reports only. Use tools like e-mail consciously. Prevent "mail ping pong" in sending e-mails with endless back-and-forth replies. Generally such mails consume a lot of time and are not really contributing to finding a solution.
  Try to streamline things. Thus, an e-mail with "Could we meet at 10:00 a.m.?" should be changed into "Could we meet at 10:00 a.m.? If not, please suggest two alternative times that would be fine for you." In more complicated cases, pick

up the phone or even better meet the person at his desk. If something has been discussed personally, the results could be summarized separately in an e-mail.

- Conduct regular meetings.
  Use meetings so that project members can be heard. Important topics are the current status and risks to the project. Send out an agenda in advance including a time schedule and keep to it during the meeting. Offer the opportunity to discuss additional points only at the end of a meeting.
- Communicate in a clear way.
  If there are tasks, they should be rightly assigned. Who is doing what until when? Choose a project member who is qualified and address the topic directly to him and do not say: "Somebody should . . ."
  As this behavior would keep tasks open, demonstrate decision problems, delay problem-solving, and make work discouraging.

Successful projects characteristically offer many opportunities for the project team to communicate and to become informed. Sometimes it makes sense to not always use the hierarchy but to also use direct contacts via cross connections.

Bring people together and pass on information effectively. Get project members to talk to each other. Provide opportunities to communicate, such as a snack corner or coffee machine in a social room. Knowledge grows when it is shared!

On the one hand, it should be assured that the project manager specifically informs (see Sect. 2.3.6). On the other hand, various means of communication within the team should be enabled.

Based on the comments above, it is clear that it makes sense for a project team to work together in one place. There should be no spatial separation.

If the project is distributed over different sites, a temporary solution with regular meetings might help. For example, the project team meets one week at one location every two weeks.

2.3.5 Glossary

Differences in understanding of terms can generate conflict in a project. Specific glossaries are available for organizations and domains to facilitate communication and collaboration. For instance, the IEEE publishes a glossary of standard terms in software development [8], and ISTQB publishes one for software testing terms [10].

Also for projects it is recommended to introduce a glossary that defines all project-related terms. There should be only one glossary and a clear responsibility. It should be updated frequently and be accessible for all project members (see also [14]). A glossary additionally helps in handling the requirements (Sect. 2.1).

2.3.6   Communication Plan

Synonym for a communication plan is *communication model*. The internal and external communication of a project should be planned and arranged. Therefore, it serves as the communication plan. The communication plan specifies who should receive which kind of information and when as well as how information is to be made accessible to the project staff. Moreover, it defines the escalation process that takes effect in case of conflicts in the project.

Example: communication of decisions of the steering committee with publication of the minutes at a specific location, best with a search option.

The communication plan should be written as early as possible in the project and should cover the planned communication with every stakeholder. Figure 2.5 presents a communication plan with hints. The corresponding template is available in Chap. 5 on p. 134.

The communication plan is based on the environmental analysis (see Sect. 3.1.3) and related to the project organization (see Sect. 3.2.6). Transparency in the project is a success factor, if every project member can access fast and easily the relevant information he requires. Ideally the access to this information is documented in the project handbook (see Sect. 2.4.6).

The following are some thoughts concerning the communication plan:

- Meetings with the principal
  Arrange with the principal routine discussions.
- Steering committee meetings
  There should be regular steering committee meetings. A rule of thumb is an interval of 2 months but this depends on the size and duration of the project.
- Project meetings
  Consider in your communication plan regular communication with your project team, typically at least once a week. For larger projects there should be separate meetings of the core team and the project team, where the project team meets less.
- Bidirectional communication
  Try to talk regularly and personally with every project member.
- Other meetings
  Depending on the nature of the project, there might be regular thematic meetings required.
- External communication
  Depending on the project, "external" may be different meanings. It could mean the organization around the project in a large company. In a public project it could refer to the population. Options for a communication strategy are:
  – Frequent communication with sponsors.
  – Project forum: topics from the project will be presented to interested colleagues in the company once a month.

Communication plan

Project name	*<Name of project>*		Project No.	*<Number of project>*
Project manager	*<Name of project manager>*			
Version / Date	*<0.1 / Day.Month.Year>*		**Status**	*<initiated, in progress, done, cancelled>*
Author	*<Name of author>*			

Kind of communication	Who/ With whom	Purpose	Frequency	Comments
<Principal meetings>	*<Principal>*	*<Update, critical issues, approval requests>*	*<Biweekly, on request>*	*<Comments>*
<Project board meetings>	*<Project board>*	*<Status, approval requests>*	*<Every two months>*	*<Comments>*
<Project meetings>	*<Project members>*	*<Status, critical issues, risks>*	*<Weekly>*	*<Comments>*
<Core project meetings>	*<Core project members>*	*<Status, next steps, issues>*	*<Daily>*	*<Comments>*
<Status report>	*<Principal, project board, project members>*	*<General information>*	*<Monthly>*	*<Comments>*

Fig. 2.5 Template communication plan with hints

Furthermore, informal communication should not be underestimated. Project critical communication is not necessarily made in corresponding planned meetings.

2.3.7 Project Meetings

Project meetings offer opportunities, but risks as well. The chances are to inform and to motivate participants, to collect good ideas, and to work productively, to advance the project. The risks are that there is a loss of valuable time because of inefficient meetings and that clear results are missing and not claimed.

The following points should be considered concerning the planning and execution of meetings:

- Definition of the right participants
- Planning an agenda with items including specific times
  Distinguish between:
  – Information
  – Discussion
  – Decision requests/decisions
  Discuss the items of the agenda with the corresponding people in advance. Consider the time difference for international meetings.
- Sending out the invitation in time including the agenda
  Depending on the topic and attendees „"in time" could be several weeks or some days. The more important the topic and the more extensive the preparatory tasks of the participants, the earlier the invitation should be sent out. It is possible to send out a placeholder invitation first and to deliver details later. The agenda should be part of the invitation so the invitees can decide if they will participate and prepare if necessary.
- Definition of a moderator
  Meetings with a big number of participants should be moderated. This is the more appropriate the more complex the topic and the more different the interests of the participants are.
- Definition of a minutes taker
  A minutes taker takes some of the load off the project manager, especially in larger meetings. The role could be assigned at the beginning of the meeting. It is possible to assign the role to a different person every meeting.
- Keeping the timetable
  During the meeting the specified times should be kept. This is one of the responsibilities of the moderator. In exceptional cases topics could be moved or extended at the expense of other topics. This should be decided purposefully and not happen at random.
- Documentation of decisions and tasks
  Consider: Without minutes a meeting did not take place. The minutes taker should record already during the meeting. If possible, the last activity of the

meeting should be to jointly go through the minutes. This saves time and effort for subsequent corrections because of misunderstandings or forgotten points.
• Definition of rules
  In general it makes sense to define rules for project meetings, especially when there are issues already, such as participants coming late.

Best practice in taking minutes is the use of a task list. Results of project meetings are information, decisions, and typically different tasks. Note these tasks in a task list, each task with the person responsible and due date, by when the task should be done. If carefully maintained and regularly updated, the task list gives an overview of all the outstanding topics in the project. Such a task list could be used as the basis for project meetings to discuss the current status, to check results, and to approve them. Chapter 5 offers templates for a task list (p. 130) and for minutes (p. 135).

Figure 2.6 displays a minutes template with hints. Tip: If there is a discussion at a meeting about complex topics, different alternative solutions, etc., it is advisable to attach corresponding documents with the minutes.

2.3.8   Means of Communication

Utilize unusual communication tools to promote your project. Use marketing techniques to convince people about your project and remember there are never enough supporters of your project. There should be no limit to your fantasy. Examples:

• Conferences,[4] specialist meetings, support of technical groups
• Flyer
• Poster
• Advertising media like cups, pens, bottle opener, writing pads, t-shirts
• Performances

2.4   Documentation

What you have in black and white, you can take home with confidence.
Johann Wolfgang von Goethe (1749–1832)

This section discusses documentation during the course of a project. Not considered is the documentation of the project results, such as a user manual for a software product.

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[4]Consider that sensitive contents may not be published in general. Often corresponding written authorizations are required.

Minutes

Project name	*<Name of project>*	Project No.	*<Number of project>*
Location	*<Location of meeting>*	Date	*<Day.Month.Year>*
Minute taker	*<Name of minute taker>*	Version	*<0.1>*
Topic	*<Topic of meeting>*		

Attendees	*<Att1 Name, department, mail, phone>*
	<Att2 Name, department, mail, phone>
	…
	<Attn Name, department, mail, phone>
Distribution list	*<Dis1 Name, department, mail, phone>*
	<Dis2 Name, department, mail, phone>
	…
	<Disn Name, department, mail, phone>

No.	(A)ction Item (D)ecision (I)nformation	Description	Responsible	Due date
<1>	*<A>*	*<Description of action item>*	*<Name>*	*<dd.mm.yy>*
<2>	*<D>*	*<Decision taken concerning specific topic>*	*<Name>*	*<dd.mm.yy>*
<3>	*<I>*	*<Description of topic to inform about>*	*<Name>*	*<dd.mm.yy>*

Fig. 2.6   Template minutes with hints

2.4.1 Objectives of Documentation

The objectives of documentation are:

- Presentation of project results
  . . . namely, for the principal as well as for the project team.
- Presentation of the current status of the project
  . . . with ongoing documentation of the status of all work packages and tasks.
- Traceability and measurability
  . . . to be able to answer questions like:
  – What has been decided, approved, and discussed?
  – How much budget has been expended for which tasks?
  – What has been achieved with what effort?
- Increasing the quality
  When documenting the facts of a case, one looks deep into the subject and as a result the quality improves automatically.

Non-goals of the documentation are:

- Documentation as an end in itself
  Something should not be documented without reason because then documentation becomes too expensive. It is important to document only what is really needed. Who is the audience for which document? Costs and benefits have to be balanced.
- Only formal completion of documentation criteria
  One should not be satisfied only because specific documents are present. The presence of a document is not sufficient as a criterion for success; more important is the corresponding content. It is wrong to assume that a degree of quality has been achieved simply because all related documents have been created.

Project Documentation
Following DIN 69901 the project documentation covers the "compilation of selected substantial data concerning configuration, organization, resources, approaches, schedule, and aims achieved of the project."
Parts of project documentation include:

- Initial situation and problem description
- Exposure of the course of the project (e.g., project reports)
- Description of the solution approach being applied

(continued)

- Project costs
- Realized benefits
- Project closure report (PCR)

The project documentation is often managed with a digital project handbook.

2.4.2 Reasons

Why is project documentation important?

- Documented decisions prevent repetitive discussions and give much more reliability to the project.
- Prompt documentation saves a lot of trouble. Discussions and contradictions can be prevented if tasks are explicitly assigned or approved, responsibility for the tasks assigned, the conditions that apply, and so forth.
- Documentation is required in some projects because of statutory liability and/or warranty obligations.
- Quality management norms like the ISO 9000 standard series require corresponding documentation.

The project documentation is the basis for the following topics:

- Openness
  A general accessible documentation results in transparency for all project participants and facilitates traceability, for example, concerning decisions taken in the project. Openness leads to:
  – Better communication among the team
  – An improved general atmosphere in the project (which avoids the formation of small groups)
  – Better party presentation
  Hint: Some access restrictions for specific documents are well justified. Financial aspects should not be known by every project member. In general, restricted access should prevent unauthorized copies from being made and passed on to third parties. This applies, for instance, to military projects and strategic projects of importance for security and the future.
- Learning organization
  Documentation can support the idea of a learning organization:
  – Building on strengths
  – Learning from criticism
  Note, however, documentation of a lessons-learned workshop does not automatically mean that the identified measures are being implemented and acted upon.

- Plan optimization
  - Plan optimization for current project
    Well-grounded actual values could be used to adapt the plan. In addition, they facilitate additional estimation for new scope.
  - Plan optimization for follow-up projects in the company
    The experience base in the organization for future projects broadens with actual values.

2.4.3 Requirements

Requirements for documentation are:

- Everybody in the project has an overview of the documentation.
- Standards are set or offered, for instance, in the form of templates.
- Tasks, ideas, decisions, and minutes of working sessions/regular communication are accessible at a certain place.
- A person is responsible to take care of the documentation or, preferably, take care of the quality of documentation.
- Company-wide standards are considered, such as corporate identity, style guides, particular fonts, or templates specific to the company.

The project documentation should be centrally accessible. In an IT infrastructure, this could be:

- Common project drive
- Common internet or intranet presence
- Content management system
- Document management system

2.4.4 Scope

The scope of documentation depends on the kind and size of the project. If, for example, there is a work breakdown structure available in the project with work packages, then the documentation of the work packages is the basis for the documentation in the project. It covers minutes, status reports, and the final documentation.

Finally, for the project closure all project-related documents are needed. Based on the expectations concerning the project closure report (PCR), all the documents that are required during the course of a project should be identified.

Using a checklist can help ensure that they are created and finalized in time during the project. An example is shown in Fig. 2.7. This example can be extended with additional columns for responsible persons and due dates.

The next subsections discuss exemplary project documents.

No.	Document	Project area	File path	Originator / Supplier	Document status
1	Project order	Project management	Server1/Project/Project-order	Principal	Approved
2	Project profile	Project management	Server1/Project/Project-profile	Project manager	In progress
3	Project handbook	Project management	Server1/Project/Project-handbook	Project manager	In progress
4	Tender specification	Project management	Server1/Project/Specification	Project manager	Approved
5	Performance specification	Project management	Server1/Project/Specification	Supplier	Approved
6	Project plan	Project management	Server1/Project/Plan	Project manager	In progress
7	WP status reports	Work package	Server1/Project/WP/Status	WP responsible	In progress
8	Project status reports	Project management	Server1/Project/Status	Project manager	In progress
9	WP minutes	Work package	Server1/Project/WP/Minutes	WP responsible	In progress
10	Project minutes	Project office	Server1/Project/Minutes	Project office	In progress
11	Decisions	Project office	Server1/Project/Minutes	Project office	In progress
12	Acceptance protocol	Project management	Server1/Project/Acceptance	Principal	Initiated
13	Project closure report	Project management	Server1/Project/Closure	Project manager	Open

Fig. 2.7 Example for a project document overview

2.4.5 Project Profile

A synonym for project profile is *one pager*. A project profile is typically a short summary of a project, presented on one page. It should include the most important facts about the project and serve as an overview, e.g., as the foundation of information for the project kickoff. Moreover, it can be used for general presentation purposes or to present the project progress with the most important project status information.

Figure 2.8 displays a project profile with hints. The corresponding template is in Chap. 5 on p. 129.

2.4.6 Project Handbook

A synonym for project handbook is *project manual*. A project handbook makes sense especially in larger projects. It contains fundamental project information as well as contact persons and the project organization. Beyond that it describes the processes, project details, and the results of the project planning phase. Typically, the responsibility to create and to maintain a project handbook is with the project office. Contents, scope, time lines, and relating milestones should regularly be discussed with the project manager.

Nowadays, the project handbook is organized as a digital project file, either as a whole document or structured in a folder, database, or document management system.

Project profile

Project name	*<Name of project>*	Project No.	*<Number of project>*
Principal	*<Name of principal>*		
Project manager	*<Name of project manager>*		
Version / Date	*<0.1 / Day.Month.Year>*	Status	*<initiated, in progress, done, cancelled>*

Steering Committee	*<NN 1, NN 2, ... , NN 7>*		
Project team	*<NN 1, NN 2, ... , NN 7>*		
Stakeholder	*<Anyone who affects or is affected by the project>*		
Supplier	*<Anyone to support the project on request by order, e.g. external companies>*		
Project start	*<Day.Month.Year>*	Project end	*<Day.Month.Year>*
Objectives	*<Aim of the project>*		
Project scope	*<What has to be delivered by the project?>*		
Milestones	*<What are the most important milestones in the project?>* *<Milestone 1> <Day.Month.Year> <Headline>*		
Terms of payment	*<When will which payments be done?>*		

_____   _____   _____

City, date   Principal   Project manager

Fig. 2.8 Template project profile with hints

The following topics could be covered by a project handbook:

1. Introduction, initial situation, and strategy
2. Short description of the project and management summary
3. Contact persons, project organization, and project environment
4. Task descriptions and responsibilities of the project team members
5. Time schedule, particularly milestones
6. Methods and tools to plan and to control the project
7. Overview of the project documentation and project files
8. A defined reporting system specifying when something has to be reported, to whom, and in what detail; additionally when and to what extent status meetings and reviews will be conducted
9. Definition of communication rules, where and what information will be provided
10. Description of customer responsibilities and provisions
11. Internal procedures and guidelines (quality assurance, processes, escalation, allocation, and so on)
12. Tools used
13. Attachments: contact data, plans, change requests, etc.

During the realization phase, the project handbook should be updated regularly, so that it always represents the current status of the project. A template for a project handbook is available in Chap. 5 on p. 132.

2.5   Quality

> A man who has committed a mistake and does not correct it, is committing another mistake.
> *Confucius (probably 551–479* BC*)*

This section deals with the topic of project quality. After reading this section, you should have a clearer idea into the background and possibilities for increasing project quality.

2.5.1   Quality Objectives

The goal is to ensure the quality in the project (management) itself.

Quality in Project Management
The originally semantic meaning of quality is: absolute characteristic of an entity (Latin, qualis = "what kind of a"). Quality in the sense of quality

management is the result of a comparison between quality requirements and
the true nature of an entity related to a specific grade.

Focus is the quality of the functional project contents. Quality management
(QM) ensures that the deliverables meet the objectives of the project. Essential
tasks are:

- Checking and ensuring that a project fulfills the corresponding specifica-
  tions
- Using of defined methods as well as examining and ensuring standards in
  the project
- Testing of work results

The PMBOK Guide 5 [15] lists three processes concerning project quality
management:

- Quality planning
- Quality assurance
- Quality control

2.5.2   Procedure

How can quality be achieved and ensured?

- Definition of the role of quality management
  The quality manager role is defined based on quality requirements and adequate
  quality processes. These quality processes are communicated and checked
  for compliance, and appropriate actions are initiated accordingly. The quality
  manager is responsible for the creation and maintenance of the quality guidelines.
- Development of a learning organization
  A learning organization has the aim of constantly improving and thereby
  achieving a higher quality:
  - Quality from inside out
    Quality requirements will be fulfilled if there is a corresponding will by the
    project team and in particular by the project manager.
    The more importance that the company places on quality, the higher the
    quality standard will be experienced in the project.
  - Building quality into a product
    You cannot test quality into a product.
  - Understanding quality in the sense of "comply with needs," not in the sense
    of "comply with formalities."
  - Concerning a quality guideline, there should be a balance between cost and
    benefit.

- Dealing with problems where they occur
  The Genba principle[5] (Japanese term meaning "the real place") recommends dealing with problems locally, where the real action takes place. It is assumed that problems can be better understood and that corresponding ideas for improvement will be developed best in place. The proceeding could be summarized as:
  – What should happen?
  – What happens?
  – Explain!
- Continuous improvement
  The idea is to introduce and to support a continuous process of improvement. It has been proved that the PDCA cycle following Deming [6] works:
  – Plan—develop measures to improve the quality
  – Do—implement the developed measures
  – Check—check and assess the measures
  – Act—take measures in case
  This can be achieved in projects with:
  – Daily status meetings (see Sect. 3.3.5),
  – Periodic retrospectives (see Sect. 2.2.5)
  – Lessons learned (see Sect. 3.4.3).
- Consolidation with project partners/suppliers
  It increases the quality if project partners are involved, e.g., with presentation of working results or by participating in reviews.
- Reviews
  Reviews have proven their worth as an efficient quality activity. They should be executed especially at phase transitions when deliverables are requested. Recipients of working results should be involved in reviews. There are different forms of review, such as an informal review, technical review, walk through, and inspection [10]. Bear in mind the KISS principle (**K**eep **i**t **s**hort and **s**imple): It is recommended that the review processes should be done as easily and comprehensibly as possible considering the circumstances and objectives.
- Use of checklists
  Checklists are one of the most elementary and successful instruments for quality assurance. Therefore, good checklists are required. Good means that they already have proved themselves, are constantly updated, are well articulated, and have a proper level.
- Quality guideline
  A quality guideline should be developed for the project. It defines quality assurance measures and adopts best practices. All project members could make use of it and apply practical quality procedures in the project. Content of a quality guideline could be:
  – Quality processes
    Which measures concerning quality assurance apply? Common or

---

[5]Also known as "Gemba principle".
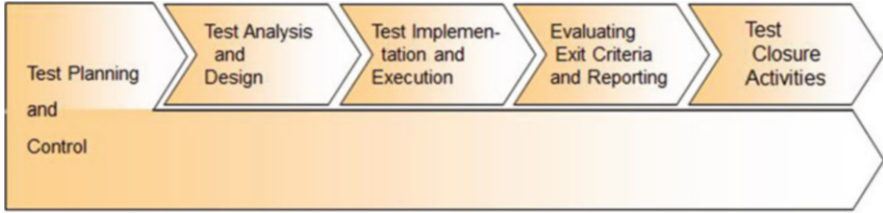
Fig. 2.9 Fundamental test process as defined by ISTQB

organization-specific quality guidelines should be used. If the working result of a project is a product, a test process should be defined.

In the software development field, it is appropriate to use the fundamental test process as defined by ISTQB (see Fig. 2.9) [10].

– Entry and exit criteria for project phases
  Measurement criteria should be defined for milestones. These will be checked during the corresponding milestone meetings, and it will be documented how the criteria are applied.
– Using and expanding a project glossary
– Using uniform formats

• Transparency
  Regularly, the current project status should be reported, mainly based on defined measurement criteria and key figures. These reports can help to detect at an early stage if project goals are at risk. In the software testing, field measurement criteria are, for example:
  – Test coverage
    How many test cases have been executed with what results?
  – Defect situation
    How many defects are open and how serious are they? How many defects are closed?

• Considering company-specific conventions and regulations
  It is important to know these conventions and regulations at an early stage. If they are not relevant, this fact should be documented.

• Audits
  An external view can give valuable help. An audit encompasses:
  – Analysis and assessment of the project and the course of the project
  – Discussion of problems
  – Development, planning, and implementation of solutions

• Professional project management with coaching

• Qualification
  This includes the project manager training and organizational training, in each case with certificates; see also Sect. 4.1.

2.5.3   Checklist

Figure 2.10 displays a checklist concerning quality in the project.

2.6   Risk Management

Risk management means the systematic approach in recording and evaluating risks, as well as the management of identified risks.

2.6.1   Objective of Risk Management

The most important goal of risk management is to prevent a crisis in the project, where crisis means a situation requiring a difficult but important decision. Unplanned crises are something like an intensification, when a risk occurs.

Any such crises need to be managed, such as via a fallback solution or a "plan B" [1]. Several alternatives could be prepared and summarized in a decision template. It is important to actively face a crisis and to have a challenging actor.

Risk management can be started by looking at project scenarios based on the environmental analysis (see Sect. 3.1.3):

- Goal scenario
- Best-case scenario
- Worst-case scenario

These scenarios will be closely analyzed to mitigate identified risks and to generate an alternative project plan if required.

Another aim is risk control with measures:

- To reduce the probability of an incident
- To reduce the estimated impact

> **Risk Management**
> DIN 69901-5 describes risk management as "the elimination, avoidance, or reduction of a project risk." Risk management is a part of project management. The scope of risk management covers:
>
> - Identification of risks
> - Assessment of risks
> - Execution of measures to mitigate risks

Checklist quality

Question	Result
1. Is the role quality management in the project defined and assigned?	
2. Is there a quality guideline defining project standards and processes?	
3. Is there a relationship to corporate or general guidelines like ISO 9000? Are there project specific differences, exceptions or additions?	
4. Are the standards and processes on hand, before the corresponding activities start?	
5. Are all team members familiar with the standards, processes and corresponding tools in the project? Are there training courses?	
6. Is every team member instructed to follow defined standards and processes?	
7. Is the team involved in further development and adaption of the standards and processes?	
8. How is the compliance with standards and processes monitored?	
9. Is a test process defined? Is a test plan available?	
10. How is it ensured that delivered working results meet the corresponding requirements?	
11. How is the handling of quality problems? How is the handling of measures to solve them?	
12. Which criteria are defined to measure the level of the quality achieved and to serve as a basis for continuous improvements?	
13. Are project data analyzed in form of key figures, so that it is possible to early detect, when (sub) goals could not be achieved?	
14. Are there meetings concerning quality improvements between the project team and quality management?	
15. How is it checked whether or not quality improvement measures have an effect?	
16. How is the quality of resulting products ensured?	
a. Are there guidelines how to evaluate the quality of a product?	
b. Are postulated quality characteristics defined?	
c. Which measures ensure the quality of the product?	
d. How is the quality of third-party products planned?	
e. Is prototyping planned in the product development?	
f. Are quality-ensuring measures for the product manufacture already planned during product development?	
g. Is there a review plan? Who is going to review which contents when?	
h. Are there tests planned for the overall product and individual components?	

Fig. 2.10   Checklist quality

2.6.2   Procedure

The most critical risks are the risks that are not known. That is why every project member should be motivated and be able to inform about risks comfortably and easily. Simple risk management is often sufficient—it is definitely better than no risk management. The management of risks should start as soon as possible. Important is the constant consideration of risks during the course of a project, e.g., in project meetings. The final question in such meetings could be: "Are there any additional risks to be considered?"

Below an approach is described how risk management could be implemented in a project.

First step is risk analysis.

Every detected risk is considered and quantified. The quantification of a risk can be calculated as follows:

$$\text{Risk } R = \text{Probability of incidence } P \times \text{Estimated impact } I \qquad (2.1)$$

Proposal for the quantification of risks:

- Probability of incidence P
  - Low = 1
  - Medium = 2
  - High = 3
- Estimated impact I
  Damage from risk if it occurs:
  - Less critical = 1
  - Critical = 2
  - Very critical = 3
- Risk $R = P \times I$
  The outcome of this is:
  - Low risk (value 1 or 2)
  - Medium risk (value 3 or 4)
  - High risk (value 6 or 9)

An example of a risk management list is shown in Fig. 2.11. A template to collect risks is provided in Chap. 5 on p. 133.

Second step is risk mitigation or better risk avoidance.

Depending on the specific risks, measures will be defined to minimize risks either by reducing the probability of incidence or by reducing the estimated impact. It has to be aspired to prevent identified risks.

Third step is risk control.

Id	Risk description				Quantification			Mitigation	
	Risk identification	Potential cause	Contact person	Date	Proba-bility	Esti-mated impa	Risk	Status	Actions
R001	Example of a risk with low probability, but possible critical implact	Cause 1	Uwe	07.04.16	1	3	3	in progress	2016-04-07 [Uwe] Further investigation planned
R002	Example of a risk with high probability	Cause 2	Daud	11.12.16	3	2	6	in progress	2016-12-11 [Daud] Meeting planned to discuss proceeding

Fig. 2.11   Example for a risk management list

In a regular review of risks, it should be examined whether or not the control measures have the desired effect. For particular risks, did the probability of incidence or the estimated impact decrease? Additionally, a check should be done for new risks, if known risks occurred already, or if some risks became obsolete.

2.7   Methods

A method is a system neutral, more or less systematic procedure to achieve an objective. This section describes proven methods from the project management area. Other methods are described in [4]. Another overview of project management methods (in German) is provided in [7] or [12].

2.7.1   Brainstorming

Brainstorming is a technique to stimulate creativity. This method can eliminate blocks when searching for new ideas and make group work more productive. The result of this method is a collection of ideas for a given problem. The following rules apply:

- Quantity before quality—the more ideas the better!
- Use creativity and fantasy—unusual ideas are very much welcomed.
- Complementing and improving of foreign ideas is allowed.
- No criticism—criticism and evaluation are done at a later stage.

When brainstorming, the role initiator and participant apply. It is helpful to designate a moderator and a recorder. The brainstorming procedure can be scheduled as follows:

1. Preparation phase (Initiator)
   This phase covers the following activities:

- Preliminary definition of the problem to find the exact question
- Invitation of participants
- Reservation of a meeting room
- Role allocation

2. Execution phase (Participants including initiator, moderator, and recorder)

- The moderator explains the rules.
- The moderator presents the problem and the current status of discussion.
- Start of brainstorming: all participants express their ideas for how to solve the problem. The moderator sets impulses, if required.
- The recorder notes all ideas.
- The moderator finishes the phase when no more ideas emerge.

  Variant: Card technique
  Every participant notes his ideas on cards. The following rules apply:

- One idea per card.
- Write clearly and legibly; use large-sized letters.
- Maximum three lines per card.

The moderator collects and organizes the cards when pinning them on a pinboard assisted by the recorder. In case of ambiguities, he discusses the content on a card with the author. Alternatively, the participants pin their own cards on the pinboard.

3. Processing phase (participants including initiator, moderator, and recorder)

- The recorder organizes the ideas that have been put forth: He sorts the ideas and sums them into a list of results.
- The participants discuss the list of results and evaluate the ideas. The following rating is possible:
    - Implement immediately
    - Good, but cannot be realized immediately
    - No evident benefit at present
- The ideas that cannot be implemented immediately are discussed again.
    - What can we do with them anyway?
    - How can the ideas be improved so they can be used?

4. Closing phase (participants including initiator, moderator, and recorder)

- The moderator gives the result list that has been worked over to the initiator.
- The moderator thanks all participants and the recorder and finishes the brainstorming.

2.7.1.1 Advantages

This method generates a lot of ideas with little effort during preparation and execution. It helps to form a group. If using the card technique, the participants can write down their thoughts without any interference.

2.7.1.2 Disadvantages

The method is limited concerning complex topics. Few individuals might dominate the discussion, and it is subject to becoming biased by the first few ideas presented (i.e., people start thinking along the same lines after hearing a few ideas). The more ideas generated, the higher is the effort for follow-up activities.

2.7.1.3 Application

It is the standard method to generate spontaneous ideas in a group. It works well for less complex problems and to start a topic.

2.7.2   Problem Statement Reversal

The problem statement reversal technique (Synonym: *brainstorming paradox*) is similar to brainstorming, only that the problem is stated in reverse to collect negative and absurd ideas. So, first one achieves a contrary proposal to what is really expected. In a second step, the circumstances are turned upside down and a good proposal will emerge.

Example: how do we ruin our project? Possible answers:

- Unclear objectives and targets that are not measurable.
- Force people who dislike each other to work together.

2.7.2.1 Advantages

It is a fresh alternative to brainstorming. It is easier for participants to find arguments why something will not work. New and different ideas get generated.

2.7.2.2 Disadvantages

The change from destructive to constructive thoughts can be challenging.

2.7.2.3 Application

This method is suitable to identify potential for improvement.

2.7.3   Mind Mapping

Mind mapping is a creative technique using visual images [2]. A mind map visualizes and relates thoughts, information, and text and addresses different types of learners.
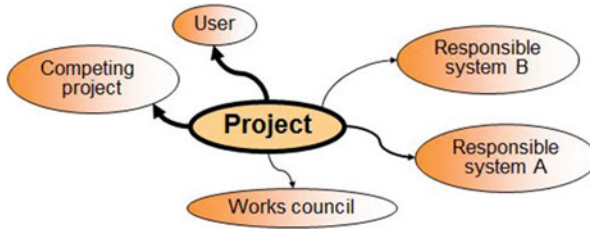
Fig. 2.12 Example of a mind map

Figure 2.12 shows a mind map, where the line width indicates the importance/intensity that a relationship represents.

2.7.3.1 Advantages
A mind map helps develop thoughts and new ideas swiftly and lightly. The central topic can be easily accessed. The method facilitates learning and memory. A piece of paper is sufficient to practice.

2.7.3.2 Disadvantages
If drawn on paper, space becomes a limitation. Using mind mapping software may cause issues with other tools concerning data exchange and further processing.

2.7.3.3 Application
The use of mind maps makes sense for individuals and small groups when written records are needed, for instance:

- Exploring new topics
- Preparation of a talk or for written consumption
- Rapid note-taking
- Systematic repetition of subject matter

2.7.4 Method 635

The method 635 stands for:

- 6 people
- 3 ideas to be produced per person
- 5 times to pass (after 5 min)

This method is a "brain writing" technique [18]. The method helps to increase creativity of a group. The objective of method 635 is to get a large number of ideas and potential solutions for a given problem. The procedure is described below with

Fig. 2.13 Example for a working sheet for method 635

assumed 6 participants:

- The problem is described.
- Each of the 6 participants gets a worksheet with 18 fields: 3 columns for ideas and 6 rows (example shown in Fig. 2.13).
- In the first round, each participant writes one idea in each column of the first row, for a total of three ideas.
- At the end of each round, each person passes his worksheet clockwise to the next person.
- In each subsequent round, the person reads all ideas on the worksheet he has received and then adds three new or related ideas to the next row on the worksheet.
- The process ends when each person receives back his original worksheet, now filled with rows of additional ideas.
- The next phase of the activity is to sort and group or "cluster" the ideas. The clusters of ideas provide the basis for further discussion and analysis, as done in brainstorming.

The following rules apply:

- All participants have to be well informed of the topic or issue before the procedure starts.
- The participants do not talk with each other during execution.
- Scheduled times have to be met.
- Per field only one idea.

The method 635 can be executed with fewer than six persons as well. Then every participant processes the working sheet several times.

2.7.4.1 Advantages

This method generates a lot of ideas within a designated time. All participants are involved; ideas are not to be discussed or criticized. The method can also be used when the people are spatially distributed.

2.7.4.2 Disadvantages
The time limit can pressure the participants.

2.7.4.3 Application
The method is proper for small working groups and to introduce a less or average complexity topic.

2.7.5 Flashlight

The flashlight method is suited for a snapshot. It could be used anytime in a project, for example:

- During a project kickoff, to ask for a current specific knowledge concerning the subject
- During the execution of a project to catch the current mood
- During the project closure for feedback

The flashlight method is applied as follows: Initially, a closed question to be answered is defined. Example: "How much do I know about the technology used in this project?" Possible responses are such as "A lot" or "Nothing at all," but with a range of others in between. Then the question is addressed to the participants with the following possibilities:

- Circle
  The participants come together in a circle. One after the other says one sentence. Rule: one person talks and everyone else listens.
- One point inquiry
  The question is written on a flip chart; below are two fields outlined, representing corresponding statements. Each participant gets a self-adhesive circle, sticking it on the corresponding position on the flip chart. Figure 2.14 shows an example.
- Positioning in the room
  The moderator uses the open space of a room and divides it into two areas, representing possible statements. The participants position themselves in the room to answer the given question. The moderator interviews people as to why they are standing at their position.

2.7.5.1 Advantages
It is a simple method; no preparation is required. Group feedback is obtained within a short time.

Fig. 2.14 Example for a
flashlight using the
single-point method
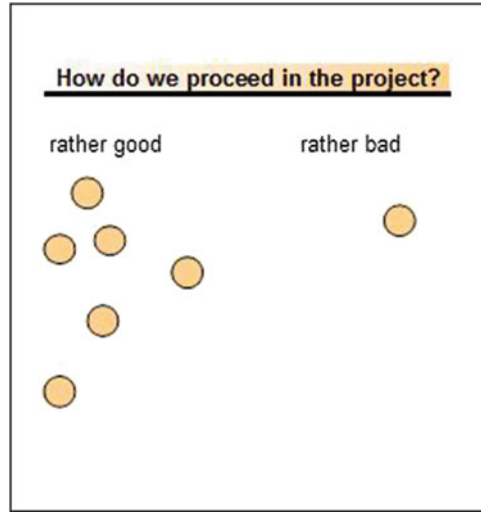
2.7.5.2 Disadvantages

There is a tendency to follow other group members. Therefore, it can be difficult to get different opinions.

2.7.5.3 Application

The method can be used to get an atmospheric picture of a group.

2.8   Summary

The chapter "Comprehensive Topics" considers topics that could not be assigned directly to project phases. These are requirements, project culture, communication, documentation, and quality and risk management. Additionally, the chapter presents methods proven to be helpful in a project.

Requirements engineering helps to deal with requirements, to identify the characteristics of a product or a system for a high customer value. In a typical project, first the requirements have to be identified and to be assessed. If these are known, the requirements have to be managed: They are fulfilled, they may drop out and get changed, or maybe some are added.

The project culture describes the cooperation of the project members in the project. Additionally, the image of a project plays a role. Globalization results in international projects with different cultures and value systems converging. This has to be considered. A common language has to be defined.

The key success factor for a project is good communication. Which communication devices are used in a project? A communication plan shows the communication channels in a project.

An important aspect is the quality of a project. Quality measures should help to achieve the required quality in a project. A good quality in a project results in high-quality project results.

Risk management enables project success, even with possible difficulties. For this risks are collected and assessed regularly to initiate counteractions if necessary.

Presented methods support the project progress. Brainstorming is a simple and effective method that could be used during the complete project life cycle. With the flashlight method, it is possible to get a group status concerning a closed question.

Problems

2.1 Communication
What effect does poor communication have in a project?

2.2 Documentation
What is the role of documentation in a project?

2.3 Quality
What does quality in project management mean?

2.4 Risk Management
Why should one do risk management in a project?

References

1. Angermeier, G.: Projektmanagement-Glossar des Projekt Magazins (2016). https://www.projektmagazin.de/glossar/. Checked on 27 June 2016
2. Buzan, T., Buzan, B.: The Mind Map Book: How to Use Radiant Thinking to Maximize Your Brain's Untapped Potential. Penguin Books, New York (1996)
3. Campbell, M.: Communication Skills for Project Managers. AMACOM American Management Association, New York (2009)
4. Cave, C.: Creativity Web - Resources for Creativity and Innovation (2005). http://members.optusnet.com.au/charles57/Creative/index2.html. Checked on 27 June 2016
5. DeMarco, T., Lister, T.: Peopleware: Productive Projects and Teams. Dorset House, London (1987)
6. Deming, W.E.: Out of the Crisis. Massachusetts Institute of Technology, Cambridge (1982)
7. GPM Deutsche Gesellschaft für Projektmanagement e. V.: PM Methoden (2016). http://www.gpm-infocenter.de/PMMethoden/Startseite. Checked on 27 June 2016
8. IEEE Standards Board: lEEE Std 610.12-1990; IEEE Standard Glossary of Software Engineering Terminology. Technical Report, IEEE (1990). https://standards.ieee.org/findstds/standard/610.12-1990.html. Checked on 27 June 2016
9. International Requirements Engineering Board: IREB - Home (2016). http://www.ireb.org/. Checked on 27 June 2016
10. International Software Testing Qualifications Board: Standard Glossary of Terms Used in Software Testing, Version 3.01 (2015). http://www.istqb.org/downloads/. Checked on 27 June 2016

11. Leffingwell, D., Widrig, D.: Managing Software Requirements: A Unified Approach. Addison-Wesley, Boston, MA (1999)
12. Lehrstuhl für Technologie und Innovationsmanagement (TIM), RWTH Aachen: WiPro Innovative mit Methode (2016). http://www.innovationsmethoden.info/. Checked on 27 June 2016
13. Mehrabian, A., Ferris, S.R.: Inference of attitude from nonverbal communication in two channels. J. Couns. Psychol. **31**(3), 248–252 (1967)
14. Pohl, K., Rupp, C.: Basiswissen Requirements Engineering; Aus- und Weiterbildung zum "Certified Professional for Requirements Engineering". dpunkt.verlag, Heidelberg (2011)
15. Project Management Institute: A Guide to the Project Management Body of Knowledge (PMBOK Guide 5), 5th edn. Project Management Institute, Newtown Square, PA (2013)
16. Project Management Institute: The high cost of low performance: the essential role of communication (2013). https://www.pmi.org/~/media/PDF/Business-Solutions/The-High-Cost-Low-Performance-The-Essential-Role-of-Communications.ashx. Checked on 27 June 2016
17. Rajkumar, S.: Art of Communication in Project Management. Project Management Institute, Newtown Square, PA (2010). http://www.pmi.org/learning/effective-communication-better-project-management-6480. Checked on 27 June 2016
18. Rohrbach, B.: Kreativ nach Regeln, Methode 635, eine neue Technik zum Lösen von Problemen. Absatzwirtschaft 12 **Heft 19**, 73–76 (1969)
19. Schienmann, B.: Kontinuierliches Anforderungsmanagement. Prozesse - Techniken - Werkzeuge. Addison-Wesley, Reading, MA (2001)
20. Wikipedia: Requirements management (2016). https://en.wikipedia.org/wiki/Requirements_management. Checked on 27 June 2016

Project Phases

3

Every project has a start and an end and so a chronological course that could be divided in project stages. At the end of this chapter, it will be possible to structure and to execute projects, based on the project phases suggested in this book including corresponding templates and checklists.

> **Project Phase**
> Following DIN 69901 a project phase is "a temporal section of a course of a project that is separated objectively from other sections". A typical separation of the phases takes place by milestones, when essential intermediate project results get delivered.
>
> Entry and exit criteria help to start and to finish project phases. Every project has at least the following phases:
>
> - Planning
> - Realization
> - Closure

Process models in project management define project phases as well (see Sect. 1.3). Both in literature and within companies they are structured and named in different ways. The project phases defined in this book are based on the experience and best practice of the authors. We suggest the use of the following phases for the execution of projects:

- Strategy phase (Sect. 3.1)
- Planning phase (Sect. 3.2)
- Realization phase (Sect. 3.3)
- Closure phase (Sect. 3.4)
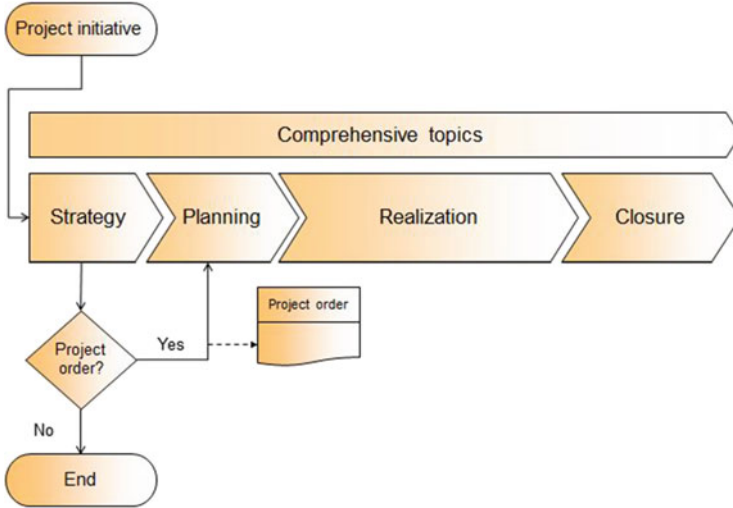
Fig. 3.1 Project phases

As shown in Fig. 3.1, the actual implementation of the project starts with the project order. The boundaries between the phases should not be interpreted rigorously. They are often fluid, depending on the project. It is possible to start with project planning even if the project order is still in coordination.

In some projects a separate conception phase (or "design phase") makes sense, even with a split into a rough conception phase and a refined conception phase. These could be assigned to the planning phase or realization phase.

Large projects with internal and external partners generally cover the preparation of one or more tender specifications and performance specifications. This is even more true for traditional sectors like the automotive, energy, chemical industry, logistics, real estate, construction industry, and the public sector.

A tender is done usually with a tender specification. Based on this an offer is made with a corresponding performance specification.

After selection a decision is taken about cooperation. This work is done in different or even in particular project phases, depending on the structure and size of a project. It is possible to prepare a tender specification prior to the actual project order, so that the project order refers to it. Here a pre-project is recommended. The preparation of a tender specification could be part of the planning phase or even perhaps of the realization phase.

From the authors' practical experience, the topics tender specifications and performance specifications usually get handled during the strategy phase; hence, they are discussed in this book related to the strategy phase as well.

Dynamic industry sectors like trade, media, telecommunication, or information technology are moving more and more to agile project management (see Sect. 4.3).

Here a framework contract is drawn up, and the requirements and their implementation are performed dynamically during the course of the project without a tender specification or performance specification.

3.1 Strategy Phase

Strategic planning is worthless – unless there is first a strategic vision.
John Naisbitt (*1929)

Synonyms for the strategy phase are *conceptional phase, initial phase*, and *project preparation phase*.

Why does a strategy phase make sense?

The careful preparation of a project avoids unnecessary risks and is the basis for a successful project execution. During the strategy phase, initial ideas get developed, how a project could progress to achieve a defined objective, as, for example, what the product to be developed should look like and how to proceed in the best way. It is recommended to learn from the experience of similar projects and to make use of existing knowledge. Do not reinvent the wheel.

This section shows the scope of the strategy phase and corresponding tasks. When done all will be known about the situation and environmental analysis and about the importance of a project order. Additionally, the tender specification and performance specification are introduced.

3.1.1 Objective/Results

The goal of the strategy phase is to receive a project order. Result of the strategy phase is the project order itself and—depending on the process model, the complexity and size of the project—a tender specification and a performance specification.

3.1.2 Situation Analysis

The formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill.
Albert Einstein (1879–1955)

First of all the motivation for a project should be analyzed. One has to be informed about the causes and reasons for a project and to be familiar with the topic and the context of the problem. The larger a project, the more important it is to do research (literature, related departments, internet), to ask colleagues or experts, and to investigate. The situation analysis should answer the following questions:

- What information, facts, and figures apply?
- What opinions exist?

- What problems are apparent? What are the ideas, requirements, etc.?
- What are the causes for the problem?
- What impact does the problem have?
- What tasks, processes, and methods are affected?
- What are the priorities?

Try to identify the core issue, the genuine problem. Find out if the issue discussed is the real problem, or if there is something more profound that is underlying. Often the iceberg principle applies: only 10–20 % of the problem is visible; the true 80–90 % root cause of a problem is not named.

Example: the workshop does not know where and how to store tires brought in by logistics. The real problem: logistics does not care about the storage of tires and simply delegated the problem to the workshop. But the main purpose of a workshop is not the storage of tires.

Find several solutions!

In the majority of cases, there is more than one way to solve a problem. It is imperative to find several solutions and then to choose the best one. Use the know-how of colleagues and other experts and the results of (literature) research. You could bring people together and collect first ideas in using creativity techniques (see Sects. 2.7.1, 2.7.2, or 2.7.4).

Figure 3.2 shows a checklist for the situation analysis.

3.1.3   Environmental Analysis

A synonym for the environmental analysis is *stakeholder analysis*. The aim of the environmental analysis is to identify all the people who play or could play a role in a project and to adequately involve them. This is important, as people related in a project can decide about the success of a project—positively or negatively. Hence, stakeholders have to be identified; they have to be informed, actively attended to, and involved in decisions.

Why is an environmental analysis required?

- There are different expectations and interests in a project.
  Example reorganization: consider the roles of the work council and shareholders.
  Example airport expansion: note the roles of environmentalist groups and the Chamber of Industry and Commerce.
- Stakeholders are affected by a project in different ways, in a subjective and objective manner. Synergies and possible conflicts should be identified.
  Example restructuring: experienced employees are used to proven processes and new employees with new ideas.
- Different forms of power
  People in power could decide about the project and influence it in a positive or negative way.
  Example: compare management to officials in charge.

Checklist situation analysis

Project name		Project No.	
Responsible			
Version / Date		**Status**	

Question	Result
1. Initial situation	
a. Is the initial situation described sufficiently?	
b. Are the challenges and issues of the current situation known?	
c. Are the persons involved concerning the current situation identified?	
2. Root cause analysis Has a root cause analysis been executed to identify the cause of the challenges and issues of the current situation?	
3. History	
a. What activities have been carried out in the past to solve the challenges and issues?	
b. Is documentation available and why have the activities not been successful?	
c. Are experiences known concerning similar challenges and issues?	
4. Interests / Cooperation	
a. Has an environment analysis been conducted?	
b. Who is interested in a solution of the challenges and issues? Which group, which project supervisor, which executive?	
c. Are there projects or departments, working on the same topics?	
d. Who has interests against a project, such as competing projects?	
5. Concerning a customer/contractor situation: Why did the customer not solve the challenges and issues by himself?	
6. Differentiation	
a. What activities are part of the project?	
b. What activities are not part of the project?	
c. Are there any constraints or decisions to be considered?	
7. Outlook	
a. Has a future analysis been performed for the project?	
b. Are project risks identified that could result in problems, issues, and conflicts during the execution of the project?	
c. Is the impact of these risks determined?	
d. Concerning the risks and possible impact: Are best case and worst case scenarios defined including recommendations?	

Fig. 3.2 Checklist situation analysis
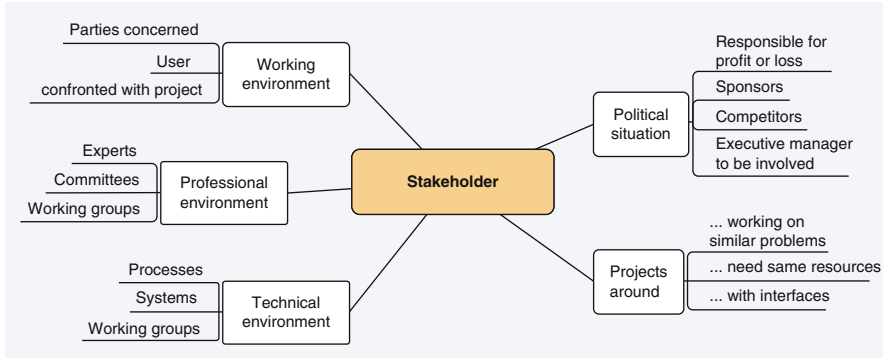
Fig. 3.3   Questions to identify stakeholder

The following questions could help to identify stakeholders (compare Fig. 3.3):

- Who is responsible for profit or loss caused by the project?
- Who are the users of the developed result of the project?
  It makes sense to develop a corresponding scenario or vision. To whom will the project result be delivered? Who will work with the project result? Who would be responsible for operation (compare Sect. 3.4.2)?
- Who is confronted with the project, and who is involved?
- Are there projects under way on similar problems?
- Which committees or working groups should be considered?
- Who has worked on the topic already?
- Are there projects that need the same resources?
- Which systems and processes are related?
- Are there interfaces to other projects?
- Political situation
  Are there sponsors and competitors? Which executive managers have to be involved?

The following procedure is recommended:

- Identification of the stakeholders
- Determination of the influence and attitude of the stakeholders to the project
- Definition of measures like regular communication

To identify the stakeholders, you could use mind mapping (compare Sect. 2.7.3). The resulting mind map or list could be extended by contact information. Responsibilities and the way of involving the stakeholders in the project should be determined and known at an early stage. This can be done by using a RACI matrix. A template for a RACI matrix is available on p. 143 of Chap. 5.

RACI Matrix

A RACI matrix helps to assign defined tasks to roles. These RACI roles are in detail:

- **R**esponsible, that is, responsible from the disciplinary point of view.
- **A**ccountable, that is, responsible from the sponsorship point of view.
- **C**onsulted, that is, to support in a professional way.
- **I**nformed, that is, if information is required for other responsibilities.

Figure 3.4 shows an example for an environmental analysis. A template is available on p. 144 of Chap. 5.

Figure 3.5 displays a checklist for the environmental analysis.

3.1.4 Project Goal

The slowest person who never loses sight of his goal always goes faster than one who wanders around aimlessly.
Gotthold Ephraim Lessing (1729–1781)

One of the first activities in a project is the determination and definition of the project goal.

Stakeholder	Possible role in project	Attitude concerning project	Possible influence / power	Measures / strategies
Director	A	positive	Very high	• Regular communication once a week
Project manager	R	positive	High	
Customer	I	negative	High	• Regular meeting 2 times a week, to be considered in Beta testing
User	C	negative	Low	• User workshop with demo
Work council	I	positive	Medium	• Execution of an information event

Fig. 3.4 Example for an environmental analysis

Checklist environmental analysis

Project name		Project N	
Responsible			
Version / Date		Status	

Question	Result
1. Identification of persons / group of persons: Who is confronted with the project?	
a. Who is somehow involved in the project?	
b. Who could deliver information for the project, what sources of information are available?	
c. Are there overarching goals and visions the project should service?	
d. Are there projects under way with similar problems? Who are the contact persons?	
e. Are there other projects, requiring the same resources?	
f. What systems and processes are involved?	
g. Political situation: Are there sponsors, competitors?	
h. Who is affected by the project, who benefits, who has disadvantages?	
i. Who could influence the success of the project in a positive or negative manner?	
2. What attitude towards the project do the identified people / group of people have?	
3. How powerful are the identified people / group of people?	
4. How to deal with the identified people / group of people? How intensely should they be included into the project?	

Fig. 3.5 Checklist environmental analysis

Project Goal
Synonyms are *project aim* or *project objective*.

DIN 69901-5 defines the project goal as "the totality of specific objectives that should be reached by the project". Goals are desires! The complete description of objectives is covered by answering the questions:

- What?
- How much?
- When?
- Where?

(continued)

> Non-goals differentiate the project and describe what the project renounces, means what should not be achieved. A strategy describes a careful plan to reach a goal.

Project goals are required to control a project and to measure the project success. They are the basis for scope management. Based on these the scope management defines the project scope, and during the progress of the project, it ensures that the corresponding tasks are completed. Further reasons for project objectives are:

- Goals help to clearly align and prevent detours.
- Objectives serve as fundamental for planning and controlling the project "to fight the coincident" (No surprises!).
- Goals are the basis for project control.
- Aims promote motivation and team building of the project team.
  An important success factor is the common reaching of (sub)goals.

Objectives are the foundation of successful projects. The following target goals could be differed:

- Main goals
  These must not lose sight of.
- Subgoals
  Subgoals help to structure a project.
- Secondary goals
  Secondary goals are additional goals that might be reached.
- Non-goals
  To differentiate a project, non-goals should be stated.

The goals should be prioritized according to their importance. It has to be ensured at all times that the most important activities for the project are in focus. The goals should be precise and quantified, so that the project success can be measured and controlled. It can then be decided when a goal has been reached.

An approved tool to create realistic and achievable goals is the SMART method (see Fig. 3.6):

- **S**pecific
  The goal is described clearly, precisely, and consistently.
- **M**easurable
  The goal is verifiable.
- **A**cceptable
  The goal is exigent; it is challenging and positively worded.
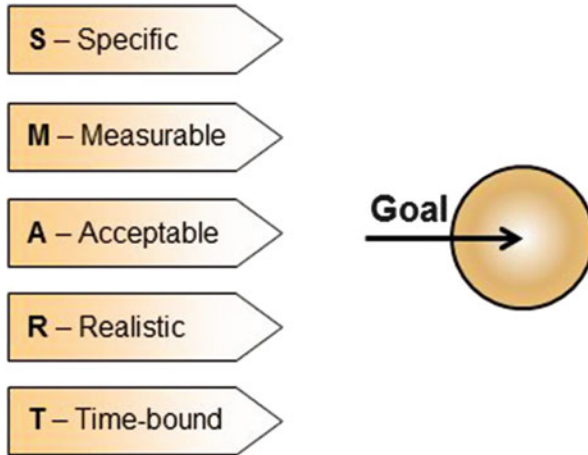
Fig. 3.6 SMART method

- **R**ealistic
  The goal can be reached with given resources in given time; conditions are clarified.
- **T**ime-bound
  The goal should be reached by a specific date.

Example Software Test

The developed webshop version 2.0 should be tested on the Ubuntu 15.04 operating system using the browsers Firefox with version 40.03 and Chrome with version 44.0 (*specific*).

The basis for testing the webshop are 400 test cases with priority "high" and 600 test cases with priority "medium". All test cases with priority "high" have to be executed completely. At least 50 % of the test cases with the priority "medium" should be executed. At the end of the testing phase, no severe defect must be open. About ten medium severe defects are tolerated. All less severe defects have to be documented (*measurable*).

The execution of the tests should follow prioritization. Found defects have to be transmitted directly to the development team including information on how they could be reproduced. About 20 % of the test cases with the priority "high" should be automatized in parallel (*acceptable*).

For the project there are ten test engineers available over an eight-week period. The basis for the planning is the already executed test cycle for the version 1.0, assuming that every tenth test case finds a defect and that every defect detected gets fixed in about three days (*realistic*).

The tests start on 04.01.2017 and should end on 26.02.2017; the final test report has to be delivered by 03.03.2017 (*time-bound*).

Measurable target figures describe when a goal is reached. They could be understood as acceptance criteria, for example:

- 90 % of all orders could be processed digitally (Yes/No).
- An event has taken place (Yes/No).

The following questions provide guidance concerning the definition of goals:

- What should be reached? What aims will be pursued with this project?
- What priority do the several goals have?
- How much should be reached? What is the goal attainment level?
- When should the goal be achieved? Which dates or periods have to be considered?
- Is there a dependency between the different goals? If so, what kind?
- Who is responsible concerning the target achievement?
- What conditions have to be considered?
- Where should the goals be reached—how is the spatial link?

3.1.5   Solution Approaches

We can not solve our problems with the same level of thinking that created them.
Albert Einstein (1879–1955)

When the goal is clear, it is appropriate to think about first solution approaches and a time schedule for a project proposal. The solution concept has to be described. If there is more than one solution concept, these have to be depicted separately with advantages and disadvantages. It should be clear how the solutions or solution concepts get prioritized.

An analysis of profitability is recommended to demonstrate the overall benefit of a project. The proof of the economic efficiency could be done by:

- Quantitative methods (monetary)
  Here the return on investment with a payback period could be calculated.
- Qualitative methods (nonmonetary)
  Here methods like cost-benefit analysis [7] or balanced scorecard [8] are appropriate.

If the economic efficiency of a project is not important or if it is not planned to be achieved, it should be clearly communicated. Below is an example of the "jubilee event of a company" describing how a solution with a rough time schedule could be developed:

- Planning
  - Definition of the organization team (6 months before the jubilee event)
  - Collection and evaluation of solution concepts: How could the jubilee be celebrated appropriately? (5 months before the jubilee event)

    1. Concert with a hip-hop band
       Advantages: extraordinary, even young employees will be excited
       Disadvantages: expensive, could be a poor show
    2. Special performance of a theater group
       Advantages: culturally demanding
       Disadvantages: not all employees like theater
    3. Group boat trip
       Advantages: number of passengers is flexible, supports team spirit
       Disadvantages: nobody could come late onto the boat or leave early

  - Coordination and decision, which solution will be implemented
    (3 months before the jubilee event)
- Preparation of the event *(details to be defined)*
- Execution of the event *(details to be defined)*
- Follow-up of the event *(details to be defined)*

3.1.6   Project Order

A project order is the formal starting signal for the project. So, the start of the project is comprehensible.

> **Project Order**
> Synonyms: *order, project brief, project charter, project contract*, or *project order definition*.
>
> DIN 69905 defines "order" as a "contract on deliveries and services that occurs if the contracting parties agree".
>
> As a rule a project order is a contractual document signed by a principal with legally binding effect. With this project order, a contractor is instructed to deliver services as agreed. In return the principal commits to pay a corresponding compensation.

The scope of a project results from the project order. The more distinct you identify the requirements and wishes concerning the expected project result, the higher is the probability of success as you could use the clearly defined scope as a basis. Depending on the project context, the term scope can be used in the sense of

project scope (What has to be done?) or in the sense of product scope (What kind of project result will be achieved?).

The scope management ensures that the project implements exactly all those tasks that are required to deliver successfully the requested project results [12].

During the course of a project, the following advantages arise from a project order:

- The team members have an orientation.
  This facilitates satisfaction and results in motivation and acceptance.
- The project organization is in operation.
  Consequentially, a good coordination, a controlled process flow, and conflict solving are possible.
- The project planning is complete.
  A clear project order avoids planning errors. Differences or issues in the project can be detected early and facilitate a plan adaption in time.

To finalize a project order, the most important topics have to be clarified, to be noted, and finally to be confirmed by the principal in writing. The scope and the granularity of the project order depend on the size of the project. It should contain the following:

- Principal
  A project or a project manager needs always a single point of contact, even if someone like the steering committee is behind this person, influencing the project with corresponding decisions. It should be clear who finally approves the project result.
- Purpose of the project
  Are the visions and wishes of the principal known?
  Description of the problem and of the task: What is it all about? Segregation of duties: What we are not talking about?
- Project objective
  What will be achieved when the project is finished? What are the quality criteria for this project result? What are the critical success factors?
- Short project description
- Project structure and project organization
  Description of the committees, the project manager, and the project team.
- Time schedule and resource plan
  Resources, costs, budget, time, and milestones are to be listed.
- Risks
  The presently known risks and—if possible—first related measures have to be provided (see Sect. 2.6 as well).

An overview of a project order is shown in Fig. 3.7. A template can be found on p. 145 in Chap. 5. From the project order a project profile can be derived (see
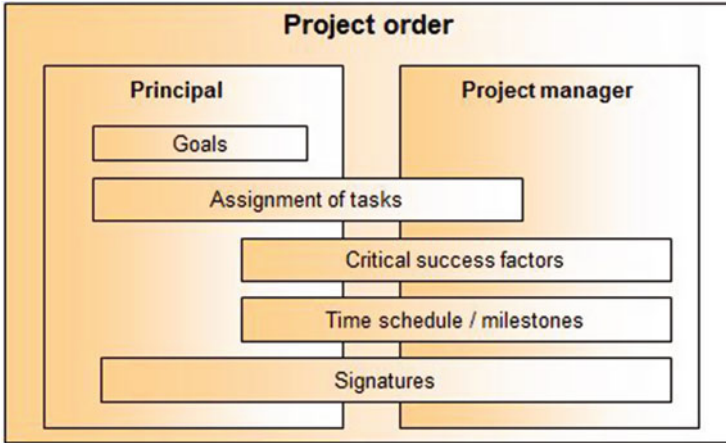
Fig. 3.7 Scope of a project order and roles involved

Sect. 2.4.5). It is sensible to start from then with the project handbook (compare Sect. 2.4.6).

Tip: In this phase you should try to attract top-ranking sponsors in your company and inform them regularly.

3.1.7   Tender Specification

The tender specification describes what kind of product should be created and delivered. It contains the requirements, expectations, and requests of a planned product and covers the contractor's supplies and services.

> **Tender Specification**
> Synonyms are *book of specifications, requirements document, requirements specification*, or *requirements specification document*.
>
> DIN 69901-5:2009 defines a tender specification as "the totality of the requirements of a customer applying for supplies and services of a contractor within an order".
>
> A tender specification describes the requirements, expectations, and wishes of a planned product. It is often a contract component in the information and communication technology field, electronics, electrical engineering, engineering, and automotive.

The requirements for a tender specification in a project depend on its topic, how large and complex it is, how long the duration, or how many external partners there are in a customer supplier relationship, for instance, as system supplier.

The tender specification (and later the performance specification) is primarily an important tool for clear communication and understanding of the requirements. As effort is required to prepare tender specifications and performance specifications, the cost-benefit ratio should be considered.

A tender specification ensures that all requirements are located at one source. It is typically the foundation of the project and serves as the basis for project acceptance to confirm the successful implementation of the requirements.

The tender specification contains the project requirements based on the project order and serves in customer-supplier projects as the basis for request proposals (call for offers). The principal himself should prepare the tender specification. If this is not possible, he has at least to approve it. The tender specification should avoid different interpretations of general requirements between a principal and a contractor.

Below is a proposal for the contents of a tender specification:

- Project objectives
- Tender documents
- Feasibility studies (concept descriptions)
- Initial situation (technical and organizational), like functionality of legacy systems
- Requirements
  The requirements should be structured domain specific and follow corresponding standards, such as the software requirements specification (ANSI/IEEE Std 830-1984) [3] or quality characteristics following ISO/IEC 25010:2011 (successor of ISO/IEC 9126) [11]. Exemplary requirements in the IT area could be structured like this:
  – Technical requirements (system performance, availability, performance, quantity structure, safety requirements, design criteria)
  – System requirements (functionality, interfaces, hardware, software, databases, services)
  – Infrastructure requirements (network, electricity, climate, rooms, fire protection, place of operation)
  – Operating requirements (service and maintenance during and after warranty)
- Constraints (Nonfunctional requirements, quality requirements, laws, standards, company-specific regulations, environment protection, decommissioning)
- Operational requirements, existing and/or planned operational and organizational processes like directives, process, and work instructions.
- Contracts and parallel running projects in the project environment (applicable regulations and specifications to be paid attention to)

- Further conditions (transport, customs regulations)
- Services provided by the principal (cooperation, contributions/provisions)
- Communication plan, workshops/coordination with the principal
- Documentation (technical product documentation, user manual, administration, and operation guidelines)
- Training (users, administrators, operation)
- Acceptance and commissioning

Below references are listed concerning the preparation of a tender specification:

- Pay attention to conflicts and inconsistencies among several requirements. Clarify general global customer requests to achieve unambiguous project requirements.
- Formulate your project requirements solution independent.
  Example: the webshop is available more than 97 % of the time.
- Prioritize requirements.
  - Must criteria: requirements to be implemented in any case
  - Should criteria: requirements to be implemented but which can be waived in certain cases
  - Could criteria: requirements that do not necessarily need to be implemented
- Use the know-how of your project staff for the preparation of the tender specification.
- Invest enough time and resources to determine project requirements and to prepare the tender specification.
- Coordinate the project requirements and the tender specification with all project participants, especially with the principal.
- Requirements that you identified, but have been declared as nonrelevant by the principal (i.e., data protection aspects, company guidelines), should be listed separately as "requirements not to be fulfilled" for your own protection.

Practical project experience shows that even for completed tender specifications, corrections or changes are possible. This topic should be taken seriously and a change management should control the handling of changes. So it should be ensured that everybody who is working with the tender specification is involved concerning changes and has access to the latest version.

3.1.8   Performance Specification

The performance specification is typically a binding document between a client and a contractor. In it, the contractor describes how a product should be created and delivered.

Performance Specification

Synonyms are *feature specification, functional specification, specification sheet*, or *technical specification document*.

According to DIN 69901-5 the performance specification is "the plan worked out by the contractor how to implement the tender specification handed over by the customer". So, it is detailing the tender specification. The performance specification is a contractually binding, detailed document.

The performance specification is based on the tender specification. Without a tender specification a performance specification is not possible.

As displayed in Fig. 3.8, a tender specification can be the basis for several performance specifications, for instance, in a call for tender procedure. Therefore, the tender specification initially has to be checked in detail concerning technical and economic feasibility and consistency. The performance specification describes the planned implementation of the requirements from the tender specification.

It covers in detail the required performance to achieve the project goals, namely, technical, economic, and organizational. The realization of the project requirements and related conditions to make it possible are agreed by contract. Depending on the kind of project, the performance specification could cover the complete project plan including time schedule and resource plan.

The performance specification is a binding agreement between the principal and a contractor. It serves as the basis for the project realization and should be created in close coordination with the principal and finally signed by both sides. Change
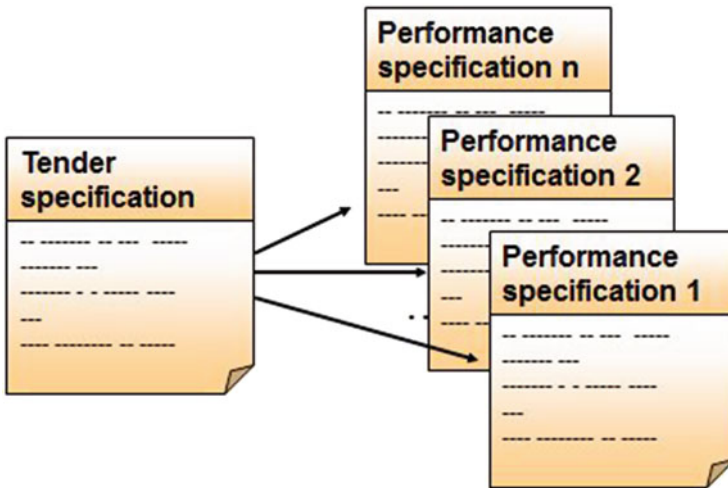
Fig. 3.8 Tender specification as basis for performance specifications

requests should follow a defined change management process. Any agreed change must be made in writing and has to be signed.

3.1.9   Checklist

Figure 3.9 presents a checklist for the strategy phase.

Checklist strategy phase

Project name		Project No.	
Responsible			
Version / Date		Status	

Question	Result
1. Project order	
a. Has a project order been placed?	
b. Who is the principal?	
c. Are the project goals agreed upon?	
d. Are the project goals measurable?	
e. Are conditions defined?	
f. Are the non-goals of the project defined?	
g. Who will be the project manager?	
h. Are the known risks listed?	
2. Has a situation analysis been executed?	
3. Has an environmental analysis been conducted?	
4. Initial planning activities	
a. Are drafts available concerning project structure and project organization?	
b. Are there estimates concerning required resources?	
c. Is there a rough time schedule with milestones?	
d. Is a first communication plan prepared?	
e. Are there ideas concerning the set-up of a project team?	
5. Profitability analysis	
a. Has a profitability analysis been conducted?	
b. Are in particular follow-up costs considered?	
6. Tender specification	
a. Who prepares a tender specification and by when?	
b. Who approves a tender specification and by when?	
7. Performance specification	
a. Who prepares a performance specification and by when?	
b. Who approves a performance specification and by when?	

Fig. 3.9   Checklist strategy phase

3.2   **Planning Phase**

Planning replaces error by coincidence.
Albert Einstein (1879–1955)

The planning phase discussed in detail in this section creates the basis for a successful project. A project plan shows how a given project order could be implemented concretely. Project planning is, in addition to project control, the central function of a project manager.

A project is divided and structured to reduce the complexity, to have an overview, and to keep track. It should be noted that the objective must always stay in focus. The goal is more important than the plan.

No plan can represent 100 % of the reality, and so planning is always a balancing act. On the one hand, the theory is: the better a project is planned, the higher is the probability of project success. On the other hand, there is the risk of too detailed bureaucratic planning: planning may be a "substitute act" for project work. The sheer compulsion to plan hinders work in the real project. All project participants must understand that a plan is only an approximation.

A plan presented, also in a draft version, eases the communication, particularly with people to be involved, as well as facilitates coordination, for example, when demanding required resources.

A plan offers the opportunity to point out problem areas and to focus purposefully on them. It applies in general as well as for project planning: The earlier a mistake is detected, the lower are the costs for fixing it. Alternative scenarios can be thought through and considered in planning.

At the end of the planning phase, there should be a well-prepared plan. In a kickoff event, the project staff will be able to say: "It can work like this." Then the actual project realization starts.

A plan is living! Initially, it refers to a rough frame that gradually develops further and gets synchronized. Eventually there is an agreed status. But even after the completion of the planning phase, the plan has to be examined and to be adapted to the actual circumstances.

This section presents activities related to the planning phase and offers information as to what to consider. At the end of this section, one will be able to prepare a project plan, containing a work breakdown structure, a cost schedule and a resource plan, a time schedule with milestones, and a project organization. It will be understood how these plans can be prepared, optimized, and coordinated. It will be clear how important it is to execute a suitable project kickoff event, depending on the kind and size of the project.

3.2.1   Objective/Results

Objectives and results of the planning phase are:

- A complete project plan including a work breakdown structure, time schedule, resource plan, and cost schedule as well as a project organization
- A successful executed project kickoff event

3.2.2   Project Plan

> Nobody plans to fail, but most fail at planning.
> *Lee Iacocca (*1924)*

What is a project plan?

> **Project Plan**
> According to DIN 69901-5:2009, the project plan is the "totality of all existing plans in a project" [1]. So, the project plan covers all the plans prepared in the project. These are usually:
>
> - Work breakdown structure (see Sect. 3.2.3)
> - Time schedule including milestone plan (see Sect. 3.2.4)
> - Resource plan and cost schedule (see Sect. 3.2.5)

Even if the project planning is along with project controlling the central task of a project manager, one should always be aware that project management means the achievement of objectives, not the fulfillment of plans.

Example: in a project "exam preparation," the following plan has been prepared:

1. Study the course documents
2. Learn from the homework
3. Go through available examination questions
4. (Related to oral examinations) Play through an exam situation

But even with optimal plan fulfillment, sometimes the examination is not passed. Truly effective is the project "exam preparation" having passed the examination, thus with objectives achieved.

A plan is a specification. It is:

- Never exact
- Outdated, as soon as it is finished

Even a wrong plan is better than no plan but please consider: the ability to plan ahead has its limits! Do not adapt the project to the plan! A project plan answers the following questions:

- What?
  Identification and description of the subprojects, work packages, and tasks; result is the work breakdown structure.
- By when?
  Description of the timeline, result is the time plan and milestone plan.
- Who/How much?
  What resources are needed with what qualification? What personnel and material costs are required in order to carry out the project? This will be documented in the resource plan and cost schedule. The project organization describes the type of cooperation.
- Conditions?
  Stating of the technical and spatial preconditions, listing of known constraints. This will be noted directly into the project plan.

One of the biggest challenges of project planning is the balance of three central topics that are also the crucial risks as well, known as the "magical triangle of project management" (Fig. 3.10, compare [1]):

- Quality
  Project scope that should be achieved with a defined quality
- Costs
  Effort in form of resources to be used
- Time
  Deadline, when the project has to be finished

One talks about a magical triangle, as the change of one size influences one or both other sizes.

As mentioned already in Sect. 2.2.3, we work together with people. Related to a good planning is good communication with all parties involved, the exchange of information. Communication is an essential precondition so that a project team can be created and allow collaboration (see as well Sect. 2.3).

Fig. 3.10 Magical triangle
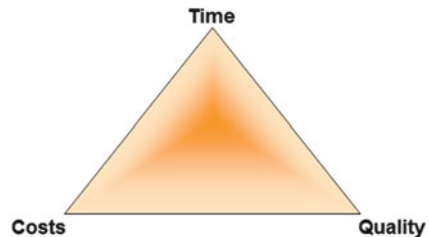
Try from the very beginning to identify the interests of the principal and to consider them in the further planning. Involve as well future project members in planning. It not only consolidates the planning but leads to higher motivation of the people involved as well. Take personal targets and expectations into account. Do the people identify themselves with the project? Are the potential project members free to join the project? Involve the supervisors in case of time conflicts.

Expect changes. As quoted in Sect. 2.1, there are changes to requirements to a lesser or greater extent in nearly every single project. These should be processed for logical reasons in a change management system. Proposal: try already during planning to consider a buffer for requirement changes, especially in larger projects. It simplifies the change management and reduces the risk of delays or cost overrun caused by subsequent required additional assignments and budget increases.

The following order in the planning phase appears:

- Preparation of a work breakdown structure together with people likely to be involved in the project (Sect. 3.2.3)
- Time scheduling with determination of milestones (Sect. 3.2.4)
- Planning resources and costs (Sect. 3.2.5)
- Setup of the project organization (Sect. 3.2.6)
- Carrying out optimizations (Sect. 3.2.7)
- Alignment of the project plan with the principal (Sect. 3.2.8)

The planning phase is completed with the project kickoff. The kickoff has to be prepared, executed, and followed up. All project members need orientation. Therefore, communicate the project plan, make it easily accessible, and visualize it, e.g., with a poster.

3.2.3 Work Breakdown Structure

What is a work breakdown structure?

Work Breakdown Structure (WBS)
The work breakdown structure (WBS) is the essential key of the project plan. Following the Project Management Body of Knowledge (PMBOK Guide 5), a work breakdown structure is "a hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables" [5, 13].

The presentation or partition could be made:

- Function oriented
- Object oriented

<div align="right">(continued)</div>

- Process oriented
- In a mixed way

The WBS structures a project in predictable and controllable:

- Subprojects
  A regional, organizational, or functional decomposition is made.
- Work packages
  This is a building block containing tasks related to a subject. If required additional levels with main work packages and/or sub-work packages are possible.
- Tasks
  Typically, tasks are listed in work packages.

Why and for what is a work breakdown structure required?
The work breakdown structure is the basis to:

- Distribute responsibility in the project
- Estimate the time required and the project costs
- Control the project
- Have a basis for the project documentation

What does a work breakdown structure consist of?

To capture a project completely, clearly, and as easily as possible, a project structure is suggested that covers all activities required to achieve the project goal.

Preconditions for the structuring of a project are clearly defined project goals and requirements. The result of planning a project structure is the work breakdown structure (WBS). The WBS offers an overview of the whole project in structuring it hierarchically. Based on the project on the top level, there are intermediate levels describing subprojects, and on the lowest level there are finally the work packages (compare Fig. 3.11):

- Project
  The project itself is at the top of the structure; it is derived from the project order and the formulated project objective.
- Subprojects
  Following certain criteria, the project is subdivided into subprojects. When indicated there will be additional project managers for the technical supervision of subprojects.
- Work packages
  Usually work packages are not subdivided anymore. As a rule one person processes a work package, but, for instance, in research projects often several
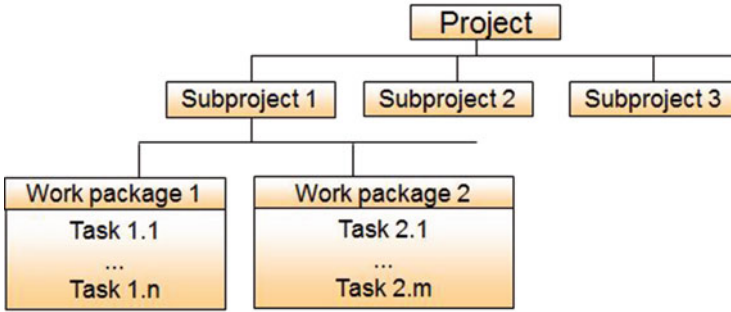
Fig. 3.11 Elements of a work breakdown structure

people work on a work package. If work packages are too large, additional divisions are possible, for example:

– Main work package
– Work package
– Sub-work package

• Tasks

Depending on the granularity and dynamic of the project, the tasks will be defined within the work packages. The tasks are listed as contents of the work packages, typically in the work package descriptions. They are the smallest entities in a project, quasi the "atoms (elementary particles)".

The quality of the WBS depends on the complete description of all project-related objects and/or activities and especially of the resulting work packages.

What has to be known about work packages?

Work packages are the lowermost objects of the work breakdown structure. They should be unambiguous and verifiable, without contradictions and overlapping to other work packages. The chronological order does not play a role yet; discussions about timescales during the structuring of a project should be prevented.

The aim of work packages is an assignment of costs, resources, and expenditure of time as clearly as possible. The scope of a work package could be very different: from a simple concluded activity (design of a template) to an entire assignment (development of a webshop).

For reasons of clarity and demonstration of connections, a homogeneous granularity of the work packages is recommended. Oversized work packages make it more difficult to keep an overview of the project progress. Work packages too small lead to high administrative effort.

A work package covers:

• Responsibility

A representative should be listed. A processor has to be named, if applicable.

- Task description
  Content-related description of the tasks in detail, services to be provided, and the expected work products.
- Acceptance criteria
  When is a work package successfully processed? Acceptance criteria have to be defined by the person who will receive the working result.
- Processing time
  The time needed is estimated. It should be done by the processor.
- Resource requirements
  This covers staff to engage, material requirements, and possibly external services as well as estimated costs.
- (Optional) Unique numbering in the WBS
  A numbering system is especially in large projects advisable for a better and unambiguous assignment.
- (Optional) Interfaces to other work packages
  To optimize cooperation in the project, to avoid losses caused by frictions, and to illustrate dependencies, the interfaces to other work packages should be specified.
- (Optional) Quality assurance measures
- (Optional) Risks
  Hint: consideration should be given for risks identified in the work packages to be processed centrally in a project risk management.

How should a work breakdown structure be arranged?

The structuring of a project can follow different criteria; accordingly, different arrangements of work breakdown structures are possible:

- Function-oriented WBS
  A structuring follows activities that make an allocation to functional areas easier. It is appropriate for service projects like a company celebration or cultural events. Figure 3.12 shows an example.
- Object-oriented WBS
  Here all relevant objects or parts of the projects are listed, like hardware, software, documents, etc. It is illustrated by example in Fig. 3.13. Concerning products the result is an overview of the individual components and parts in the form of a bill of material (BoM).
- Process-oriented WBS
  The depiction follows a chronological order, for instance, in the form of a development process with the activity analysis, design, and implementation. Figure 3.14 shows an example.
- Mixed oriented WBS
  Often a pure object-oriented or function-oriented structure could not be established; thus, in practice often mixed structures arise. In Fig. 3.15 the structuring was made in the first level following process oriented and in the second level partially object oriented.
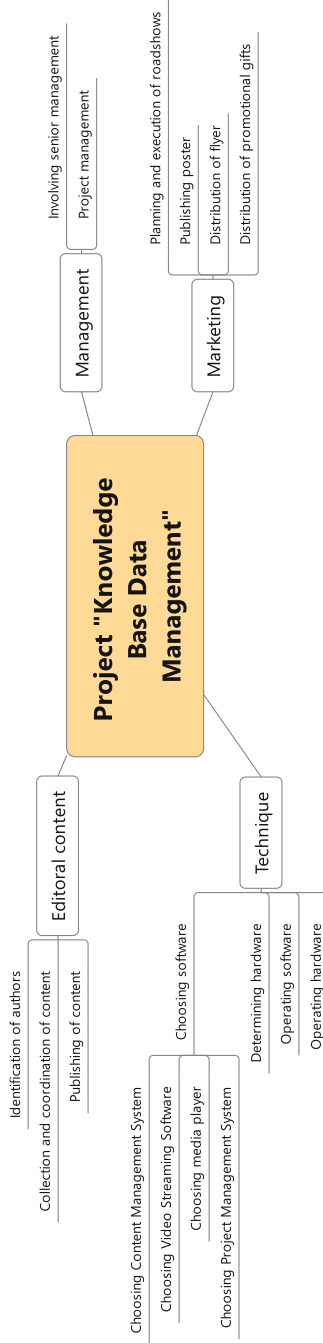
Fig. 3.12 Example for a function-oriented WBS
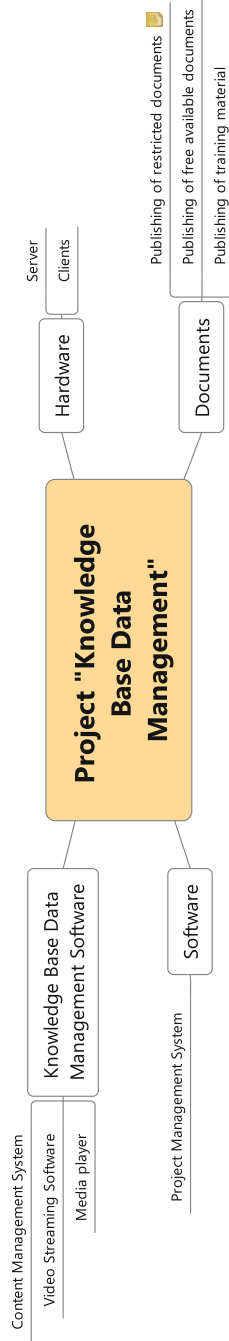
Fig. 3.13 Example for an object-oriented WBS
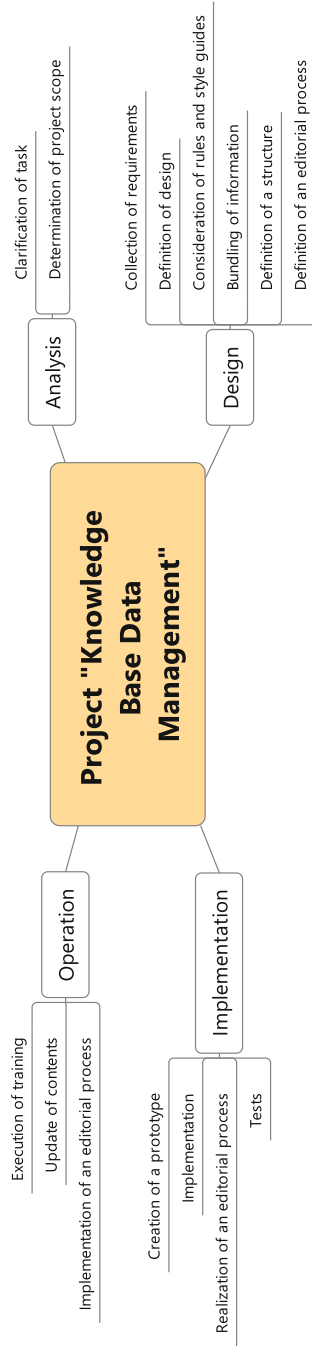
Fig. 3.14 Example for a process-oriented WBS
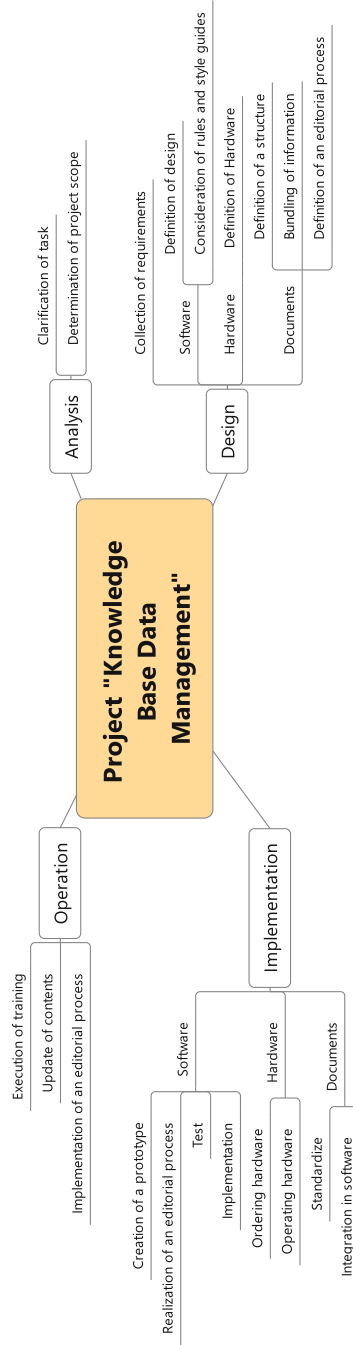
Fig. 3.15 Example for a mixed oriented WBS

What can be done with the completed work breakdown structure?

Depending on the size and complexity of the project from the work breakdown structure, the following can be derived:

- Time schedule (see Sect. 3.2.4)
  This covers the time planning and milestones.
- Resource plan/cost schedule (see Sect. 3.2.5)
  This covers personnel costs and material costs as well as the required budget. It serves as the basis for the effort estimation.
- Employee requirement (see p. 91)
  Depending on the project, different professional competences are required that should be covered completely in the project.
- Risk analysis
  From the working packages, concrete risks can be identified (see Sect. 2.6).
- Planned documentation and communication in the project

How is a work breakdown structure prepared?

There are two main approaches to generate a work breakdown structure (compare Fig. 3.16):

- Top down—deductive procedure—from the general to the specific
  Starting from the project objective, the subprojects and finally the work packages are designed.
  Recommended for clear projects.
- Bottom up—inductive procedure—from the specific to the general
  First, all work packages related to the project objective are collected. In the subsequent step, the work packages are grouped to subprojects.
  Reasonable for projects not easily accessible.

Is more information available concerning the work breakdown structure?
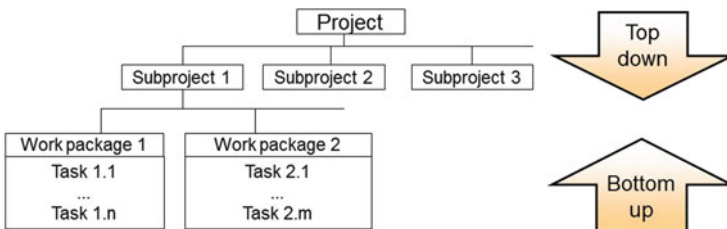
Fig. 3.16 Top down and bottom up

The following are hints related to the work breakdown structure:

- Reuse of existing work breakdown structures
  It should be analyzed if it is possible to refer to work breakdown structures of similar projects.
- Preparation of a work breakdown structure in a team
  As basic project planning activity prepare the WBS preferably together with the project team or in larger projects with the core team. As a method it is recommended to do a joint structuring with a metaplan board and facilitation cards. This offers a good overview. Furthermore, assignments can be updated flexibly and quickly.
- Usage of external know-how
  Refer to (project) external specialist expertise to structure a project.
- Working with pictures and figures
  The WBS should be visualized in a prominent position so that the project team has a complete project overview.
- Considering effort for project closure
  Often project results are transferred during the final project activities. This effort should not be underestimated and considered in planning (compare Sect. 3.4).
- Check regularly
  It is important that the WBS is up-to-date during the entire term of the project.
- Measuring the project progress based on the work breakdown structure
  The WBS can be prepared in a project management software. The progress in the project could be documented as well, e.g., when work packages are completed. If regularly maintained, a current picture about the project status is given. Examples include MS Project [4], Jira [2], and ProjectLibre [6].

Figure 3.17 shows a checklist for a work breakdown structure.

3.2.4 Time Schedule

The time schedule arranges the work packages identified in the WBS to a realistic project procedure.

> **Time Schedule**
> The time schedule is part of the project plan and represents the chronological sequence of a project with start, end, and milestones. It shows graphically the duration of the separate work packages in a project, for instance, in using bar charts or flowcharts.

The following procedure is possible:

- Definition of the order of work packages
  Work packages are brought into a chronological order.

Checklist work breakdown structure (WBS)

Question	Result
1. Procedure to prepare a work breakdown structure (WBS)	
a. Is it decided what method to follow? Inductive (bottom up) or deductive (top down)?	
b. Were all project related tasks completely collected by people affected?	
c. Have the tasks been structured and assigned to subprojects as well as work packages (main or sub work packages)?	
d. Are responsibilities assigned?	
2. Takes the breakdown within the WBS place at the different levels (from project to subproject, from subproject to work packages) in each case into about five to ten comprehensible entities?	
3. Is there a subproject / work package „Project management"?	
4. Work packages	
a. Can work packages be assigned to team members with full responsibility?	
b. For every work package is there a responsible and a representative (pair principle)?	
c. Is there a profile of qualification with required capacities?	
d. Are the work packages described sufficiently precise with expected results and scope of work?	
e. Are not more than seven people working on a work package so that there is a manageable granularity?	
f. Is the work load of a work package at least a month (about 160 hours)?	
g. Is the duration of a work package not shorter than three months?	
h. Is the time required by individual work packages consistent with the time required by the whole project?	
i. Do the WBS and the time schedule match?	
j. Is the cost volume of the work packages in proportion to the total project costs?	
k. Do the WBS and the resource plan/cost schedule fit together?	
5. Has the WBS been coordinated with the project members?	

Fig. 3.17 Checklist work breakdown structure

- Temporal sequence of the work packages
  After coordination with the responsible person, the project manager defines in a timeline for every work package a start date and an end date. The temporal arrangement depends on the duration of the work packages, buffer time, and availability of resources. Additionally, dependencies to the resource plan/cost schedule have to be considered.
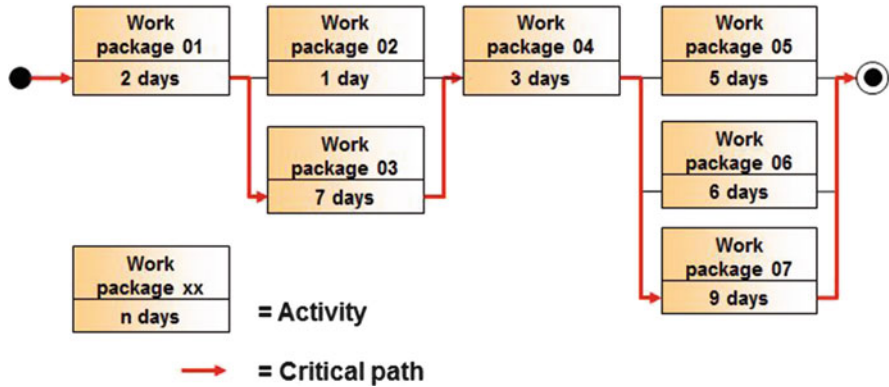
Fig. 3.18 Example for a critical path

- Determination of the milestones
  The start and end dates are synchronized and linked to milestones.
- Revision of the plan
  Temporal dependencies (e.g., a subsequent work package requires working results of another work package) and resources available limited in time (e.g., expensive tools) result in constraints for the time schedule of the whole project.

The time schedule could be prepared by using a forward calculation beginning with the project start or in computing backward from the proposed project end date.

Work packages, where start and end dates cannot be moved, define the critical path. If the processing times of the work packages change and they are part of the critical path, it directly affects the duration of the whole project. Figure 3.18 shows an example.

Milestone/Milestone Plan
Synonyms are *Stop-or-Go point, quality gate*, or *review point*.
According to DIN 69900:2009 and the PMBOK, a milestone is "a significant point or event in the project" [1, 5].

It is an implementation of intermediate goals with an important project result. Milestones are a substantial part of project management, especially of the project control. Often they define a phase transition.

A milestone covers:

- A date
- Expected results with verifiable criteria

Contents of a milestone plan are:

• Project start date
• Different milestone dates
• Project end date

Milestones give an orientation for important events such as go-live dates, fair dates, or steering committee meetings. They summarize end dates of one or a number of work packages. This results in a phased plan. This phased plan should be coordinated with the principal. In that way activities from the WBS converge into milestones. Beside the acceptance criteria related to the work packages, additionally separate quality criteria related to the acceptance of milestones can be defined.

The number of milestones should be defined related to the size and the duration of the projects. A number of maximally eight to ten milestones have been proved effective in practice. Figure 3.19 shows an example for a milestone plan.

The following steps usually apply per milestone:

• Planning
• Execution
• Review
• Closure

This means specifically for the milestone planning:

• The next milestone has to be planned in detail in terms of content.
• The next but one milestone has to be planned concerning date and headline level.
• The overall plan has to be adapted and updated.
  Conflicts regarding dates and scope of milestones have to be detected and solved.

The following planning techniques can be used:

• Bar chart (compare Fig. 3.20)
• Network technique using forward calculation or backward calculation
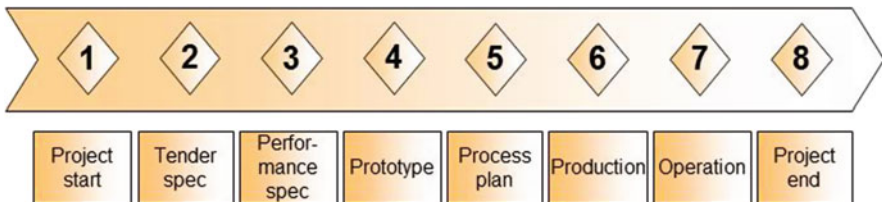
Fig. 3.19 Example for a milestone plan
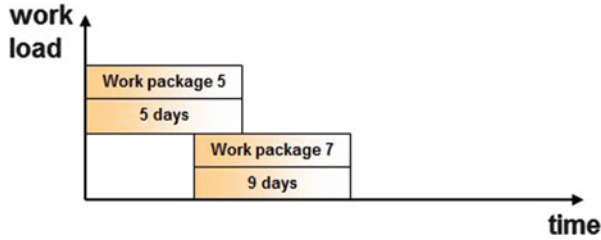
Fig. 3.20 Example for time schedule—bar chart

Checklist time schedule

Project name		Project No.	
Responsible			
Version / Date		Status	

Question	Result
1. Is there a work breakdown structure (WBS) as a basis for the time schedule?	
2. Milestones	
a. Does the number of milestones fit the size and duration of the project?	
b. Is the next milestone planned in detail, coordinated, and decided?	
c. Is there a fixed date for the next milestone?	
d. Is the next but one milestone defined regarding heading level and date?	
3. Are influences by other projects considered in the time schedule? Was there a corresponding coordination with other projects?	
4. Is the critical path defined concerning dependencies and duration?	
5. Completeness of the time schedule	
a. Were further education and training periods taken into account?	
b. Were holidays, holiday seasons, sick leave, and absentee time considered?	
c. Are additional time buffers included?	
6. Is the time schedule consistent in the project? Does the sum of times of the working packages fit the overall schedule?	
7. Has the time schedule been coordinated and reviewed by the project team?	

Fig. 3.21 Checklist time schedule

• Milestone planning

Figure 3.21 shows a checklist for the time schedule.

3.2.5 Resource Plan/Cost Schedule

The objective of the resource planning and cost scheduling is the calculation of the overall project costs.

Resource Plan

The resource plan is part of the project plan and describes what personnel costs and material costs are required to master the project.

Typically the most important resource in projects are people; therefore, the largest part of resource planning is the personnel planning. So, sometimes the term is extended to "personnel and resource planning".

The estimations are normally based on the estimated effort of every work package in the WBS.

Cost Schedule

The cost schedule is part of the project plan. DIN 69901-5 defines the cost schedule as "representation of the expected costs of a project". Optionally, the costs over time are part of the cost schedule [5].

The project and naturally the project members require resources. Resource planning estimates and plans the required resources. As a budget is required for resources, normally the resource planning is done in parallel to the cost scheduling. Especially in the matrix project organization (see Sect. 3.2.6), it should be clarified during resource planning which resources in what volume could be provided by the line organization. The resources in a company and especially in the project should be optimally utilized to capacity.

The following distinctions can be made:

- Material costs
  These costs cover, for example, suitable premises, machines, tools, IT infrastructure, office equipment, IT tools like development environments, test tools, and so on.
- Personnel costs
  Costs occur for the project manager and every collaborating person in the project. To be noted are different required capabilities with different costs, internal or external specialists, resource bottlenecks, time, and spatial availability. Depending on the kind and size of the project, a separate personnel plan might be required.

- Other costs
  Costs that cannot be assigned to material costs or personnel costs, like travel expenses or expenses for advertising material.

From the practical experience of the authors, the cost estimation is mainly done based on the WBS and the work packages listed there. Therefore, every work package reports corresponding budget figures, and these get added for the subprojects. Finally, a cost estimation for the entire project is made. The key element is the quality of the budget figures reported by the work packages. They should be checked and critically scrutinized as required: has the loss of resources (holiday, sick leave, training) been considered? Has the communication effort for meetings and workshops been considered? Is a need for qualification and job training included? Have quality measures like reviews and training courses been calculated?

In addition, the following procedures are known to estimate the costs of a project:

- Simple estimation with a description how the estimation has been done
- Cost estimation following phases with personnel or material costs
- Expert estimate
  The Delphi method has proven its worth [10]. In a multistage process, several experts are consulted. Every expert estimates independently from others' efforts, for instance, for work packages. The results are brought together. If there are major differences, justifications are collected and the experts reconsider their estimations. The objective is to reach a consensus in a defined tolerance range.
- Comparison with similar projects
- Algorithmic cost model
  An example of this is the Constructive Cost Model (COCOMO) by Barry Boehm for IT projects [9]. It is an algorithmic model that calculates the required man-months and the project duration based on company-specific parameters like code lines to be delivered and the complexity of the project.

For the estimates risk premiums have to be considered. The execution of cost estimation workshops has been proven effective. The Scrum method, for example, uses "planning poker" to do an effort estimation for specific tasks. The project members use "planning poker cards" to estimate over some rounds the efforts of defined tasks. Every member has the same card set. Everyone chooses the card with a value representing best the convenient effort for the task to be estimated. As soon as everybody has finished, the cards are called by turning them over, and the estimates are compared. If there are differences in the estimations, people exchange views and play another round. The goal is to finally find by consensus an estimation that is acceptable to all.

An example is shown in Fig. 3.22.
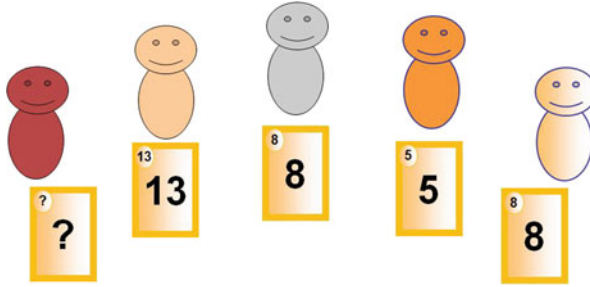
Fig. 3.22 Example for "planning poker"

The personnel resource plan is based on the efforts of every work package in the work breakdown structure. These will be estimated in the following steps:

1. Estimation of the amount of work
   For this purpose experience from similar or previous projects is helpful. The person concerned has to be integrated.
   Example: the person concerned estimates ten man-days' effort.
2. Estimation of the extent that the employee could work in the project
   Example: because of additional commitments, the employee could work only 25 % of the time he is available in the project.
3. The actual overall demand results from the amount of work divided by the work intensity
   Example: outcome is (10 days/25 % =) 40 days total duration.
4. Adaption of the total duration
   If the work can be easily distributed without additional efforts, then a simple adjustment of the total duration considering the number of simultaneous available project collaborators is possible. But it has to be noted that not every task can be divided in any desired way.
   Example: without considering increased training efforts, additional communication requirements, calculating with two employees results in (40 days/2 =) 20 days total duration.

A proposal how to proceed for the personnel planning is:

- Identification of the personnel requirements
- Determination of the available capacity
- Comparison of requirements and capacity
- Capacity balancing or optimization of capacity, dates, and costs

Figure 3.23 presents a checklist for the resource plan/cost schedule.

Checklist resource plan/cost schedule

Question	Result
1. Is there as a basis for the resource plan/cost schedule a work breakdown structure (WBS)?	
2. For what period is the resource plan/cost schedule valid?	
3. Is it defined, when a target-actual comparison will be executed, and when updates are planned?	
4. Effort in the work packages	
a. Is the required communication for meetings and workshops considered?	
b. Are qualification needs and training requirements planned?	
c. Has it been considered that a project member optionally has to train new staff?	
d. Are quality measures like training, preparation, or revision of the results of one's own work, review activities, or lessons learned considered?	
5. Effort estimation	
a. Have the efforts been estimated by the project members themselves?	
b. Are there expert estimations, e.g., from systematic estimation workshops?	
c. Is there experience from similar projects that can be used?	
d. Have effort estimation procedures been used like COCOMO?	
6. Personnel planning	
a. Is there a recruitment plan (for external or internal staff)?	
b. Did the responsible manager agree to release resources for the project?	
c. Is there a plan for when which project members will be engaged in the project for what period of time?	
d. Is the capacity utilization balanced?	
e. Is it ensured that the workload per person is about 80 % in the long term, and if so, then does it only temporarily exceed 100 %?	
f. Are there reserves for a shortfall of personnel due?	
g. Has the workload resulting from other projects or line work been considered?	
7. Is there a spatial planning? Are there enough workspaces, meeting rooms, computers, office material? Has lead time been considered?	
8. Are there commitments for all required resources?	
9. Are there reserves for risks?	
10. Is the cost schedule consistent in the project (Sum of costs of the work packages to overall project costs, comparison of cost categories, accounts)?	

Fig. 3.23 Checklist resource plan/cost schedule

3.2.6   Project Organization

Project Organization
DIN 69901 defines the project organization as a "totality of the organization entities and the rules for the structural and procedural organization to execute a particular project". Possible organization forms[1] are:

- Pure functional project organization (following division, departments)
- **Functional project organization**
  Synonyms: *influence project management, influence project organization, project coordination*
- **Matrix project organization**
  Synonym: *matrix project management*
- **Pure project organization**
  Synonyms: *pure project management, task force*
- Project society

The project organization covers:

- Roles like principal, project manager, controller, and so on
- Committees like steering committee, core team, project team, extended project team, or expert working groups
- Organizational arrangements, like a project handbook
- Organization chart of the project including reporting and decision-making paths

The form of project organizations as listed above is characterized as follows:

- Pure functional project organization
  Here the project management is relatively less important. The project is processed in a given organizational structure; the line work however takes priority. Advantageous is the better access to the project members. The risk is that the given hierarchy is preserved in terms of strengths and weaknesses.
- Functional project organization
  In this organization form, the project members stay in the line organization. The project manager has no direct access to the project team but advises and mediates between the participating departments. As he is reporting directly to the executive management, he nevertheless has a big influence on the project.

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[1]The most important are highlighted in **bold** characters.

- Matrix project organization
  This is a mixed form between a pure project organization and a project coordination. Responsibility and authority are divided between the project manager and the participating line functions. Project members are with a certain percentage part of the project, but they remain as staff members in the line organization. Advantageous is the possible better handling of workload fluctuations. The risks are conflicts that can occur because of unclear responsibilities in dual supervisions, as well as contradictory demands of the line organization and the project organization.
- Pure project organization
  For the duration of a project, the people working on the project are allocated to an independent unit in the organization. They are no longer part of the line organization. Advantageous is that all relevant resources to achieve the project objectives are available.
- Project society
  The company's purpose is a project.

Which project organization to choose depends on the size and kind of project, the corporate culture, the available resources, and the urgency. Concerning the project organization at different companies, it plays a role how intense a project is involved in a line organization: the less involved in a line organization, the more independently a project can act. The project organization covers all organizational units and arrangements to implement a project. It describes what roles there are in the project, and how the roles in the projects interact. Every role is assigned to tasks, competencies, and responsibilities. Finally, a role is assigned to a specific project team member.

Project Roles and Boards
The typical most important roles and boards in projects are:

- Principal
  Synonyms are *executive* or *sponsor*.
  The principal is the highest decision-taking body in the project and provides the project manager with the required resources. The principal has the most important role.
- Project manager
  Synonym is *project lead*.
  The project manager is fully responsible to reach the project objectives as committed to the principal.
- Project team
  The project members are responsible to the project manager to get their content work done.

(continued)

> • Steering committee
>   Synonyms are *review board* or *steering board*.
>   If there are a number of organizations affected by a project, then they send
>   their representatives into a steering committee. From the organizational
>   point of view, it is recommended that the project manager reports to the
>   steering committee and that only the steering committee is authorized to
>   give instructions to the project manager.

Especially in larger projects there is an additional project management office
(PMO) role. This role supports mainly the project manager concerning administra-
tive tasks. By arrangement other project members are supported as well.

Figure 3.24 shows how an overview of tasks and responsibilities with corre-
sponding project roles can be visualized by using a RACI matrix.

The project organization shows who is reporting to whom and who approves
what results. The following principle should apply in a project organization (see
Fig. 3.25):

• Decisions top down[2]
  Steering committee ⇒ Project manager ⇒ Subproject manager ⇒ Project
  member

ID	Tasks	Roles	Principal	Project manager	Project member 1	Project member 2	Project member 3	External consultant
1	Formulating project order		C	R				
2	Signing project order		A	A	I	I	I	
3	Situation analysis		I	A	R			
4	Project organization and optimization		I	A	I	I	I	C
5	Work package 1			A			R	C
6	Work package 2			A		C		R

R = Responsible - working on the task
A = Accountable - delegating and approving the work
C = Consulted - typically expert on subject
I = Informed - interested in progress

Fig. 3.24 Example for a RACI matrix

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[2]Regarding decision culture, see also Sect. 2.2.4.
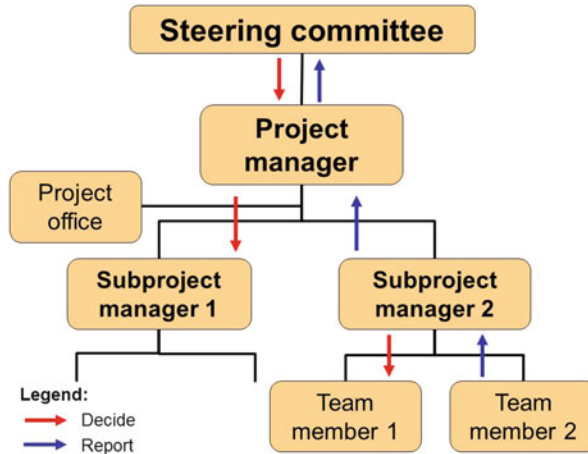
Fig. 3.25 Organizational chart including reporting and decision-making paths

- Reporting bottom up
  Steering committee ⇐ Project manager ⇐ Subproject manager ⇐ Project member

The following are hints concerning structuring and buildup of a project team:

- Manageable subprojects
  Depending on the size and complexity of a project, it is recommended to create several functional subprojects including a corresponding subproject manager for the technical supervision, if required at several levels. The project should be divided in the way that every sub-team has not more than seven persons.
- Social mixture
  From the project experience of the authors, it would seem the more heterogeneous a team, the more powerful. Therefore, it is suggested to bring together in a team:
  – Female and male
  – Old and young (experienced and new ideas)
  – Different nationalities
- Combining different competences
  Try to bring broad knowledge into the teams:
  – Technical knowledge/commercial knowledge
  – Method knowledge/specialist knowledge
  – Generalists/experts
  – Practitioners/theoreticians
- Resource assignment for project members
  Especially in mixed organizations a resource conflict can occur if project members are "servants of two masters", as they have to fulfill a line function in

parallel to the project work. In this case binding agreements are recommended, such as how many hours of the weekly working time can be spent for project work.
- Establishing of pairs
The better the people work together in a project, the more successful it is. The work efficiency can be increased when people work intensively together in teams. For instance, one project member could process, while another project member reviews in parallel, with subsequent reversal of roles. The pairs should be constantly newly formed, so a good cooperation in the project team can be achieved.

  For details see Fig. 2.4.
- Establishing of relationships with the line organization
Especially in matrix project organizations, the project team members come from the line organization. It is worth integrating many parts of the company to have corresponding access to a wide range of company know-how.

An organizational chart (example in Fig. 3.25) shows the project roles, their relationship to each other, and additionally the communication paths within the project. It could also list different meetings and their frequency. Figure 3.26 shows a checklist for the project organization.

3.2.7   Plan Optimization

During the planning process, there is time and again new information to be considered. Even interactions are possible: Resources that are only available at specific times result in an updated schedule planning. An iterative approach is recommended to optimize the given plan step by step to come closer to the "ideal plan".

There are the following optimization possibilities:

- Resources
  - Absence planning
    The planning should be done in the way that the availabilities for the project are optimized. To be considered are line tasks, tasks in other projects, or absences because of vacation or a training program.
  - Load balancing
    Work overload on the project members should be avoided.
- Dates
  - Use of the network technique
    An optimized plan can be reached by using the network technique. The calculated critical path helps to identify the shortest possible duration of a project.

Checklist project organization

Project name		Project No.	
Responsible			
Version / Date		**Status**	

Question	Result
1. Does every project member know the principal?	
2. Is it clear who the project manager is?	
3. Project team	
a. Does everybody know who the members of the project team are?	
b. Are the tasks and roles of all team members defined in common and accepted by all?	
c. Are strengths and weaknesses in the team compensated?	
4. Project member	
a. Especially in a matrix project organization: Are project objectives and the involvement of employees in the project agreed on the corresponding responsible managers?	
b. Are all project members motivated? Do individuals' targets correspond to the targets of the project?	
c. Are all capabilities of the project members known?	
d. Do the capabilities of the project members match with the needs of the project?	
e. If capabilities are missing in the project: is it clear, how the required knowledge is to be developed or how external support can meet the needs?	
f. Are the tasks in the project clear?	
g. Is every project member able to spend the time needed for his tasks?	
h. Has every project member the competences required to complete his tasks? Have training measures been taken, when necessary?	

Fig. 3.26 Checklist project organization

- – Buffer planning
  A temporal buffer should be considered, as well as risk premiums in determining dates.
- Costs
  Even if the cost estimations cannot be reduced anymore, sound practice can be used in the project:
  – Cost-intensive work packages should start late.
  – Risky work packages should start early.

The advantage is that during the project execution it is possible to validate the estimations done and to correct them as required. Moreover, one tries to minimize the actual project costs when it becomes known that the project will fail.

Even when planning is done, during the implementation phase of a project, the plans have to be checked again and again and to be adjusted if needed. This is to ensure that outdated plans are not executed.

3.2.8 Plan Alignment

After the overall project plan has reached a relevant maturity, coordination with important stakeholders should be done. For example, in a matrix project management organization, the communication with the supervisors of the project members is particularly important. Finally, the plan has to be coordinated with the principal. Depending on the project organization, the steering committee has to be involved as well.

It is important to be able to react to suggestions about improvements, additional risks, or criticism even before presenting the draft versions. The plan can then be updated, or one can seek an acceptable compromise.

3.2.9 Project Kickoff

After finishing the project planning, the project kickoff is an essential component of successful projects. The objectives of a kickoff are:

- Mediation of the project objectives
- Information about the project plan
- Motivation:
  - The project is important. Decision-makers support the project as well.
  - The project members get to know each other.
  - Community spirit: it can work!
- The start is clear: conflicts are solved, and critical topics are clarified.

Take your time for a successful project kickoff. It should be planned exceptionally well. Potential "savings" concerning this activity are as a general rule counterproductive: one has to pay the price later during the course of a project.

At the project kickoff the complete team has to be present. The supervisors of the project members should participate as well—they have to release their staff for the project and that is why they have to be well informed about the project. The more political a project, the more important is this aspect. One should be consequent: if too many supervisors are missing at the kickoff, cancel it. Give feedback to the principal and clarify further proceedings.

In large projects the project kickoff might be split: first there is a project start-up meeting and then the actual project kickoff with the principal. It is possible as well to limit the project kickoff to a core team (with about a maximum of eight to ten people). Where appropriate a difference can be made between an internal and external kickoff if, for instance, several companies are involved.

The first meeting offers the possibility to set the foundation for successful teamwork. The project members can get to know each other, build confidence, agree on objectives and expectations, and adopt a joint approach to the project.

If successful in directly involving the individual team members, one can tap the creative and constructive potential of the project team. By good planning of the venue, for example, external, it can be prevented that the participants are distracted or disturbed. The project kickoff offers a good opportunity to inspire in good time all parties in the project, to establish the preconditions for the good development of the project, and to achieve a constructive cooperation.

The agenda of a kickoff meeting might include the following items:

- Round of introduction
- Official opening of the project with the principal
  Presentation of the history and status of the project and depiction of future collaboration with the principal
- Project objective
  Why do the project and the project team exist?
- Project plan
  Presentation of the results of planning:
  – Work breakdown structure
  – Time schedule with milestones
  – Resource plan/cost schedule
  – Presentation of risks
- Project organization
  Introduction of the project organization and the project members with assigned tasks and responsibilities
- Communication
  Outline how to communicate in the project, such as frequent project and executive meetings, status reports, and reviews. Stating of the project rules.
- Documentation:
  – Agreement about the documentation in the project such as timetable, reporting system, and minutes
  – Definition of the document management
    Description where to leave project data, e.g., in a document management system or on a common drive
- Quality
  Description of the quality goals of the project and how these should be reached
- Tools
  Introduction of the tools used

- Change management
  Presentation of the change management process
- Outlook:
  – Presentation of the next milestone in detail
  – Rough presentation of the next but one milestone

Depending on the size of a project, the duration of a kickoff is several hours or a few days. A kickoff for several days might make sense to start already with some content work to coordinate the next steps in a work package. An external moderation is the more recommendable, the larger the project is.

3.2.10 Checklist

Figure 3.27 presents a checklist for the planning phase.

3.3   Realization Phase

> The key is in action, not in words.
> *Louis R. Hughes (*1949)*

Synonyms for the realization phase are *execution phase* or *implementation phase*. This section describes how a project can be controlled by means of milestones, a useful controlling, and status reports or interim reports. The traffic light logic has been proven as a simple but effective tool. After working through this section, it should be clear how a good planned project could be executed and controlled successfully.

3.3.1   Objective/Results

The aim of the realization phase is the achievement of the defined project goals. Depending on these project objectives is the result to be achieved: it can be a service, a product, a document, or something similar. The scope management ensures that all project activities focus on the implementation of the tasks from the work breakdown structure.

The objective is achieved by a successful approval by the principal. Concerning technical projects, it can be the delivery of the developed product to the systems operation. Abstractly summarized the following results are possible:

- Project success
- Partial project success
- Project cancellation

Checklist planning phase

Question	Result
1. Project objective	
a. Are the project goals and the subproject goals clear to every project member?	
b. Can everybody optimally use his capabilities to achieve the project goals?	
2. Project plan	
a. Are all required plans available (work breakdown structure, time schedule, resource plan, cost schedule)?	
b. Is in each case the (temporal) matching of the plans ensured?	
c. Is the documentation of the project plan sufficiently voluminous?	
d. Is the project plan comprehensibly displayed in form of a presentation, a list, a bar chart, or similar?	
e. Has the project plan been jointly agreed by the project team?	
f. Has the project plan been communicated and is it accessible for the project staff?	
g. Does everybody know what has to be done with which expected result by when?	
h. Is it ensured that the project plan gets updated regularly? When will be the next version available?	
i. Is the duration and are the costs of the planning phase documented?	
3. Is the project organization clear?	
4. Are aspects of the project culture considered?	
5. Project communication	
a. Is the project communication controlled? Is there a communication plan?	
b. Is the communication in the project ensured so that every project member receives the information that they require?	
6. Project marketing	
a. Is the responsibility for project marketing assigned?	
b. Are project marketing activities defined?	
7. Are company-wide specifications, such as corporate identity and the usage of company-specific templates, fulfilled?	

Fig. 3.27 Checklist planning phase

3.3.2   Summary of Tasks

To execute a project successfully, the following tasks have to be done:

- Executing the project controlling
  This ensures that the technical and economic project objectives are achieved.
- Completing work packages
  The tasks should be completed with the resources made available within the agreed period.
- Updating the planning (dates, work packages)
  Continually, the deadlines and work packages are to be adjusted.
- Controlling deviations
  Caused by deviations in the project, new tasks can emerge or given tasks can change. These duties have to be arranged. This can be done by the project manager himself or he can delegate this function, for instance, to the subproject managers.

Challenging is the milestone management (compare Sect. 3.3.3). The central aspect of the project management is continuous communication (see Sect. 2.3), especially with the background knowledge that projects can fail because of poor communication.

The regulated communication should cover at least:

- Regular meetings with the principal
- Regular project meetings
- Meetings of working groups
- Regular meetings with the project members and individual meetings as needed

3.3.3   Milestones

Figure 3.28 shows that the structuring of the realization phase results in milestone cycles. Such a milestone cycle basically represents again a project in miniature. This means that proceeding from one milestone to the next milestone complies with the proceeding in a project with the phases strategy, planning, execution, and closure.

During a milestone cycle, one focuses on the objectives of a given milestone. The related phase contents as presented in this book are to be examined and to be tailored, so they match the respective project needs. In a strategy phase for a milestone, it should be clarified, if the present project order is still valid or if it has to be updated, for example, if the framework conditions have changed. Related to the planning of a milestone, a separate work breakdown structure will not be required nor any additional project organization. However, new work packages are feasible, as well as changed content of work packages or changes of deadlines of work packages.
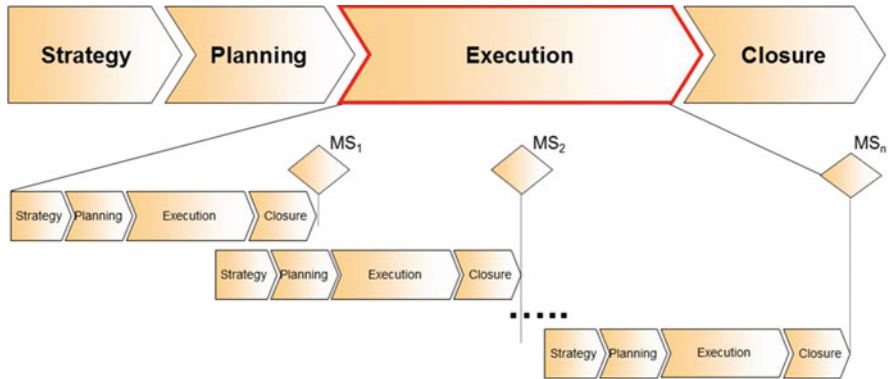
Fig. 3.28   Realization phase with milestones

To be considered is a possible overlap. Parallel to project realization work for the next milestone, strategic and planning activities for the next but one milestone can be executed.

The milestone management covers:

- Preparation of milestone meetings
  It has to be ensured that all the planned working results or the corresponding status are delivered up to the respective milestone.
- Execution of milestone meetings
- Post-processing of milestone meetings
  The minutes are to be finished and distributed. It has to be organized and ensured that any action items arising from the milestone meetings are completed.

A milestone meeting is usually executed on the milestone date itself but in exceptional cases also shortly before or shortly after. The following content is normally discussed:

- Comprehensive information and presentation about the current status to the project participants, especially to the steering committee
- Approval of milestone related working results after presentation and review
  It is possible concerning a working result that there is a need for updates or improvements. If these are extensive, then the working results have to be presented again in a follow-up meeting.

In agile projects it has proved successful, after the completion of a milestone, to execute or to adapt the detail planning of the next milestone. The next but one milestone should be planned concerning dates and on heading level.

After the completion of a milestone, conflicts because of dates and scope of future milestones should be discussed and resolved. Finally, the whole project plan has to be adapted and updated.

3.3.4   Project Controlling

Measure what is measurable, and make measurable what is not so.
Galileo Galilei (1564–1642)

Project Controlling
According to DIN 69901-5:2009, the project controlling covers the data collection, the analysis and evaluation of deviations of the plan, the preparation and planning of corrective measures, as well as the management and implementation of these measures.
  The project controlling comprehends:

- Target-actual comparison
  If any deviations have taken place, especially concerning budget and resources used, a cause analysis is required.
- Evaluation of the consequences of new findings and events influencing the course of the project (positive and negative)
- Development, planning, execution, and controlling of corrective actions
- Update of the planning and analysis of the further course of the project

The project controlling comprises the following three aspects:

- Project monitoring (*past of the project*)
  At first the status of the project has to be considered. Is the project still on track? What has been achieved so far? Present difficulties arising like delays or increased resource consumption must be visualized and analyzed. What are the reasons? Are there indications of systematic problems that need to be addressed? What are the consequences of these difficulties?
- Project control activities (*present of the project*)
  Concerning the current project situation, an intervention has to be done as necessary. Occurring problems are to be analyzed and addressed; decisions have to be taken.
- Trend analysis (*future of the project*)
  How is the further course of the project? If required measures are to be taken like the change of objectives or the adaption of the timeline.

The objectives of project controlling are:

- Always knowing the current degree of fulfillment and the remaining effort
- Doing a good job and ensuring that all project members can do a good job as well
- Always having an updated plan

Often the project manager is supported by a project controller. He attends the project, for instance, as an external professional, ideally right from the start. His essential tasks are the analysis and the reporting about the project situation as well as the evaluation of the project and introduction of the appropriate countermeasures as required. For this he needs social skills and experience to act appropriately in the team. Additionally, methodical expertise is required for a structuring approach.

3.3.5 Project Monitoring

Project monitoring is the precondition for an efficient project control. Simplified the idea of project monitoring could be summarized by the following questions:

What do we want? Where do we stand?

A regular target-actual comparison is recommended, e.g., once a month or related to the milestones. Within the scope of Scrum, there is a daily short meeting called "daily scrum". It lasts a maximum of about 15 minutes. The main idea is to establish a regular exchange in the team. Based on this idea, one should think about introducing a daily fixed short date. The project manager can invite the team to such a regular appointment to talk to them. Every project member gives feedback:

1. What have I achieved since the last meeting?
2. What do I plan to do until the next meeting?
3. What issues are there? Where do I need support?

Especially the third point provides the responsible people with the opportunity to respond and react to problems in time.

The project monitoring covers:

- Target-actual comparison
  This might be achieved in the following ways:
  - Use of project key figures
  - Progress—content-related progress control, oriented by the project goals
  - Schedule control—based on the time schedule
  - Cost control—based on the cost schedule
- Presentation of the project progress
  Status reports or interim reports are recommended.

- Milestone management
  Within the scope of milestones, there is an intense reflection about the current project status. Sufficiently in advance of the milestone date, the project members are informed and asked to prepare their working results. The milestone meeting has to be prepared, executed, and recorded. After that rework and tasks identified have to be completed and the task fulfillment to be tracked.
- Considering change requests
  Section 2.1.4 discusses the handling of requirement changes in the project. It is recommended to collect and to process the most important change requests for a milestone date, if they could have a big influence on the project. They can be purposefully discussed and it can be decided how to proceed further.

3.3.5.1 Content-Related Progress

The biggest challenge in the project control concerning the target-actual comparison is the measurement of the content-related progress. It is the most important as well as the most difficult monitoring task. How can the stage of completion of a work package be determined? The measurement of the degree of completion using percentage figures is treacherous and dangerous. Well known is the "90 % trap": at a specific date, the project member indicates that he has achieved about 90 % of the expected project result. This is explained through the fact that the approach is known but not the "unforeseen circumstances". These can result in many cases despite the clear solution approach in additional extensive effort, as disorders and unforeseen difficulties may delay the implementation. Therefore, especially for inexperienced project members, the effort estimations have to be questioned critically and are to be increased noticeably if required.

Without technical know-how, a measurement of the content-related progress is hardly possible; the respective projects are too diverse. As this book deals with the topic project management in general, the discussion of different content-related topics and possible measurable quantities of different projects is not possible. A project manager needs the project-specific professional skills. Expertise is required so that a progress control based on technical facts is possible. The following procedure is proposed:

- Definition of measured parameters and criteria together with the people responsible
- Evaluation of the quality of the current status based on a degree of maturity (status information)
  In the simplest case, only the status "in progress" and "done" are used.

3.3.5.2 Presentation of the Project Progress

The presentation of the project progress normally takes place with status reports. This should be done frequently every week, every 2 weeks, or once a month, depending on priority, criticality, size, and duration of the project. The status reports should refer to project goals and present the current degree of fulfillment. They serve on the one hand as information for the principal and on the other hand as protection
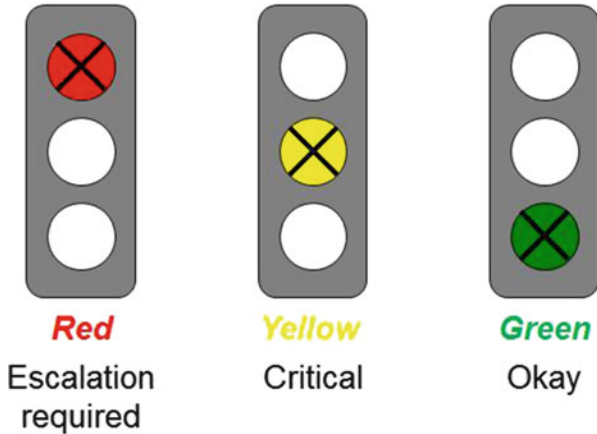
Fig. 3.29 Traffic light logic

for the project team. What have we achieved so far? Are we on the right track toward reaching our objectives?

As well as the target-actual comparison, for instance, in the form of project figures or key performance indicators (KPI), there is often a simple color representation using the traffic light logic (Fig. 3.29):

- Traffic light color **red**: escalation required
  There are serious difficulties; an escalation to the next responsibility level is necessary.
- Traffic light color **yellow**: critical
  There are issues but these can be solved within the organizational unit.
- Traffic light color **green**: okay
  Everything is going to plan. Problems which may have occurred can be solved within the normal workflows.

This traffic light logic can be used in all levels of a project: for the project itself, the subprojects, and the work packages.

3.3.6   Project Control Activities

The project control activities are, besides the project planning, the central tasks of project management. A good project control ensures that the project is implemented as planned. The execution of a project should be done as effectively (the goal is reached) and efficiently (with optimal use of time and resources) as possible.

Project control activities cover:

- Determination of the project closure or request for the discontinuation of the project

The main goal is of course a successful project closure. But even if a project has to be canceled, it is the noble task of a project manager to honestly admit the situation and to ask for a project cancellation (see Sect. 2.2.7).

- Approval of (partial) results of work packages
  Work packages as central units of a project are to be overseen and maintained by the project manager. The aim is the approval of the working results of the work packages. Furthermore, the project manager starts, attends (e.g., if there are changes), and terminates work packages.
- Description of results and of the status along with project presentations
  This is a part of the project communication. It helps to depict a project reasonably well and to show joint successes. With this the project culture can be influenced in a positive way. The minimum scope of project reports are the most important activities and achieved results during the reporting period, as well as the next planned activities.
  Potential changes of plans should be shown and be rationally explained. It makes sense to elaborate on plan changes in advance and to make consequences for the project transparent. Consequently necessary modifications of the plan result in follow-up activities regarding the plan optimization and reconciliation.
- Conflict management
  It is important to recognize conflicts as soon as possible, to face them together with the parties in conflict and to solve them. Professional aspects and personal aspects should be separated. It is helpful to clearly state the similarities and the conflicts. In conflicts the different positions should be pointed out and the differences with their respective advantages and disadvantages worked out. The project manager should take a decision subsequently if required. Defined escalation procedures have to be taken into account. Depending on the project organization, the line manager can be involved in resolving the conflict. External support has to be requested if needed.
- Change management
  Change requests during the execution of a project can have a considerable impact on the project. A project does not stand alone but always in a connection with the environment. These are the more intense, the larger a project is and the longer the duration. If important parameters change in the environment, the project has to be flexible: changes are needed. These changes are certainly legitimate and have to be processed in a professional change management under the responsibility of the project manager. Especially the principal requires transparency concerning possible consequences: do change requests result in additional costs, delays, or more complexity?
- Risk management
  The project manager should regularly check the risks and take corresponding actions. It is important to identify unknown risks in time (compare Sect. 2.6).
- Ensuring communication
  As already said, communication is the most important task of a project manager during the course of a project (see also Sect. 2.3).

- Lead project members
  The leading of project team members differs from the leading of employees in the line organization. A project manager addresses technical requirements but has as a rule no authority to issue directives. Depending on the project organization and on the organizational culture, the project manager often is legitimized to assign tasks to the project members. Managing with goals originating from work packages has been proven effective.
- Applying for and attending a project review
  A periodical project review can help to prevent in a timely manner a crisis situation but to ensure as well that the project is "well on the way". It can be executed by an internal audit. Often an external view helps with an external auditor (see as well p.). For long-standing projects a regular review at least once a year is recommended.

3.3.7   Trend Analysis

The responsibility of the project manager is not only to continually monitor progress and to control the project but to provide an outlook for the future as well. It is important to determine if the project can be implemented according to plan or if the plan has to be adapted. Here the trend analysis helps with the following contents:

- Prediction of the course of the project
  This takes into account knowledge obtained in the project and contains the communication of the same as well as the search for possible solutions with corresponding decisions.
- Continuous updating and correction of the project plan in answer to disturbing events and new insights in the project
  This is an ongoing process.

The milestone trend analysis (MTA) is a special form of the trend analysis based on the milestone plan. The aim of the MTA is the monitoring of the project progress and to detect delay in dates early. Based on the milestone plan, the agreements on deadline and the current status or the working results are continuously examined.

An example is shown in Fig. 3.30 with reporting dates on the *x*-axis and corresponding milestone dates on the *y*-axis.

In January 2016 (*x*-axis), there are following planned dates:

- Milestone 1 **Strategy**: June 2016
- Milestone 2 **Specification**: October 2016
- Milestone 3 **Closure**: December 2016
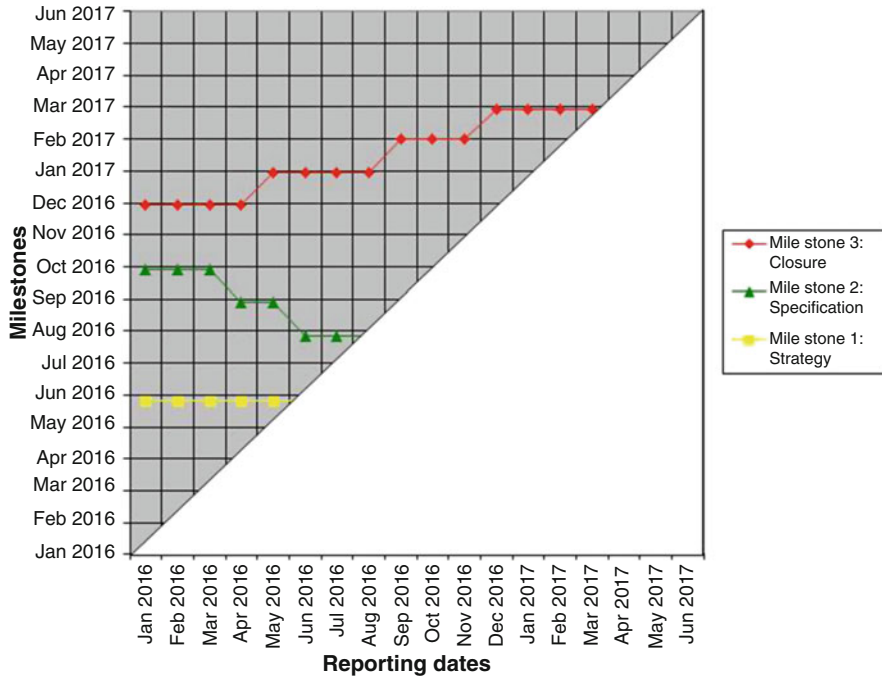
Fig. 3.30 Example for milestone trend analysis

The course of the milestones can be interpreted as follows:

- Milestone 1 **Strategy** (lower line, starting from June 2016): the course of the series of the milestone dates is ideal. The estimated dates are continuously confirmed and the planned deadline is met.
- Milestone 2 **Specification** (middle line, starting from October 2016): the course of the series of the milestone dates is falling. It is possible that too much buffer has been planned. The milestone has been reached earlier than planned.
- Milestone 3 **Closure** (upper line, starting from December 2016): this course of the series of the milestone dates shows an overoptimistic scheduling. The initial date of completion could not be achieved and had to be postponed several times.

At regular meetings, but best directly at milestone meetings, with both those responsible and those involved, the status concerning the milestones is reported.

3.3.8   Checklist

Figure 3.31 shows a checklist for the realization phase.

Checklist realization phase

Question	Result
1. Regular consideration of the project with regard to objectives or attainment	
a. Is it checked what (sub-) goals have been reached already?	
b. Are measures defined if (sub-) goals have not been reached yet?	
c. Do all project activities serve the attainment?	
2. Next project activities Are the tasks to be done by the next milestone clear? Are the objectives clear for the next but one milestone?	
3. Project status – Is the project still in budget, in time, and in quality?	
a. What is the current project status, especially related to the milestones?	
b. Is there a target-actual comparison concerning structure, duration, and costs of the project?	
c. Is there a project documentation containing project progress reports, minutes, decisions, and agreements?	
4. Working in the project	
a. Is every team member able to finish their tasks successfully?	
b. Are pending problems being examined or escalated if required?	
c. How are working results examined and saved?	
d. Are there project specific training activities?	
5. Project communication	
a. Are all stakeholders adequately involved or informed?	
b. Are there regular recorded project status meetings?	
6. Project team/project culture	
a. Are there activities for people entering and leaving the project?	
b. Are there team building activities to improve the project culture?	
7. Regular risk management	
a. Are new risks identified? Are new and known risks processed?	
b. Are existing risks in discussion with the principal and the project team? Are measures defined and examined?	
c. Are risk probabilities of incidence and estimated impacts updated?	
8. Continuous project marketing	
a. Are project marketing activities executed?	
b. Will information get outside the project, for instance, to other departments or customers?	

Fig. 3.31 Checklist realization phase

3.4   Closure Phase

It's the result that calls deeds by their name.
Johann Wolfgang von Goethe (1749–1832)

Synonyms for the closure phase are *completion stage*, *finalization stage*, *project close down*, or *project completion*. This section describes the final activities in a project: the project closure. Most important is the delivery of the project result to the principal and his approval. A partial approval is possible. Final activities cover securing earnings and the (stepwise) dissolving of the project team.

3.4.1   Objective/Results

Project Closure
The project closure is the administrative and technical end of a project. It means the termination of all activities related to the project.

At the end of the project closure of a successful project, the project team is exonerated with acceptance of the project result. The activities and results of the project are documented in a project closure report (PCR). Finally, the project team is dissolved and the resources are released.

3.4.2   Acceptance

The acceptance process could be divided into four phases:

1. Presentation of the project results
   The project result is presented to the principal. She or he receives—depending on the project:

   - Product
   - Product documentation
   - Project closure report
     This report contains the most important facts of the project:
       – Project order
       – Management summary
         What has been achieved? How has the project been planned and implemented?

– Project result:
  · To what extent have the objectives been achieved?
  · What solution approaches have been adapted?
  · What effort (time, costs, or resources) was required?

A template for a project closure report is available in Chap. .

2. Approval
   The principal signs the project closure report and therewith gives formal discharge of the project. The principal confirms:

   - Degree of achievement of the objectives
   - Delivered quality
   - Actual costs
   - Required time

   As the case may be the principal confirms proportional discharge, and the parties agree on rectifications, in each case with responsibilities and target dates.

3. Transition of the project result
   The nature of the transition and to whom the result will be transferred depends on the project and the project result. This can be even separate (sub)projects that have to be implemented during the project execution. The following transfer scenarios are conceivable:

   - Handover to service/operation
     . . . with integration, customization, introduction to the hotline, training of employees, creation and delivery of an operation manual, etc.
   - Transfer to the line organization
     A separate department takes care of operation and further development.
   - Migration
     Migration of data from the legacy system to the new system.
   - Transfer to an introductory project
     Especially in larger organizations with hundreds of people involved, it may be necessary to plan and to implement the introduction of a new system stepwise over a longer period with the following activities:
     – Pilot stage
     – Stepwise enlarging the user group
     – Rollout/go live: complete launch

4. Final phase
   It has to be clarified who is the contact person for project topics after project closure. For example, problems with failures in a software, detected only after the release on the customers' side. The following suggestions are given:

   - Stepwise "shut down" of the project by keeping a project team which gets progressively smaller
   - Definition of a successor project with suitable project members

3.4.3 Final Documentation and Lessons Learned

A project is successfully finished with the approval of the principal. However, important matters have to be done to learn for the future. Feedback helps to reflect the positive and negative aspects of the project.

Results of the closure phase are:

- Lessons learned workshop/feedback
  The principal and the project team should reflect on the lessons learned: what went well in the project and what can be improved in future projects? This could be done in a common meeting or in separate meetings. Every project member should give feedback what he has learned and what positive or negative experiences he had.
- Project closure report (PCR)
  A project closure report is helpful for further projects in the company. Lessons learned reports are the basis for a learning organization.
- Final presentation of the final documentation
  This presentation includes a summary of the project contents as well as the most important insights from the lessons learned workshop.
- Final meeting
  A possible agenda for the final meeting can be:
  – Final presentation
  – Further proceeding
  – Handover of the final documentation to the principal
- Deposit of the final documentation in a company knowledge base
  The aim should be a systematic preservation of the experiences gained in a project. Every (future) project manager should have access to such a knowledge base. Especially failed projects should be considered, as a lot can be learned from them.

3.4.4 Dissolving

A project is characterized by a start and a clear end. When finishing the project the project manager and the project team terminate their activities, the boards are dissolved. A release of the project resources takes place, for instance, for other new projects. As a rule the resources are reduced step by step. Specific project members look after possible subsequent projects. In IT projects, for example, a part of the project team attends the transition into the operation.

At the latest then, if not done yet, the project results should be secured. A good emotional project finalization is a nice party (Fig. 3.32)! The final business activity is the closure of the project cost center.

Fig. 3.32 Project closure
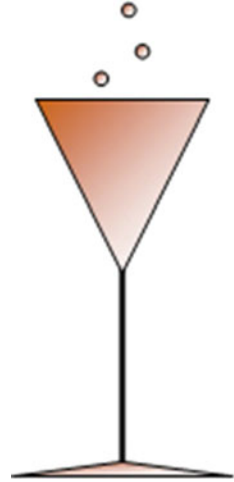
3.4.5 Outlook

It is appropriate at the end of a project to think outside the box. What can a meaningful subsequent project look like? How is it possible to extend a project result or to improve further? If, for example, a product has been introduced onto the market, the following follow-up projects are suggested:

- Financial services to purchase the product (financing, leasing)
- Services for the product (maintenance, repair work)

In projects often good cooperation has developed among the project members. It makes sense to keep an experienced team ("Never change a winning team"). So, one can try to assign the complete team to a new project to exploit synergy effects.

3.4.6 Checklist

Figure 3.33 shows a checklist for the closure phase.

3.5 Summary

A project can be divided in project phases. As described in the literature and as defined individually by companies, there are different possibilities of structuring a project and naming the project phases. This book defines the following four practice-oriented phases:

Checklist closure phase

Question	Result
1. Project acceptance	
a. Has the principal approved the project? If there is a partial acceptance with required repairs: are measures defined with responsibilities and due dates?	
b. Are the project results delivered including project documentation?	
c. Has the principal formally discharged the project?	
2. Project documentation	
a. Is there an acceptance report?	
b. Is there a project closure report including all open points?	
c. Are the project duration and costs (final invoice) documented including a target-actual comparison?	
d. Has the project set-up been documented?	
3. Final meeting	
a. Is there a feedback from the principal and the project team?	
b. Has a project review with consideration of lessons learned been conducted?	
c. Has it been documented what went well in the project, what avoidable mistakes have been made, and what to improve in future?	
4. Was there an emotional completion with dissolution of the project like a closing ceremony?	
5. Project dissolution	
a. Have the project members been released, for instance, transferred to other projects or back into the line organization?	
b. Are employment contracts or contracts with partners terminated?	
c. Has the cost center been closed?	
d. Has the final completion been communicated?	
6. Post project phase	
a. Are there agreements for remaining tasks?	
b. Who is responsible for further support or implementation?	
c. Has the transition to the line organization, specialist department, or operation department been organized?	
d. Are there corresponding documents like an operational manual?	
e. Are there practical follow-up projects?	
7. Has the project know-how been transferred for future projects, e.g., by an entry into a project database?	

Fig. 3.33 Checklist closure phase

- Strategy phase
  The strategy phase starts with a situation analysis and an environmental analysis to identify framework conditions for a project to be implemented. If a project becomes specified, the definition of project goals is made. First solution approaches complete the basis for a project order. The project order signifies the start of a project. Depending on the size and kind of a project, the creation of a tender specification and performance specification has to be done.
- Planning phase
  The planning of a project is an essential task of a project manager. The result of the project planning is a project plan, covering further plans. The most important plans are the work breakdown structure (WBS) and based on this the time schedule including a milestone plan as well as the resource plan and cost schedule. The function of a project organization is to find the most effective structure in relation to the line organization for a successful implementation of the project. Corresponding roles and boards are to be defined.
- Realization phase
  The controlling of a project is another essential task of a project manager. In the foreground is the organization of the approval of intermediate milestones, the project closure, or—if required—the project cancellation. The project internal and external communication with the stakeholders has to be ensured. If there are deviations or disturbances in the course of the project, corresponding activities have to be carried out. In using the milestone trend analysis based on the milestone plan, the project progress can be monitored and possible schedule difficulties detected.
- Closure phase
  In this phase the project completion is done. The central point is the acceptance of the project by the principal. The closure phase covers, transitions and the release of the resources. Lessons learned and a final documentation secure the newly acquired knowledge for future projects.

Problems

3.1 Project Objectives

(a) How is a project objective to be understood?
(b) Why are project objectives important?
(c) What should be considered in describing project objectives?
(d) What methods can be used to identify project objectives?

3.2 Environment Analysis

(a) What methods can be used to do an environment analysis?
(b) What are possible issues when doing an environment analysis?
(c) What is the difference between an environment analysis and risk analysis?

3.3 Milestones

(a) What is a milestone?
(b) Why are milestones required in a project?

3.4 Project Plan
What are the most important plans summarized in the project plan?
Explain them briefly.

3.5 Work Breakdown Structure (WBS)
Why is a work breakdown structure needed?

3.6 Work Breakdown Structure (WBS)—Evaluation

(a) What are the advantages of a WBS?
(b) What are the limitations of a WBS?

3.7 Resource Plan and Cost Schedule
What is the benefit of a resource plan and cost schedule?

3.8 Project Organization

(a) List the project organization forms you know.
(b) What questions should a project organization chart answer?

3.9 Project Organization—Evaluation

(a) Is a line organization appropriate to execute a project?
(b) What are the advantages of a project organization?

3.10 Project Control

(a) What is understood by project control?
(b) What is a prerequisite for project control?
(c) What is comprehended by project control?

References

1. Angermeier, G.: Projektmanagement-Glossar des Projekt Magazins.   https://www.
   projektmagazin.de/glossar/ (2016). Checked on 27 June 2016
2. Atlassian: Jira. https://www.atlassian.com/software/jira (2016). Checked on 27 June 2016
3. IEEE Standards Board: IEEE Std 830-1984; IEEE Guide to Software Requirements Specifica-
   tion. Tech. rep., IEEE Press, Piscataway. https://standards.ieee.org/findstds/standard/610.12-
   1990.html (1984). Checked on 27 June 2016

4. Microsoft: MS project. https://products.office.com/en-US/project/project-and-portfolio-management-software (2016). Checked on 27 June 2016

5. Project Management Institute: A Guide to the Project Management Body of Knowledge (PMBOK Guide 5), 5th edn. Project Management Institute, Philadelphia (2013)

6. projectlibre.org: ProjectLibre. http://www.projectlibre.org/ (2016). Checked on 27 June 2016

7. reimus.NET GmbH: Controlling-Portal.de - Die Nutzwertanalyse. http://www.controllingportal.de/Fachinfo/Grundlagen/Die-Nutzwertanalyse.html (2016). Checked on 27 June 2016

8. Wikipedia: Balanced scorecard. https://en.wikipedia.org/wiki/Balanced_scorecard (2016). Checked on 27 June 2016

9. Wikipedia: COCOMO. https://en.wikipedia.org/wiki/COCOMO (2016). Checked on 27 June 2016

10. Wikipedia: Delphi method. https://en.wikipedia.org/wiki/Delphi_method (2016). Checked on 27 June 2016

11. Wikipedia: ISO/IEC 9126. https://en.wikipedia.org/wiki/ISO/IEC_9126 (2016). Checked on 27 June 2016

12. Wikipedia: Scope (project management). https://en.wikipedia.org/wiki/Scope_%28project_management%29 (2016). Checked on 27 June 2016

13. Wikipedia: Work breakdown structure. https://en.wikipedia.org/wiki/Work_breakdown_structure (2016). Checked on 27 June 2016

Outlook

4

This chapter gives an overview about ways to get certified in project management. It offers an outlook into the future of project management and the possibilities of dealing with the subject more intensely.

4.1   Certifications

Different organizations offer certificates related to project management:

- Certificates from the IPMA [6]
  There are currently four levels:
    – IPMA Level D: Certified Project Management Associate
    – IPMA Level C: Certified Project Manager
    – IPMA Level B: Certified Senior Project Manager
    – IPMA Level A: Certified Projects Director
- Certificates from the PMI (Extract) [8]
    – Certified Associate in Project Management (CAPM ®)
    – Project Management Professional (PMP ®)
    – Program Management Professional (PgMP ®)
    – Portfolio Management Professional (PfMP ®)
- Certificates related to PRINCE2 [3]
    – PRINCE2 Foundation
    – PRINCE2 Practitioner
    – PRINCE2 Professional

4.2   More Information

Several project management glossaries are available, e.g., related to the PMI [7] or PRINCE2 [4]. An extensive German glossary—but with limited access for people who are not subscribers to the "Projektmagazin"—is accessible [2].

Several project management online courses are offered like the one, for instance, by the Alison company [1]. A selection can be found here [5]. A free project management course in German with the possibility of achieving a certificate (with costs) is provided [9].

4.3   Future Project Management

In software development the agile proceeding is becoming increasingly popular,[1] so that the topic "Agile project management" will also play a more and more prominent role in the future. Methods and innovative ideas like time boxing (compare to milestone planning in Sect. 3.3.3) or the retrospective from Scrum (see Sect. 2.2.5) will be used outside of IT project management as well.

4.4   …and Additional Information

We would like to summarize for you the most important findings:

- Make people concerned to be people involved.
- Demand truth and commitment.
- If you fail, then fail in good time.
- Integrate project members in the effort estimations.
- Let the right people do the work that is right for them.
- Consider environmental aspects
  Projects influence and inevitably also form the environment. Take responsibility for projects changing the environment favorably or in the worst case causing the least harm possible. In projects related to the creation of products or where waste originates, be aware of the environmental protection as well. Consider with a holistic approach at an early stage the topics of conservation of resources and recycling.

Finally, for successful project management, further study of conflict management, communication, soft skills, and emotional intelligence is strongly recommended. Exchange ideas, thoughts, and experiences with experts, and use supervision and advice from colleagues.

The authors wish you the very best for your projects!

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[1]Following VersionOne in the year 2013, about 84 % of all companies used agile methods [10].

4.5   Summary

Certification programs of national and international organizations offer the possibility of extending project management knowledge and having it confirmed. In companies corresponding qualification programs are often available as well. In the future, agile project management will play a major role.

References

1. Alison: Diploma in Project Management. https://alison.com/courses/Diploma-in-Project-Management (2016). Checked on 27 June 2016
2. Angermeier, G.: Projektmanagement-Glossar des Projekt Magazins. https://www.projektmagazin.de/glossar/ (2016). Checked on 27 June 2016
3. Axelos: PRINCE2 Best Practice Solutions. https://www.axelos.com/best-practice-solutions/prince2 (2016). Checked on 27 June 2016
4. Axelos: PRINCE2® Glossary of Terms English. https://www.axelos.com/Corporate/media/Files/Glossaries/PRINCE2-2009-Glossary-of-terms_GB-v1-1.pdf (2016). Checked on 27 June 2016
5. Capterra Project Management Blog: The 5 Best Online Project Management Courses. http://blog.capterra.com/the-5-best-online-project-management-courses/ (2016). Checked on 27 June 2016
6. International Project Management Association (IPMA): Homepage. http://www.ipma.world/ (2016). Checked on 27 June 2016
7. Project Management Institute: PMI Lexicon of Project Management Terms, Version 3.0. http://www.pmi.org/~/media/PDF/Standards/PMI_Lexicon_PM_Terms_Ver3.ashx (2015). Checked on 27 June 2016
8. Project Management Institute: Homepage. http://www.pmi.org/ (2016). Checked on 27 June 2016
9. TEIA AG - Internet Akademie und Lehrbuch Verlag: Projektmanagement und MS Project. https://www.teialehrbuch.de//Kostenlose-Kurse/Projektmanagement-und-MS-Project-2000/ (2016). Checked on 27 June 2016
10. Version One: 7th Annual State of Agile Development Survey. https://www.versionone.com/pdf/7th-Annual-State-of-Agile-Development-Survey.pdf (2013). Checked on 27 June 2016

Templates

5

Here are the templates related to topics discussed in this book.

As shown in Fig. 5.1, the following templates suitable for the project phases are:

- Comprehensive topics
- Strategy phase
- Planning phase
- Realization phase
- Closure phase

Fig. 5.1 Templates suitable for project phases

Project profile

Project name		Project No.	
Principal			
Project manager			
Version / Date		Status	

Steering Committee	
Project team	
Stakeholder	
Supplier	
Project start		Project end	
Objectives	
Project scope	
Milestones	
Terms of payment	

_____   _____   _____
City, date   Principal   Project manager

Task list

Project name		Project No.	
Responsible			
Version / Date			

No.	Task	Category	Respon-sible	Start date	Due date	Prio-rity	Status	Results	Comments

Requirements list

Project name		Project No.	
Responsible			
Version / Date			

No.	Requirement	Stakeholder	Com-plexity	Priority	Status	Comments

Project handbook

Project:	....
Author:	....
Version:	....
Last saved:	....
Location:	....

Document administration

Version history

Date	Author	Version	Changes

Distribution

Date	Version	Distributors, names

Approval

Date	Version	Distributors, names

Related documents

Author, title	Version	Location

Project handbook

1   Introduction

....

1.1   Purpose

....
....
....
....

1.2   Short description of the project

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....
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1.3   Contact persons

Name	Role	Department	Phone	E-mail

Project handbook

2 Project overview

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2.1 Situation analysis

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2.2 Environmental analysis

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2.3 Project order

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2.4 Objectives

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Project handbook

2.5   Communication

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2.6   Escalation

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2.7   Rules

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2.8   Documentation

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Project handbook

3   Project plan

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3.1   Work breakdown structure (WBS)

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3.2   Work packages

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3.3   Time schedule

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3.4   Resource plan and cost schedule

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Project handbook

3.5   Project organization

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3.6   Kickoff

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Project handbook

4   Project execution

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4.1   Milestones

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4.2   Project controlling

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4.3   Protocols

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4.4   Risk management

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Project handbook

5   Project closure

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5.1   Acceptance

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5.2   Project closure report

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5.3   Transition

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Risk list

Project name		Project No.	
Responsible			
Version / Date			

Id	Risk identification	Potential cause	Contact person	*P*	*I*	*Risk = P * I*	Status	Actions

Legend:

P = Probability of incidence

I = Estimated impact

Communication plan

Project name		Project No.	
Project manager			
Version / Date		Status	
Author			

Kind of communication	Who/ With whom	Purpose	Frequency	Comments

Minutes

Project name		Project No.	
Location		Date	
Minute taker		Version	
Topic			

Attendees	
Distribution list	

No.	(A)ction Item (D)ecision (I)nformation	Description	Responsible	Due date

RACI matrix

Project name		Project No.	
Responsible			
Version / Date			

R = Responsible - working on the task

A = Accountable - delegating and approving the work

C = Consulted - typically expert on subject

 I = Informed - interested in progress

Environmental analysis

Project name		Project No.	
Responsible			
Version / Date		Status	

Stakeholder	Possible role in project	Attitude concerning project	Possible influence / power	Measures / strategies

Project order

Project name		Project No.	
Principal			
Project manager			
Version / Date		Status	

Steering committee	
Project team	
Project start	Project end
Objectives	
Non-goals	
Project scope	
Milestones	
Contract value	

_____   _____   _____
City, date   Principal   Project manager

Work breakdown structure (WBS)

Project name		Project No.	
Project manager			
Version / Date		Status	

			Plan		Actual	
WBS No.	Subproject / Work package	Responsible	Amount of work	Duration	Amount of work	Duration

Work package (WP)

Project name		Project No.	
WP name		WP Id	
WP owner			
WP approval			
Version / Date		Status	

Progress control	Plan		Actual	
	Amount of work	Duration	Amount of work	Duration
	Start	End	Start	End
Comments				

Objective	
Preconditions (Input)	
Scope	
Results (Output)	

Milestone plan

Project name		Project No.	
Project manager			
Version / Date			
Author			

No.	Plan date	Actual date	Milestone	Id	Criterion	Result

Cost schedule

Project name		Project No.	
Project manager			
Version / Date			
Author			

Personnel costs			Plan			Actual		
WBS No.	Working package / Name	Int. / ext.	Hours	Rate	Costs	Hours	Rate	Costs
Sub-total personal costs								

Material costs			Plan			Actual		
WBS No.	Working package	Item	Quantity	Price	Costs	Quantity	Price	Costs
Sub-total material costs								
Total								

Milestone report

Project name			Project No.	
Project manager				
Version / Date				
Author				
Milestone			Status	

Exit criteria				Result		
No.	Criterion	Respon- sible	Accepted by	Description	Status	Comments

Project status

Project name		Project No.	
Project manager			
Report period		Version / Date	
Author			
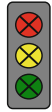
1. Status

Results	
Activities	

2. Forecast

Planned activities	
Planned activities until end of project (Backlog)	
Risks	
Open points, issues	

Project closure report

Project name		Project No.	
Principal			
Project manager			
Version / Date		Status	
Project start		Project end	
Project results			
Acceptance			
Project evaluation			
• Achievement of objectives			
• Delivered quality			
• Amount of the costs			
• Time needed			
Findings			
• Positive impressions			
• Potential for improvement			

_____   _____   _____
City, date   Principal   Project manager

Solutions

6

Problems from Chap. 1

1.1 Project

(a) What is a project?

A project is an intent, characterized by uniqueness of conditions in their totality. A project is distinguished by an aim with temporal, financial, and personnel restrictions.

(b) What are the characteristics of a project?

- Temporal limitation
- Uniqueness
- Defined objective
- Adequate complexity
- Interdivisional
- Limited resources

1.2 Success Factors

Name at least three success factors for projects.

1. User involvement
2. Executive management
3. Clear statement of requirements
4. Proper planning
5. Realistic expectations
6. Smaller project milestones
7. Competent staff

8. Ownership
9. Clear vision and objectives
10. Hardworking, focused staff

Problems from Chap. 2

2.1 Communication
What effect does poor communication have in a project?
Poor communication is the main reason that projects fail.

2.2 Documentation
What is the role of documentation in a project?

- Documentation serves mainly to inform and as a substantial quality characteristic to show transparency and traceability:
  – What problem had to be solved (project order)?
  – How has the problem been solved (project result)?
  – How was the course of the project?
    · Why has the particular approach been chosen; what were the advantages?
    · What effort and what costs have been generated?
- The objective is as far as possible complete and significant documentation, written best in parallel during the course of a project.

2.3 Quality
What does quality in project management mean?
Ensuring that the working results correspond to project goals. Focus is on functional project content.

2.4 Risk Management
Why should one do risk management in a project?

- Risks are a typical characteristic of projects.
- Risk management helps to deal in time with risks, to prevent them from occurring or reduce the effects if they do occur.
- Risk management makes it possible for endangering influences and changes to be identified early and for corresponding measures to be taken to ensure project success.

Problems from Chap. 3

3.1 Project Objectives

(a) How is a project objective to be understood?
   The project objective describes what a project will accomplish, the expected outcome. It should be the answer for the following questions:

   - What should be achieved?
   - When should it be achieved?
   - How much should be achieved?
   - Where should it be achieved?

(b) Why are project objectives important?
   Unclear project objectives increase the risk that a project fails, as there is no common understanding. If there are unclear, too ambitious, or even contradictory ideas from the initiators of a project, an alignment is required to identify a joint project objective.

(c) What should be considered in describing project objectives?

   - The goals should be quantifiable: make goals measurable.
   - Define the scope with non-goals: what should not be achieved?

(d) What methods can be used to identify project objectives?

   - Brainstorming
   - Mind mapping

3.2 Environment Analysis

(a) What methods can be used to do an environment analysis?

   - RACI matrix
   - Mind mapping

(b) What are possible issues when doing an environment analysis?

   - An insufficient communication policy causes missing or wrong information.
   - Hidden agenda: people concerned about the project do not talk frankly about their concerns, objections, and expectations.

(c) What is the difference between an environment analysis and risk analysis?

- The environment analysis investigates the attitude of people who influence a project.
- Risk analysis considers and evaluates (monetary) potential damage caused by risk.

3.3 Milestones

(a) What is a milestone?

- An occasion with a special significance
- A sub-ordinate target with important project results

(b) Why are milestones required in a project?

- To check during project execution at specific points of time if planned goals have been reached or can be reached.
- Milestones define measurable criteria to approve activities.
- Milestones make it possible to divide a project into phases. This supports a target-oriented common proceeding.

3.4 Project Plan

What are the most important plans summarized in the project plan?
Explain them briefly.

- Work breakdown structure (WBS)
  The WBS divides a project and describes its contents and scope.
- Time schedule
  The time schedule arranges the work packages identified in the WBS to a realistic project procedure.
- Resource plan and cost schedule
  The resource plan and cost schedule identifies the resources required for processes, working products, and subprojects and presents the estimated costs thereby incurred.

3.5 Work Breakdown Structure (WBS)

Why is a work breakdown structure needed?
The work breakdown structure (WBS) is the basis for following topics:

- Distribution of responsibilities in the project
  - The WBS divides the project aim into operative goals for the project members.
  - The WBS makes it possible to define clearly the scope of tasks and to assign them to project members.

- Estimation of time needed and project costs
    - The creation of the WBS results in transparency for the whole scope of the work.
    - This transparency is a prerequisite to estimate the required time and the costs.
- Project control
    - The WBS facilitates early and directed reaction to any trouble in the course of the project, delays, capacity bottlenecks, and budget overruns.
    - Additionally, the WBS supports in regular evaluation of project risks.
- Structuring of the project documentation
  The WBS could be used as structure principle of the project documentation, reporting systems, and the agenda of project status meetings.

3.6 Work Breakdown Structure (WBS): Evaluation

(a) What are the advantages of a WBS?

- Assignment of responsibilities.
- Basis for estimations of the project duration and the project costs.
- Basis for project control.
- Basis for project documentation.
- Assessment of risks is made easier.

(b) What are the limitations of a WBS?

- No time display of the chronology of work packages within the project
- No overview about the work load of the project resources

3.7 Resource Plan and Cost Schedule
What is the benefit of a resource plan and cost schedule?

- It offers transparency by exposing the costs of a project.
- Based on the demand of resources and financial means, requested by estimations of procedures, work packages, and subprojects, the complete project costs could be estimated.

3.8 Project Organization

(a) List the project organization forms you know:

- Pure functional project organization (following division, departments)
- Functional project organization
  Synonyms: influence project organization, influence project management, project coordination
- Matrix project organization
  Synonym: matrix project management

- Pure project organization
  Synonyms: pure project management, task force
- Project society

(b) What questions should a project organization chart answer?

- Who is the principal?
- Who is the project manager? Who are the subproject managers? Who are the
  people responsible for the work packages?
- Who is reporting to whom?
- Who accepts what results?

3.9 Project Organization: Evaluation

(a) Is a line organization appropriate to execute a project?
A line organization normally is inappropriate to execute projects. The reason is
line organizations are:

- Ideal to perform periodic business cases
- Not flexible enough for a fast reaction on problems and on need for changes

(b) What are the advantages of a project organization?

- There is a clear managerial responsibility and decision-making authority of
  the project manager to effectively implement a project.
- A high identification of the project team with the project is possible.
- Conflicts do not have to be solved using hierarchies of the line organization.

3.10 Project Control

(a) What is understood by project control?
The objective of the project control is to follow the actual course of the project
concerning costs, dates, and results as far as possible consistent with the planned
course.
(b) What is a prerequisite for project control?
The basis for a target-performance comparison is the project plan.

(c) What is comprehended by project control?

- Target-performance comparison with cause analysis if variations occur
- Evaluation of the consequences of new findings and (positive or negative)
  events affecting the progress of the project
- Planning, developing, executing, and controlling of operation of (corrective)
  activities
- Update of the planning and analysis of the further progress of the project

Glossary

Note:

All the project management standards following DIN 69901-5:2009 follow the project management glossary from the "Projekt Magazin" (Angermeier, Georg; URL: https://www.projektmagazin.de/glossar/).

Balanced Scorecard Concept to measure, document, and control the activities of a company or organization related to its vision and strategy. It usually covers a financial, customer, process, and potential perspective.

Bar Chart Synonym: *bar diagram.*

Diagram to show the time schedule of a project. The duration of a work package is visualized by the length of a bar in the timeline. The bars can show both target data and actual data. Events correspond to points in time.

Best Practice Within a benchmark process, the theoretical or technical best possibility is not sought. Instead the products or services are compared that are offered on the market, with respect to common quality criteria. The winner is called "Best Practice".

BoM Bill of material

CAPM Certified Associate in Project Management

CCB Change Control Board

Closure Phase The last project phase brings the final project activities together.

Coaching Coaching is an umbrella term for different consulting methods. Related to project management, a coach functions as an accompanying consultant who supports the project manager by sharing his experiences.

COCOMO Constructive cost model
  Algorithmic cost model to estimate costs and efforts in the software development.

Communication The exchange of information to share experiences or to find problem solutions, among those involved in the project, especially within the project team.

Communication Plan A communication plan describes the communication paths, escalation paths, and information paths within the project. It is the basis for the regulated and structured information exchange within the project.

Controlling Controlling covers the processes and rules that within the project management ensure the achievement of the project goals.

Cost-Benefit Analysis It is a nonmonetary valuation method from the domain of cost accounting. The aim is the comparison of nonmonetary subgoals to be able to decide between several alternatives.

Cost Schedule The cost schedule is the depiction of the expected arising expenses for the project. It is part of the project plan.

Creativity Techniques Methods to stimulate creativity for new solution approaches.

Crisis A crisis is an unplanned difficult decision situation.

Critical Path Within the network technique, the critical path describes the longest duration of a sequence of operations. If an operation on the critical path is delayed, the total duration of the project is delayed as well.

Effort Estimation Estimation of the required effort to execute a work package (assuming 100 % "pure project work").

GPM GPM Deutsche Gesellschaft für Projektmanagement e. V.

ICB IPMA Competence Baseline
  International project management standard and central reference of the GPM.

IPMA International Project Management Association

IT Information technology

KISS Principle KISS stands for **K**eep **it s**hort and **s**imple[1]: use the simplest solution possible.

KPI Key performance indicator

Magical Triangle The magical triangle of project management represents three key objectives of a project that interact. These are, first, the quality[2] requested for the project goal; second, the time that might be spent on the project; and third, the costs. If one objective changes, then one or both other objectives will change as well.

Method A method is the path to the goal. Method originally means (from Greek) "path", that is, in choosing a method one tries to find a way to reach a given objective.

Milestone Synonyms: *Stop-or-Go point, quality gate*, or *review point*.
    A milestone is a significant point or event in the project.

MTA Milestone trend analysis

NCB National Competence Baseline

Network Technique Procedure for calculating the earliest possible starting time and the latest necessary end time of the work packages.

Non-goal Non-goals are there to differentiate: they explicitly describe what should not be reached in the project.

PCR Project closure report

PDCA Plan, Do, Check, Act

Performance Specification Synonyms: *feature specification, functional specification, specification sheet*, or *technical specification document*.
    It is the plan worked out by the contractor on how to implement the tender specification handed over by the customer.

PgMP Program Management Professional

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[1]There are also other meanings like **K**eep **it s**imple and **s**mart.

[2]In literature sometimes quality is replaced by *scope and contents*.

Planning Phase The planning phase comprises planning activities and the determination of the project organization. This project phase is completed when the project plan is approved and a kickoff has been executed.

PMBOK Project Management Body of Knowledge

PMBOK-Guide Guide to the Project Management Body of Knowledge

PMI Project Management Institute

PMO Project Management Office

PMP Project Management Professional

PRINCE2 Projects in Controlled Environments

Process A process has a defined start with an event or an input and a defined end with an output. It describes a flow of activities, optional with intermediate status.

Project A project is an intent, characterized by uniqueness of conditions in their totality.

Project Closure The project closure is the administrative and technical end of a project. It means the termination of all activities related to the project.

Project Controlling The project controlling covers the data collection, the analysis and evaluation of deviations of the plan, the preparation and planning of corrective measures, as well as the management and implementation of these measures.

Project Culture The totality of the behavior of the people involved in a project, affected by knowledge, experience, and tradition, and also how it is appraised by the project environment.

Project Documentation It covers the compilation of selected substantial data concerning configuration, organization, resources, approaches, schedule, and aims achieved of the project.

Project Goal Synonyms: *project aim* or *project objective*.
   A project goal is the totality of specific objectives that should be reached by the project.

Project Management Project management comprises the coordination of people and the optimal use of resources to reach project goals.

Project Manager Synonym: *project lead*.

The project manager commits to the principal the achievement of the project goals as defined in the project order. Therefore, he plans and controls the project.

Project Office Synonym: *project management office (PMO)*.

Role in a project that supports the project manager, mainly administratively, for example, in creating and maintaining a project handbook, organization of meetings, etc.

Project Order Synonyms: *order, project brief, project charter*, or *project order definition*.

A project order is a contractual document. With it a contractor is instructed to deliver services as agreed for a corresponding compensation by a principal.

Project Organization The project organization is a totality of the organization entities and the rules for the structural and procedural organization to execute a particular project.

Project Phase A project phase is a temporal section in the course of a project that is separated objectively from other sections.

Project Plan The project plan is the totality of all existing plans in a project.

QM Quality management

RACI Responsible, Accountable, Consulted, Informed

Realization Phase Synonyms: *execution phase* or *implementation phase*.

This project phase covers all the activities to achieve the defined project objectives.

Requirements Engineering Requirements engineering ensures that all requirements in the project are known and documented as well as that sufficient agreement with the stakeholders concerning these requirements has been reached.

Resource Resources execute the project tasks. There are personnel and material resources.

Resource Plan The resource plan describes what personnel costs and material costs are required to master the project. It is part of the project plan.

Risk Management It covers the elimination, avoidance, or reduction of project risks.

RUP Rational Unified Process

Scope Management   The scope management ensures that based on the project objectives, the project scope is defined, prepared, and implemented. All related tasks are listed usually in the work breakdown structure.

Soft Skills   Synonym: *social competence*.

Soft skills are interdisciplinary competences in one's behavior and dealing with others. They complement professional abilities and qualifications.

Stakeholder   A stakeholder is everyone who could influence a project, is concerned by a project, or is interested in a project.

Steering Committee   Synonyms: *review board* or *steering board*.

The steering committee is the supervisory body of a project. Members of the steering committee are the principal, typically as chairman, and the key stakeholders from the internal organization.

Strategy Phase   The fundamental, initial project phase comprises typically of the analysis and clarification of the problem situation and is completed with a project order.

Task List   Synonyms are: *Action item list* or *To do list*.

Typical results of project meetings are information, results, decisions, and tasks. Tasks should be documented in a task list, in which every task has a description of the activities to be done, the actual person responsible, and the deadlines. If regularly updated, the task list always shows the open points at the current time.

Tender Specification   Synonyms: *book of specifications, requirements document, requirements specification*, or *requirements specification document*.

The tender specification describes the totality of the requirements of a customer applying to supplies and services of a contractor within an order (DIN 69901-5:2009).

Time Schedule   The time schedule is a graphical representation of the duration of several work packages in a project, for instance, in the form of bar charts or flowcharts. It is part of the project plan.

Trend Analysis   In the project management area, this is a mathematical technique to predict future results based on historical data. Therefore, variances in the cost and in the operational process are recorded.

WBS   Work breakdown structure

Work Breakdown Structure   It is a hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables. It is part of the project plan.

Work Package A work package is the smallest entity of a work breakdown structure that can be located at any project structure level.

WP Work package

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