



# Project Management

TITTESI  
„Transfer of innovative training tools for  
entrepreneurial skills improvement“

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# 1. Basics

The dynamics in the technologies development in economy, in social environment and in law-making, along with the evolving global trends, call for more extensive and more complex handling of entrepreneurial tasks to make an enterprise succeed on the market.

Since the 1950s project management has been under development as a tool enabling faster and more objective-oriented processing of complex data than it would be the case in routine operation of a particular organisation.

## 1.1 What a project is

A project is a time-framed organisational undertaking aimed to achieve certain defined objectives. There are a number of characteristic features setting a project apart from the business-as-usual operation.

Projects are ...

<b>A change</b>	Projects are designed to bring changes about. The pivotal aspect of projects is a CHANGE.
<b>New/unique</b>	A new product, a new customer, a new technology – although parts of the process may be similar, no two projects are alike.
<b>Complex/dynamic</b>	The tasks are extensive and distinctly networked. There are ties between individual tasks and the project context.
<b>Interdisciplinary/surpassing individual fields</b>	Handling of tasks is possible only by joint collaboration of a number of organisation units or fields of expertise.
<b>Significant</b>	While projects are highly relevant for the participating organisation units, they are not needed for routine tasks.
<b>Time-restricted</b>	After implementation of the change required, the project is not needed anymore. Projects have a defined beginning and a defined end.
<b>Uncertain</b>	Their novelty and complexity makes projects increasingly uncertain, risky and involving more conflicts than routine business activities.

## 1.2 When a project is meaningful

The terms “Project” and “Project Management” have lost much of their value. Are there any tasks left that couldn't be labelled as “a project”? Besides ambiguity it also leads to loss of motivation, as planning and documentation are meaningful in complex intentions, but useless in routine tasks.

Project management methods and procedures are applicable and useful also if new, complex and major tasks are to be implemented by means of specific resources in the near future. Methods and procedures have been developed for that purpose.

If such methods and procedures are used in any commonplace task which might be easily handled by a single department, the work gets more costly and laborious while motivation of the staff drops.

Many enterprises therefore have explicit rules setting the limits of measurable values and complexity of intentions to identify tasks to be undertaken as projects with project planning and management.

## 1.3 Complexity of projects

It is the change as the substance of projects which makes them fundamentally complex. They, however, differ in a number of aspects: the novelty of plans and business cases, the tasks difficulty, special know-how required, or simply an enterprise having a new customer.

Projects are strongly influenced by their high complexity:

- frequency of conflicts grows,
- higher management effort is necessary,
- duration and costs increase,
- project needs a more intensive guidance, i.e. the management must devote more time and effort to all the crucial aspects of the project:
  - selection and guidance of the team members,
  - communication with stakeholders,
  - clear definition of objectives and
  - good establishment of the project management.

Other two aspects highlighting the projects' complexity are the **clarity of objectives and the project deliverables target group**.

### Clarity of objectives at the project beginning

Sometimes, due to various reasons, not all project objectives may be analysed clearly enough and defined in measurable values in the start-up stage of the project.

Such situations often occur with use of new technologies, new solution methods or a new product development, with research and development projects being classic examples, too.

### Internal or external projects

Another key feature is the differentiation based on a specific customer or a user of project outputs. Besides providing deliverables for a single external customer, projects may also address more complex internal plans and business cases:

- Change processes in the enterprise
- Development of new strategies
- Structural changes
- Penetration into new markets
- other.

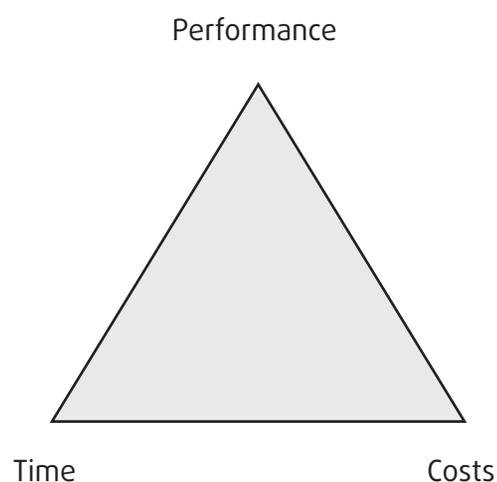
Higher complexity of internal projects arises from the fact that internal stakeholders and sometimes even the entire organisation are concerned. Such stakeholders attempt to directly influence the project and its deliverables, making the risks and strains of internal projects higher in comparison with external customer projects.

## 1.4 Project management

Project management involves planning, assignment, control and guidance of all the project aspects. Project management isn't a development/production of results/deliverables of the project, as these are the tasks of specialist team members.

**Project management deals exclusively with managing the project.**

The well-known project management "magic triangle" identifies the variables to be managed by the project:









## 2. Project organisation

From the time aspect, project is a temporary undertaking. As such, it requires clear tasks and responsibilities in order to be adequately managed and objective-oriented.

Every project is positioned within an existing organisation and is often a part of a major programme. In the following section a project organisation structure is presented.

### 2.1 Tasks and responsibilities

Organisations have built up their own project management traditions and rules, making the respective terminology differ, too. It causes no trouble, if the contents and responsibilities are clear.

What is more important than the nomenclature of individual tasks is a clear assignment of responsibilities, clear limits of competences and clear paths to meet the objectives.

<b>Sponsor/ owner</b>	Every project requires a sponsor, a decision-maker positioned high in the hierarchy and having a capacity to enforce their aims, provide the resources and implement strategic decisions.
<b>Project board</b>	The sponsor is often supported by a project board consisting of the principal stakeholders. Recommended is the involvement of representatives of customers/ users or suppliers.
<b>Project manager</b>	The project manager, subordinated directly to the sponsor, is responsible for operative management of the project's "daily business". Appointing a single person for the position has proven a good practice.
<b>Subproject leader</b>	Only very big projects – indicatively involving more than seven work packages – may require an extra level to be set up between the project manager and the work package leader positions. Subproject leaders take on bulky and content-related project parts and steer their work package leaders.
<b>Work package leader</b>	Individual work package leaders are overseen by a person in charge reporting to the project leader and acting on his or her instructions. Work package leaders coordinate the work of their experts to develop individual subdeliverables of the project.
<b>Base team</b>	Large projects may easily go adrift. The project leader creates a joint base team with basic work package leaders (or with subproject leader) to facilitate the planning, management and evaluation of the project.
<b>Project office</b>	The project office supports the project manager in all tasks related to the administration and documentation of the project and may also provide standards and tools.
<b>Coordination boards</b>	Boards able to resolve conflicts over priorities and resources may be set up on the enterprise level (above the project tier).
<b>Specialist boards</b>	Other boards may be added for specific project tasks (e.g. change management, quality assurance,...).

## 2.2 Project management is a team work

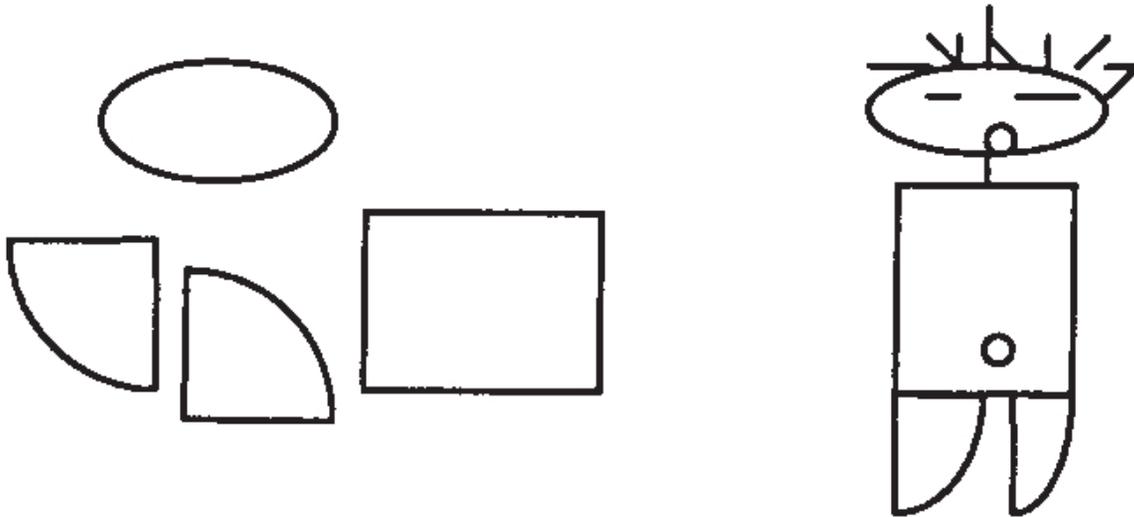
It is the fact that projects are intended to handle complex tasks involving various fields of expertise that makes teamwork indispensable in project management. Good teamwork is an imperative precondition for exploiting advantages of projects and making them deliver higher value in comparison with other undertakings.

**Teams capable of joint and efficient operation cannot be created overnight and they don't emerge spontaneously or at will.**

Certain **conditions** are necessary to give the team a chance, though not certainty, to become a high-performance team:

- The task must be complex and multi-layered so that teamwork becomes really necessary for its handling.
- Clear boundaries of the team must exist, i.e. its members and people around must clearly see who is in the team and who is not.
- The team must have its range of decision-making competences clearly defined.
- Longer-term team stability must be ensured. Constant changes ruin even the best teams.
- Objectives must be clearly defined, but the means to achieve them should be within the specific team's competence.
- Objectives must be defined in a motivating way, without overloading the team members and without any demotivating effect.
- Teams shouldn't be too large and, if appropriate, a base team capable of real functioning should be created.
- An adequate variety of miscellaneous specialisations and social competences is necessary in a team.
- Opportunities allowing the team members to have a feedback on their work's methods and results need to be incorporated in the project workflow.
- Team achievements must be attributed to the team and adequately rewarded.
- Targeted, but tendentiously free handling of information by the team members is recommended.
- In critical stages an external advisor should be available for the project manager and the team as well.
- Even largely virtually-operating teams must have opportunities and time for direct contact to cultivate their shared standards and rules of behaviour.
- Of special importance are the experienced project leaders able to put into balance their role of leading project members on one hand with that of peers to other managers on the other.

The main task lies in integration of differences. That is, in the way a team gets built up from a variety of skills, viewpoints and interests.



### 2.3 Project management is a guidance

Project management is not just a masterly use of planning tools. Project is a dynamic and very unsteady undertaking. Besides official commands, a project may also be affected by information concerns and expectations of the customer, major stakeholders within the enterprise, and team members with their managers. Last but not least, project manager's own interests also play a part.

Guidance is required in such a situation.

**A project manager is a temporary managing director.**

Throughout its duration a project is intended to create balance in a web of relations and interests within and around the project. The artful approach lies in settling such balance to allow the team to concentrate on the tasks and to facilitate the achievement of the objectives defined without losing a necessary contact with the organisation.

Mostly, the staff enthusiastically and frequently engaged in projects is highly motivated anyway. Projects would be hard to complete without highly motivated team members. The high risk and high danger of conflicts within projects results rapidly in demotivation.

#### Motivation

Disregard for the above rules has a particularly demotivating effect on the project manager and team members (see: Project management is a team work). A major motivation for the project is, in itself, the respecting of particular principles of team work and the proper safeguarding of project conditions by the organisation and the managing staff. To put it simply, "non-demotivation" alone is enough!





### 3 Project start-up

Projects normally arise from a certain opportunity, such as a customer’s demand, an idea or a necessity. That, however, requires a number of activities to specify or define such an opportunity or idea so that its objective-oriented implementation could be possible in practice.

The project start-up stage is crucial as it involves shaping of foundations for the whole project. Almost all problems emerging in the course of the project are rooted in this stage. Every aspect missed or unclarified at the start is certain to backfire later on. Besides that, errors are much easier and smoothly eradicated at the project beginning than in its later stages.

**There’s therefore a hard-and-fast rule:  
Investment of time at the start helps to save the overall time of the project.**

Following the first briefing, often based just on an idea or a customer’s demand, it becomes necessary to consider the idea thoroughly, to examine its prospects, conditions and peculiarities, and to clarify anything that is still “fresh”, uncomplete and unclear. The project definition and objectives must be not only clear, but also equally understood and shared by all the participants. Individual “images” of the project and its results must be unified.

At the end of the process the project manager and central team members need to have a specific idea about what is to be done in the project and should also have a rough idea about how to do it. The project sponsor, the customers/ordering party and crucial stakeholders should be certain that they want to have the planned results (deliverables) under the given conditions.



### 3.1 Project definition workshop

It is recommended to organise a workshop to define the project at the very beginning. Its aim is to establish a common understanding of the project, its objectives and risks, and to reach a consensus on key points (COMMITMENT).

The workshop should be attended by the SPONSOR, PROJECT MANAGER, PROJECT BOARD members, and possibly also CUSTOMER'S REPRESENTATIVES and members of the future BASE TEAM. Especially in major projects, but also in pioneer projects, external moderation has proved useful.

The workshop allows the project leader and the base team to better elaborate the details and the definition of the project and to prepare the material to be presented for approval by the project sponsor (re-briefing).

### 3.2 Project objectives

An objective is basically a future condition supposed to be achieved. That is often confused with "tasks" – tasks may be derived from objectives, but objectives always describe a **condition**.

The definition of project objectives should embrace all the six dimensions to be managed within the given project:

1. **Scope:** What exactly is produced/developed? What is in and outside the scope?
2. **Quality:** What purpose are the results supposed to have? What is the expected quality of deliverables? What criteria can be used to measure it?
3. **Time:** When will the project finish? When are the partial objectives to be achieved? When are the subdeliverables going to be available?
4. **Costs:** How high should the costs be? What tolerances are there?
5. **Risk:** How much and what risk do we wish to accept? What limits aren't to be exceeded?
6. **Benefit:** What benefit is the project supposed to bring? What is an acceptable business case?

The setting of an objective influences the direction of the project. It often triggers errors that may endanger the project's success later on. Therefore, the following aspects need to be considered in the objective setting: good objectives have certain features for which the SMART mnemonic is a useful tool.

The well-defined objectives are ...

**S**pecific

**M**easurable

**A**cceptable

**R**ealistic

**T**ime-framed

### Objectives are hierarchical

In major projects it is useful to create objective hierarchies, that is, a sequenced breakdown of overall goals into detailed individual objectives. That allows the bridging of the gap between strategic overall project goals on one hand and the measurable detailed objectives on the other. It is particularly necessary not to let the lower objectives compete with the higher ones and with the overall goal.

### Setting the priority of objectives

Various levels may be established in the objective attainment. The setting of priority of objectives specifies the major gravity centres of the project. It also aids in highlighting the most important matters in the continuous project management.

The following scheme is useful in defining the priority objectives:

**MUST** – must be achieved unconditionally

**SHOULD** – should be achieved

**COULD** – may be achieved

**WON'T** – is not an objective of the project

Both the first two categories (MUST and SHOULD) need to be defined in a way that would make them achievable in the project. The category WON'T: "what is definitely outside the project scope" is particularly useful in defining the scope and quality of the project deliverables.

### Objectives are specific

Objectives must be set as specifically and clearly as possible. Too general and ambiguous definitions are neither clear nor attractive. The more general an objective is, the less probably it is to be achieved.

**Objectives are measurable**

Objectives must be set in a way that would make them unambiguously measurable or examinable, as their achievement cannot be determined otherwise. Measurement indicators and criteria also need to be specified.

**Objectives are motivating and realistic**

Objectives must be set in a way that would make them motivating and achievable. Avoid any unrealistic aims. Unrealistic objectives are demotivating in the same way as too plain ones are. As a rule, the achievability chance should be around 50%. It is also useful to derive partial objectives attainable in shorter time span. In this way you can proceed step by step, from one partial objective to the next.

**Objectives are accepted**

The best objectives will fail if they are not appropriated, i.e. not accepted by key actors, especially those supposed to implement them.

The projects involving the cooperation of various departments and enterprises are particularly often exposed to divergence of individual aims of respective actors and the project objectives. Objective-related conflicts must be handled promptly and actively by the project leader.

It's also important that, besides the factual context and tasks, the project objectives' definition includes the social environment of participants, too (who the customers are, what persons influence the project, etc.).

**The project leader must ensure that all the persons involved in the project have an identical "internal view" of the project objectives.**

### 3.3 Context and project information analysis

Project success greatly depends on the quality of communication and the quality of relationships with the project environment. A context analysis provides an overview of the relevant surroundings in order to win the support of important project stakeholders.

#### Context analysis

Early at the project beginning, after the basic outline and objectives of the project are drafted, and prior to the first planning, a context analysis should be conducted.

If other ways are impossible, the analysis may be conducted by the project leader; in any case, it's best to do the analysis together with the base team. Its results are thus of better quality and more comprehensive.

It is important to perform the analyses in a number of separate steps:

1. List of all the stakeholders and stakeholder groups, including those not directly involved in the project.
2. Assessment of each individual group/person based on their influence on the project. A graded rating may be used, e.g. from 0 (no influence) to 5 (very high influence).
3. Assessment of each individual group/person based on their attitude/opinion of the project. A graded rating may be used, e.g. (+) positive, (~) ambivalent, (o) neutral, (-) negative.
4. List of all the anticipated pros and cons (expectations or concerns) that may have an influence on the project. If they are unknown, estimates may be applied.
5. Discussion and selection of specific activities and measures for each context group.

Context	Influence of the success 0 ... 5	Attitude to project -/~ /o/+	Expectation (+) or concern (-)	Measures
Business management	4	~	(-) extra costs	
Customer	2	+	(+) favourable price	
Production	5	-	(-) price pressure	
Supplier A	3	+	(+) more orders	
...	...	...	...	

#### Context analysis sample

The context analysis results provide grounds for much better planning of specific measures. It is also examined whether the project is accepted by the surrounding, how it is accepted and what activities may be used to maintain or increase the acceptance in individual target groups. Timely detection of problems is possible, too.

#### Project information

On the basis of the context analysis results the need of informing individual stakeholders or stakeholder groups may be promptly determined.

Prudent and far-sighted planning of project-related communication often helps to prevent misunderstandings and disputes.

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Elementary questions of the communication management may be:

- Who must be informed about what and in what extent?
- What contents are particularly important?
- How must the information for various groups be processed?
- What kind of communication and what media are appropriate?
- What information is to be gained from who?
- Who was supposed to discuss the project with whom?

Besides the planned reporting methods it will clearly emerge how to direct the communication within the project and in the project environment.

Good project marketing doesn't only aid the appropriate siting of the project and support the project objectives. The positive impression also acts in backward direction to the project by stimulating and motivating the team members.

### **3.4 Building of management resources**

The project's progress must be controlled throughout its duration with reports made in order to allow the individual levels – the enterprise management, sponsor, project manager, work package leader – to implement the necessary decisions and to ensure achievement of the objective – i.e. to allow a proper management of the project.

For this, a number of management instruments need to be created. If the enterprise already has standards and procedures available for individual elements, they can be adopted and customised.

Project management tools required to be established for this stage include:

1. **Periodic project progress reports;** their intervals are set with regard to the complexity and length of the project. E.g weekly reports to the work package project manager, monthly reports to the sponsor / project board.
2. **Event-specific project progress reports;** these are made only if a certain event occurs. E.g. milestone reports or reviews made in individual project stages.
3. **Quality management strategy:** Creation of procedures and definition of competences for all activities safeguarding the compliance of the project deliverables and subdeliverables with the defined quality requirements. The best practice is to establish a central **quality register** of all the quality-related activities (audits, reviews, inspections) and all the take-overs of deliverables.
4. **Risk management strategy:** Creation of procedures and definition of competences for all the activities safeguarding a timely identification, analysis, handling and communication of the project risks. The best practice is to establish a central **risk register** of all the risks and their solutions.
5. **Change management strategy:** One of the cardinal project challenges is a “stealthy” change of objectives and product requirements. It is highly important to establish procedures and competences for all the activities safeguarding that any changes of the defined deliverables and subdeliverables will be exclusively **planned** and adequately **approved**. It is also necessary to determine where and how the previous versions of the changed deliverables, if any, will be archived.
6. **Issue management:** This strategy addresses the way of handling the open issues and problems of the project, how they are to be reported, analysed and assessed. Specified is also the boundary coverage of urgency and consequences for respective hierarchical levels of the project. Plus, when the issues / problems are to be presented to the management.

### 3.5 Project definition

In the project definition the project fundamentals are summed up in a single document or in a set of separate documents. Individual organisations and methodologies may use various nomenclatures for the project definition.

Irrespective of the terms commonly used in your enterprise, the essence lies in existence of a basic document containing the start-up conditions of a specific project.

A project definition may have, for instance, the following features:

- Normally it is a relatively short document of 5 – 15 pages.
- Typical contents:
  1. Management summary
  2. Background, stimulus
  3. Assumptions and dependencies
  4. Objectives, results, benefits
  5. Subprojects/work packages, milestones, target deadlines
  6. Project organisation, responsibilities
  7. Crucial resources, conditions, budgets





## 4. Project planning

Efficient project management requires efficient planning, as no management is possible without planning. Formulation of realistic plans creates a basis for continuous progress check.

The planning of entire project is a good opportunity for the project team to consider the running of the project in advance. Missing some measures out or duplicity in application of measures may thus be prevented and potential dangers or chances can be identified, too.

Only after creation of the plan of the entire project it may be possible to make a realistic estimate of the project duration, the project costs and attainability of objectives. Plans are therefore a central part of project documentation and project charter.

### 4.1 Objects structure plan

The objects structure plan is based on the deliverable of the project and represents a central background for all the other plans of activities. The key question is: **“What does the deliverable consist of?”**

In the object structure plan the deliverable is broken down into subdeliverables and components and its full list is provided. The result is a list of all the subdeliverables comprising the deliverable. Sometimes such plan exists at the very start of the project as a specification (a detailed customer’s requirement) or as a plan developed within a preliminary project.

After all the subdeliverables (parts, design units, components) have been analysed, the project team composition and important assumptions may be reviewed again. The typical questions are:

- Does the team have all the necessary skills and abilities?
- Does the enterprise have all the necessary knowledge and technologies?
- Is it necessary to make additional procurement of work or certain parts?

## 4.2 Project structure plan

A project structure plan is based on a systematic recording of all tasks that the project will involve. In this respect, the primary question is: **“What are all the necessary things to be done?”** Only after this is clarified may the tasks be followed by assessment of the performance and dates (time) and requirements (resources and costs).

The project structure plan (also: work breakdown structure) is...:

- A division of the overall task into plannable and controllable subtasks (work packages or tasks).
- A clear overview of overall project activities.
- A structure applicable to the entire project and providing basis for the following management activities: dates scheduling, allocation of tasks, staff planning, cost planning.

Two different approaches may be used in drafting the project structure plan: top-down or bottom-up.

### The top-down method consists of the following steps:

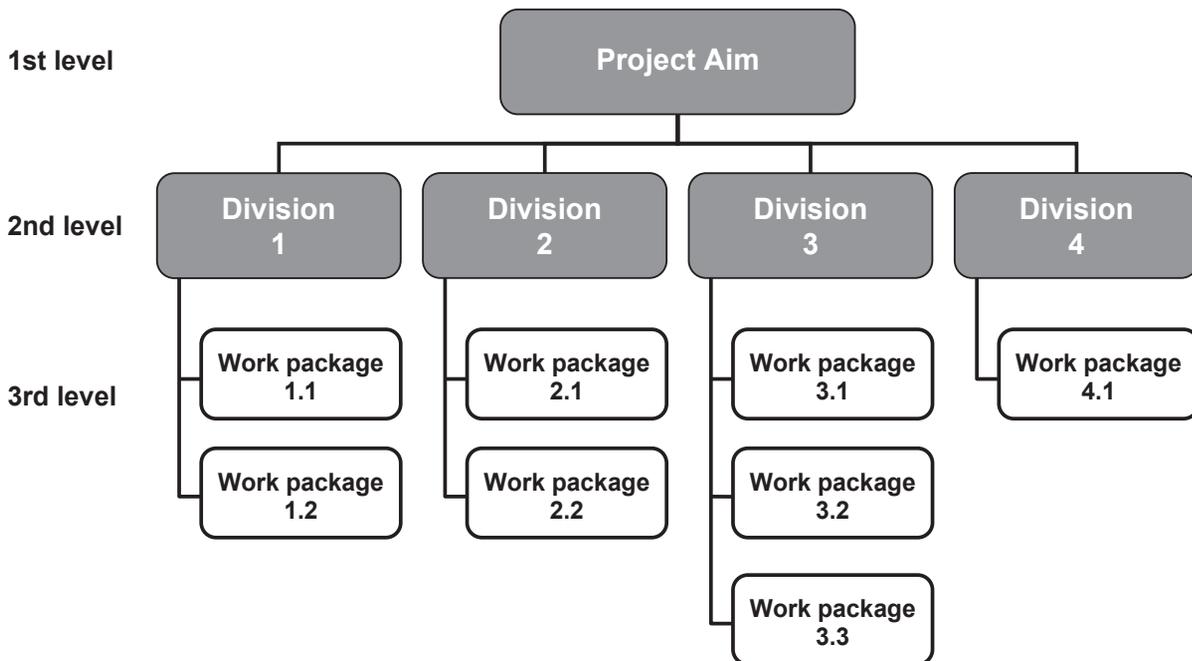
1. Identification of the overall project (the top level of the project structure plan).
2. Selection of an appropriate criterion for Level 2.
3. Division of the overall project into subprojects / work packages.
4. Listing of all the Level 2 tasks.
5. Selection of the most appropriate breakdown criteria for each Level 2 element.
6. Further breakdown of tasks into plannable and controllable work packages / tasks. This division process ends when an activity reaches a reasonable size that may be characterised as follows:
  - a. estimate of costs can be made
  - b. budget can be drafted
  - c. a task can be unambiguously assigned to a person, a supplier company or a group of persons.
7. Identification of each task with a numerical code.

### The bottom-up method has the following procedure:

1. In this step all the tasks required to be done in the project are listed – irrespective of the hierarchy (e.g. through group brainstorming)
2. Analysis of relationships using the question: “What is a part of what?”
3. Building and creation of the project structure in a hierarchical form
4. Addition of missing but required tasks
5. Deletion of duplicate tasks
6. Allocation of a numerical code

Note that the **project management activities** are often missed out, which results in unrealistic time frame and costs estimates. Project management activities are an integral part of the project and thus need to be considered in the project structure plan. That includes also the activities of quality management, risk management, change management and information management.

## Project structure plan



The project structure plan also serves the purpose of reviewing the final **project organisation setting**, in which questions and requirements that couldn't be anticipated at the start may still emerge. Perhaps the division of individual work packages would need to be improved? Could we merge some of them? Are some individual parts so complex that a separate subproject should be launched? Such inevitable changes also affect the project organisation.

### 4.3 Plan of individual project stages

Material logical/content-related and thus also time-related dependencies are to be handled only after the project structure plan is finalised. Which activity is precedent to the next? What work package provides the results to which the following activities are tied? In this step neither the work difficulty is estimated, nor deadlines are set; instead, the question "What comes first, what then, and then...?" is considered.

There is a wry joke about project plans: "A plan is a way of replacing coincidence with a mistake". To prevent this, a stage-based project planning would be the best practice, with the overall project split into a number of large stages. The most common ones are:

1. Project definition
2. Project start-up
3. Several project management stages
4. Project close-down

Within the overall project a rough-draft plan of the project progress and the project timeframe is made, with just the successive stage being planned in detail. That also prevents unnecessary work related to purely virtual plans.

### Milestones and stage transitions

Milestones make projects clearer by marking the transitions between individual stages, i.e. the end of one stage and the start of the next. A milestone is a clearly defined event of special importance within the project, visible to all the project organisation bodies. A milestone, or a move from one stage to the other, is thus also used for project progress checks. It is always a prompt for:

- review / project progress report,
- objectives check
- forecast and planning of further steps,
- update of changes, risks and open issues,
- evaluation of the experience so far (lessons learned)

Achievement of major milestones may be a reason to celebrate as well.

## 4.4 Project scheduling

There is a range of various methods as well as a multitude of planning techniques and tools designed for project scheduling. Selection of an appropriate method and an adequate form of display is of crucial importance.

Not every project requires elaboration of network plans that can only be maintained with aid of software. Instead, simple deadline lists or bar-chart schedules are often sufficient. What extent of planning would be adequate for a specific project?

<b>Time schedule</b>	A simple list of tasks and their time-related progress
<b>List of dates</b>	A list of tasks with respective final deadlines, plus fixed dates
<b>Bar-chart schedule</b>	A list of tasks, starting date of each task, ending date of each task, plus their duration and fixed dates
<b>Networked bar-chart schedule</b>	A list of tasks, length of each task, with dependancies among the individual tasks, fixed project dates
<b>Network plan</b>	A list of tasks, length of each task, all the logical dependencies among individual tasks, fixed project dates

Such schedule planning methods are compactible bottom-up, i.e. the schedules not present in the upper list are contained in the schedules positioned below them. All other plans may be derived from the network plan, but it's not possible vice versa.

**Bar-chart schedule (Gantt chart)**

The bar chart is designed to provide a graphic illustration of processes (tasks) and events (dates) in a clear form.

In addition, it also lists all the processes (work packages, tasks) and events as fixed dates or milestones, provides an estimate of length for each process and sets individual starting and ending dates.

On the timeline individual planned values are recorded in form of bars. The bar length represents the period of individual work packages. This facilitates a clear illustration of time overlapping.

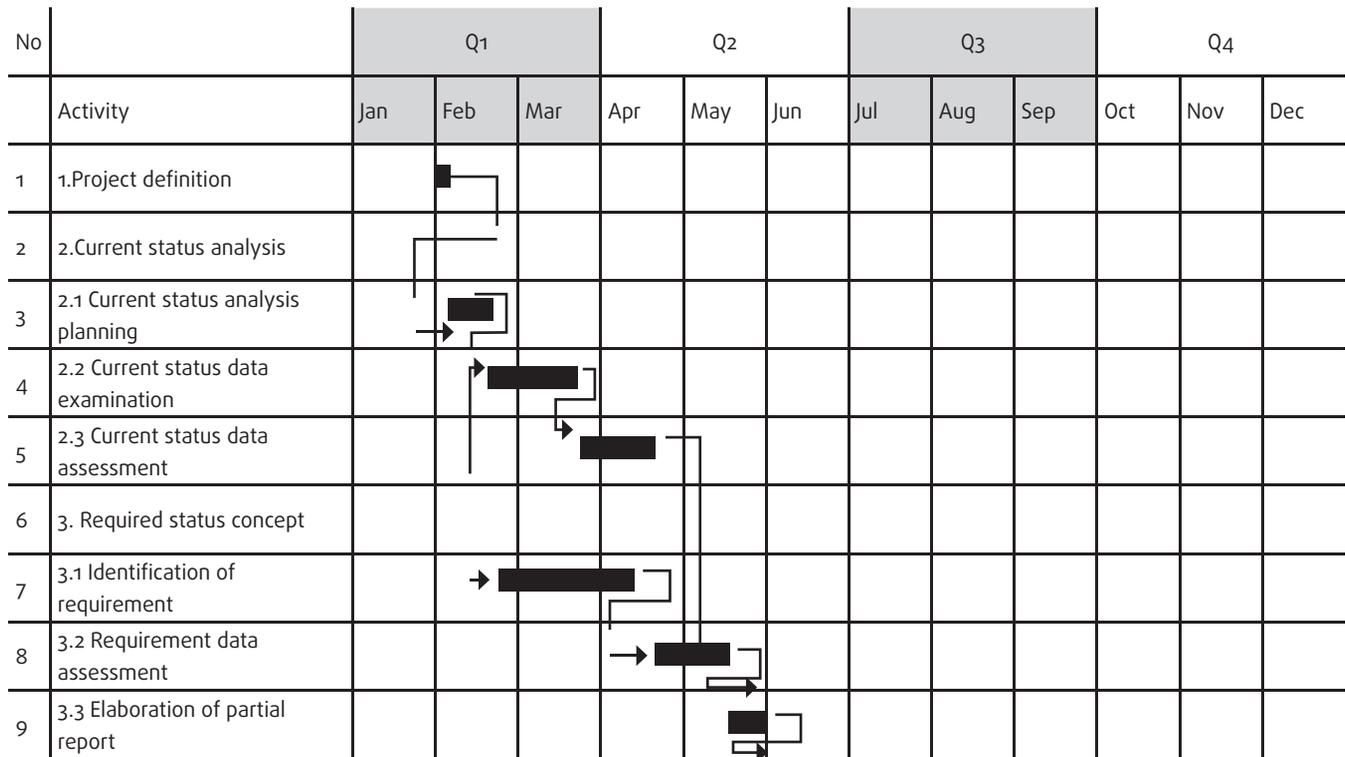
No	Activity	Q1			Q2			Q3			Q4		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1. Project definition		■										
2	2. Current status analysis												
3	2.1 Planning of current status analysis		■										
4	2.2 Current status data examination			■									
5	2.3 Current status data assessment			■									
6	3. Required status concept												
7	3.1 Identification of requirements			■									
8	3.2 Requirement data assessment				■								
9	3.3 Elaboration of partial report					■							
...	...											■	■

Example of a networked bar chart (implemented in accounting and IT systems)

### Networked bar-chart schedule (networked Gantt chart)

In a networked bar-chart schedule the normal bar-chart is extended with depiction of type- and time-specific dependencies of the tasks. The identification of dependencies between the tasks highlights the critical path and free floats.

If all the dependencies are present in a networked bar-chart schedule, it has the same information content as a network plan. However, if the graphical networking of bars is too dense, the readability of such a schedule drops.

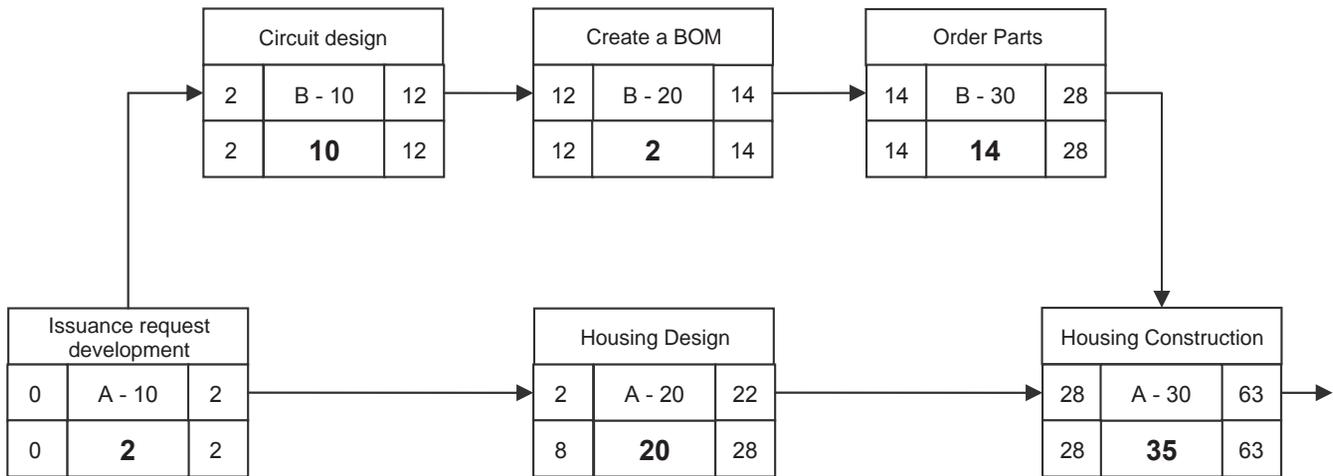


Example of a networked bar-chart schedule

### Network diagram

A network diagram is meant to depict the course of the project based on a sequence of the tasks to be carried out and their mutual dependence. The deadlines and dates are expressed digitally (software-aided processing). Based on this, a critical path and float may be detected.

Depiction in the form of a network diagram is recommended especially in highly complex and long-term projects. It is much more demanding, though, and impossible to handle without a software.



A cut-out sample of a network diagram

### Relationships within the arrangement

A variety of arrangement relationships exists among individual processes/work packages. Four possible relationships are:

**1. Successor relationship, finish-to-start relationship**

The end of Process 1 is a precondition for the start of Process 2.

Example: Completion of assembly works is a precondition for putting the product into operation.

**2. Predecessor sequence, start-to-start relationship**

The start of Process 1 is a precondition for the start of Process 2.

Example: The beginning of programming is a precondition for the beginning of documentation works.

**3. End succession, finish-to-finish relationship**

The end of Process 1 is a precondition for the end of Process 2.

Example: Completion of assembly is a precondition for the termination of cleaning works.

**4. Leap succession, start-to-finish relationship**

The start of Process 1 is a precondition for the end of Process 2.

Example: The start of using the heating system is a precondition for the termination of the period without regular heating supply.

## 4.5 Critical path

For each process two extreme points are set in a networked bar-chart schedule and in a network diagram in time analysis.

Forward scheduling. From the project start-up on, the early start date and the early end date are set for each process. Based on this the early close-out date for the project will arise.

Then, in a backward pass, i.e. from the project close-down to the project start-up, the latest permissible dates for individual processes are calculated.

As individual processes (work packages) show different length and dependencies, float for each work package can be identified.

The **critical path** is therefore a **sequence of processes with no float**. That is, each work variance has in these work packages a direct influence on the end date of the project.



Why is actually the **critical path** so important?

1. If on the basis of the set fixed dates ensues a purely mathematical negative overall float, these processes will be denoted as excessively critical. That will highlight where time must be saved in the project.
2. In resource planning and risk monitoring the processes (work packages) located on the critical path are of the absolute priority!

## 4.6 Resource planning

The aim of resource planning is the planning and illustration of all the deployed project resources and engaged collaborators in the time sequence. The required staff and deployed resources are allocated to the work packages (processes).

In relation to the overall project as well as in relation to every work package or every process the following questions arise:

- Which persons and which resources deployed are indispensable?
- How many resources will be required?
- When will these resources be needed?

### Resource planning procedure

As a rule, resource planning includes three important steps which must be planned interactively:

#### 1. Requirement identification

First, the work demands are estimated on the basis of experience. The estimate must be as accurate as possible, otherwise the overall planning will be delusive. For the planned process period it is thus possible to determine the necessity of workforce/deployed resources for the specific process/work package:  $\text{requirement} = \text{demands}/\text{time}$ .

In this, constant deployment throughout the process period is envisaged. If differences in resources deployment are not negligible, the process needs to be broken down.

In this step experience available from other projects, documented in the enterprise, is greatly helpful. Especially in staff involvement caution is recommended. A possible way facilitating a realistic estimate is to ask the persons responsible for the work package to provide three estimates: an optimistic, a pessimistic and a realistic one.

#### 2. Identification and depiction of the requirement profile

The requirement profile provides a graphical and chart-based account of requirement on the timeline. As a time position is known for each process/work package from the scheduling, for each resource it is possible to determine a requirement plan by summing up, in all processes, the quantity units of the resource deployed, related to each calendar unit.

#### 3. Availability analysis

Based on comparison of requirement and availability it's possible to identify surplus or shortage of the resource as early as in the planning stage and, possibly, even to put it in balance. This step encompasses not only the staff engagement, but also the use of equipment, such as a testing environment, while that may also be in shortage.



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## 5. Project management

The notion of project management encompasses all the activities used in the project execution stages aimed to steer the project towards the agreed objectives.

There is a clear project definition approved by the sponsor (internal ordering party). A rough draft plan of the overall project is prepared and fixed dates are determined. In an ideal case the project execution is split into a number of stages with the first management stage being planned in detail.

### 5.1 Project progress

The stage-specific work is guided by the project manager to meet the respective stage objectives. In minor projects the project managers themselves take over and manage the work packages, while in major projects there are team members at the project manager's disposal to be put in charge of the particular packages.

That would be based on the workflow laid down in the stage plan and scheduling plan. The basic question of the progress management is:

**“What is the relation of the project to the plans?”**

So that possible corrective measures may be initiated, clear and defined reporting methods are required for the project management:

### **Regular status reports**

The staff in charge of a work package (and possibly also the subproject leaders) inform the project manager on the current status of the work package in regular time-framed progress reports (also: status reports).

It is also agreed that the project manager would submit project progress reports to the sponsor or to the project board in regular intervals, as agreed at the beginning.

The periodical reporting intervals would be shorter in the project's start-up and close-down stages than in the less critical middle stages.

### **Event-specific status reports**

Under special circumstances, such as completion of important work packages, in the case of occurrence of major open issues which may be decisive for risks, or in the case of handing over the subdeliverables/partial results, **event-specific project progress reports (status reports)** are prepared and presented to the person having decision-making powers in the project.

### **Challenges for the project manager**

Guiding the project in the management stage is a major challenge for the **project manager**:

- The project manager ensures the implementation of activities planned in the scope of the quality management, risk management, change management and issue management, as well as the documentation of the results.
- In the case of variance, corrective measures are performed by the project manager – jointly with the project team whenever possible. The project manager may appoint a person to be in charge of the work packages, or steers them on his own.
- If the high demands and/or urgency of the variance exceed the project manager's competences, the project sponsor (and the project board, if established) becomes the decision-maker. The project manager prepares the decision with a description and presents recommendations for the decision.
- The project manager prepares the transitions between stages, or milestones, and reports on the results to the sponsor.

### **Meetings of team members**

Milestones and stage transitions provide an excellent opportunity for organising a meeting with the project team (in major projects: with the base team).

In this respect, an appropriate scope needs to be set, according to circumstances and the project:

On the one hand, a team requires regular face-to-face meetings in order to be able to work well.

On the other hand, too frequent meetings are considered a burden and a "waste of time". In international project teams the members' meetings are particularly hard to organise and finance.

Alternative methods may be used, such as a project newsletter, a project website or a videoconference.

## 5.2 Detailed planning of the successive stage

If the project is well structured into individual stages, the nearing termination of one stage is the right time to deal with detailed planning of the following stage.

This allows a prompt complex consideration of the current developments in the detailed plans along with any necessary modifications or measures (e.g. acceleration, increase in resources, engagement of an external organisation, etc.).

The detailed plans are then more realistic and earnest, and thus also more readily acceptable. Nothing is actually more harmful than a plan vanishing in the drawer “in a wink”.

It gives the team an opportunity to review the bases and conditions of the project afresh. Any framework conditions changed or new technologies may thus be integrated more promptly, with the project benefits preserved.

## 5.3 Risk management

There are always risks involved in every project.

**The project risks, i.e. the potential outcomes affecting the project objectives, need to identified, assessed and managed.**

Here a continuous maintaining of a **risk register** where all the team members enter the identified risks has proven useful. It also documents the responding analysis, planning and implementation steps.

As a project is a dynamic endeavour, risks don't remain static either. Existing risks may change and new ones may emerge. Regular risk check and updating of risk records must be ensured.

### Identification of risks

As early as in the project start-up stage all the related risks are identified in the project definition. If necessary, they can be classified according to specified **criteria** (e.g. technology risks, customer risks, context risks, etc.).

In any case, **early warning signals** communicating the possibility of risk should be considered and recorded.

A **RISK-OWNER**, i.e. a person responsible for risk monitoring and risk management should be appointed as well.

It is best to record the risks immediately and prior to their assessment into the **risk register**.

### Risk assessment

In the following step all the risks identified are first individually assessed and then a total risk level of the project is determined.

Organisations' **risk policies** define the range of risk from acceptable to intolerable levels. If such acceptability thresholds are exceeded, approval by the project sponsor or the project board is always required.

There are various methods of risk assessment. Two examples are as follows:

**Expected monetary value analysis**

A probability of occurrence is set for each risk (e.g. 30%). A consequence of the risk in a monetary value is then estimated (e.g. € 10,000), from which an expected value is derived through mathematical calculation (€ 3,000 in this case).

This provides a prompt overview of individual risks and the total risk level of the project.

Risk	Probability	Consequence (€)	Expected value (€)
1	60%	20,000	12,000
2	30%	13,000	3,900
3	10%	4,000	400
<b>Total risk</b>	<b>Expected monetary value</b>		<b>16,300</b>

Example: Expected monetary value analysis

**Probability and impact matrix**

Every risk is assessed according to two criteria:

1. How high is the risk occurrence probability?
2. How big is the impact on the project objectives?

Based on that is the risk seriousness matrix.

Probability	Low	Medium	High
Impact			
High	high risk	unacceptable risk	unacceptable risk
Medium	medium risk	high risk	high risk
Low	low risk	low risk	low risk

Example of a probability and impact matrix

In the case of **unacceptable risk** of the project (risky policy of the enterprise) the project needs to be discontinued and started up again under completely new conditions. In general it is good to use preliminary projects to clarify or create the basic preconditions prior to re-starting the project again.

**Risk management planning**

On the basis of the assessment responses to the risk are planned. Some can be prevented by implementing fundamental changes – up to the project discontinuation. Some can be reduced by adequate preparation, for some the fall-back strategy will be prepared and some will have to be accepted.

In planning a person responsible for the risk management must be appointed, if it had not been done yet. It doesn't always need to be the project manager. A decision on the **risk budget** must be made as well.

**Risk solution implementation**

The risk owner makes a decision on a planned solution of the risk, and activities and results will be documented in the risk register.

Every risk solution has its consequences! Even after a risk is solved, residual risk may remain, or associated new risks (**secondary risks**) may emerge. These need to be handled in the same way as any other risk.

## 5.4 Quality management

The role of quality management is to ensure making the project deliverables adequate for the planned purpose and to safeguard continuous adequacy control throughout the project.

Based on the customers' expectations, performance parameters and specific properties of the final deliverables are laid down in the project definition and project charter.

**Achievement of these qualitative objectives must be planned and managed.**

Again, a central **quality register** acts here as an aiding tool, in which all the quality plans, all the quality-related activities and all the results are recorded. The quality register also includes take-over protocols.

### Quality planning

In the quality planning, the quality **criteria** are based on expectations of an internal customer or external customers/ordering parties. Such criteria must be determined and formulated in a way that would make them examinable and/or measurable.

Incorporated is also the creation and documentation of deliverable's **take-over criteria**, and criteria for any subdeliverables intended to be handed over in the course of the project.

Setting the **priorities and tolerances** is useful for both criteria.

Important in setting of the quality criteria and take-over criteria is also the determination of **control methods** (e.g. tests, inspections, survey, pilot trials, consultations,...) and **responsibility** for quality control implementation. Required competence and experience of the controller may also be specified.

In the project scheduling and resource planning it is also necessary to bear in mind that quality control activities require some time and generate costs.

### Quality management

Quality management covers all the activities designed and planned to achieve qualitative objectives. This concerns all the quality control activities (see Control Methods), but also all the activities needed for eradication of reasons of insufficient performance.

The planned activities are carried out by respective controllers on scheduled dates, using the testing methods determined.

The quality documentation encompasses all the activities and quality control results, as well as the **take-over documentation** of the deliverables and subdeliverables.

## 5.5 Change management

Some of major threats in a project are unplanned, “stealthy” changes at all levels of project objectives. Although they may often result in chaos while the project is still running, upheaval is certain to erupt at the project close-down or at the final take-over or hand-over of the deliverables.

**The change management isn't about preventing any change. Instead, it is more important to keep any changes that may affect the planned project values (costs, scope, quality, duration, risk, benefit) under systematic and controllable management.**

That requires a targeted configuration management and change management, implemented as a continuous task throughout the entire project.

Targeted changes can only be assessed on the basis of comparison with a well-established and set status-quo, with the **baseline**. In the project charter a baseline is laid down for the project objectives (e.g.: quality of the final deliverable, or: scope of the deliverable, or: project costs). These fundamentals may only be changed by a plan, and the change must be approved.

Precondition for that is the recording of **configuration data sets** delimiting the baseline – i.e. the underlying and relationship configurations. All the changes in the course of the project, that could alter such configurations, are subject to **change management**.

### Responsibilities

As clear and unambiguously identifiable responsibilities as possible must be defined for the change management. Setting of tolerance limits is also helpful. Minor changes in individual work packages can, to certain extent, fall within the project manager's competence. Any changes exceeding this scope or the management stage changes must be forwarded to the sponsor/project board.

The best practice in this respect would be creation of a **register of changes (issue register)** in which all the change requests are recorded and their solution measures are documented.

### The following procedure has proven the best practice in the handling of changes:

1. **Recording of the change**, e.g. by a team member or the project manager
2. **Check of the change by the project manager** together with an expert
3. **Proposal for action** from the project manager
4. **Decision** made by the sponsor/project board
5. **Implementation** by the project manager

As every change approved alters the baseline, the **configuration set** needs to be modified. A new version of the underlying base then becomes valid, while the previous version must be safely archived.

### Follow-up activities

Every change approved generates costs as well, affects the plans and the project risk. The following activities must therefore ensue:

- Control and update of the project plans
- Risk identification and analysis
- Update of the project costs, if a separate budget wasn't set up for the specific change

## 5.6 Issue management

In its due course, every project brings “open points” and problems (issues) up to the daylight. Often these are minor and insignificant, and can be solved by a single phone call. Sometimes, though, they are early warning signals for risks accumulated. Or, they can herald major changes required to be solved systematically.

It is then an advantage if the issues (open points and problems) are solved the same way as the change issues. In this case the **issue register** is sufficient for both purposes.

The responsibility for solution of open points and problems must be clear. Normally it is the project manager who decides about which of the minor issues are to be solved immediately and in an indicative manner, and which would need a closer look.

There are several possibilities available for the project manager then:

1. The open points indicating a risk are recorded in the **risk register** and handled thereafter as a risk
2. The open points which are likely to lead to a major change are recorded in the **issue register** and are handled as a change
3. All the other open points (no risks, no changes) which cannot be solved immediately are also recorded in the **issue register** in order not to get lost and to allow their solution as soon as possible



## 5.7 Project team management

When talking about project management, methods and processes are normally highlighted. No wonder, as truly complex and risky plans and business cases are handled, requiring painstaking planning a management.

However, projects acquire a higher degree of innovation, higher issue capacity and quality only if the team cooperates well despite its heterogeneity. And good management is indispensable for that.

Good project management can rarely rely on the instruments available to the managing staff. The team members are usually hierarchically subordinated to the managerial staff of the respective enterprise units and departments. In the case of external team members, for instance if suppliers and contractors cooperate in the project, the members aren't from the same organisation at all.

The basic question of the project manager in the project team is how many different members with their diverse knowledge, interests and viewpoints are to be involved in the joint endeavour. Here the project manager acts as an "advocate of the objective" and should never lose the following cardinal question from the sight:

**"What does my team need to be able to work well?"**

Project management tools help to clarify objectives, tasks and responsibilities, but simultaneously also to set the rules of the game and cooperation. The principal tasks of the project manager are:

1. To create, maintain and, if necessary, also actively safeguard favourable teamwork conditions (see the "Project management and teamwork" section).
2. To provide the team members with a lot of opportunities to be engaged in cooperation through personal contact and always share their success with the team.
3. To find, for himself or herself, a personal equilibrium between the role of a leading project participant and a collaborator subordinated to another manager on a single level and not to slip to any of the two sides.

## 5.8 Project context management

Project management isn't just the utilisation of methods and teamwork. Project management is, most of all, a matter of communication, which is actually one of the management functions. **Communication, processing of conflicts and negotiation** are the project manager's activities meant to actively shape the overall project context in the project intentions.

The context basically decides whether the project is going to be successful or not. Even after termination of the project there still applies the following rule: Though the results may be excellent, if the message of success is not delivered to the appropriate audience – the Customer, Sponsors, superior authorities, suppliers and contractors or others, nobody would know.

Context analysis and the draft information system of the project create a good base for establishing relationships with the environment. Especially in long-term and complex projects the conditions often change, so the base needs to be continuously examined.

**Communication must not be just planned; adequate and targeted communication is also necessary if the time pressure and workload are high.**

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## 6. Project close-down

The purpose of a project close-down is the handing of the deliverables over to the customer or user, safeguarding of the project outcomes and experience (lessons learned) and the termination of the project clearly perceivable for all the counterparts. That unties the project resources.

Even a premature project termination (project discontinuation) must be done in a clear and adequately documented manner. In this case, too, any subdeliverables and subresults need to be safeguarded so that they may be used for another project later on. That includes the experience which has to be assessed and made available for the organisation. Again, the rule is that a clear termination must be defined, so that the energy and capacities might be released.

### 6.1 Take-over and hand-over of deliverables

The project results/deliverables must be duly delivered and received. Some subdeliverables might have already been handed over and received by the customers/users. **Take-over protocols** must be therefore maintained on that.

At the end of the project it is necessary to check again, whether all the **quality management** activities (audits, inspections,...) have been carried out, whether related protocols were made and whether the deliverables meet the quality expectations agreed.

It is carefully reviewed and checked whether all the documented **changes** of deliverables have been approved and accepted according to **change management**.

Deliverables are **handed over** to the customers/users. If necessary, appropriate contractual amendments are made, e.g. service or maintenance agreements.

### 6.2 Open issues

All projects, even the best ones, still have "open points" (issues) at the end. Checked and analysed in this stage are all the gathered **open issues** (issue register):

- Which of them are so important that they still need to be solved?
- Which open issues are yet to be addressed?
- Who is to take up the responsibility for solution of the remaining open issues at the end of the project?

Open issues often give rise to stimuli and, although they alone do not pose threat to the project success, they need to be processed more intensively.

It is an advantage if the project team prepares **recommendations for further processing** that would take place outside the project. For instance, recommendations for a follow-up project to a certain theme, or launch of a feasibility study, or a project for a technology development.

### 6.3 Lessons learned

Every project provides a range of knowledge not directly related to the intended deliverables/results. This **experience and knowledge** is of immense value for next projects and for the organisation. In spite of that, it often gets lost.

Documentation and accessibility of the specific project experience is important and helpful in preservation and enhancement of the enterprise competitiveness. The knowledge may vary, e.g.:

- Experience by methods of estimate to determine the project value
- Experience of suppliers and contractors
- Experience of the applied project management methodology
- Knowledge of real activity-specific costs
- Knowledge of the specific technology used
- Evaluation of forms and processes

### 6.4 Project evaluation

This task basically stems from the comparison of the required and the real status of deliverables and events of the project with the objectives defined at the project beginning in all the six dimensions: costs, time, quality, scope, risk and benefit.

**The point is to determine how successful or unsuccessful the project was.**

Instead of comparing planned and completed aspects, an analysis and assessment, such as an **analysis and substantiation** of variances, needs to be made in the subsequent project evaluation.

The project evaluation includes also an **illustration and evaluation of the project flow** and major events, such as a change in the project definition and change of objectives, change of conditions and change of basic assumptions.

**Evaluation of the project team performance** is also a part of the project evaluation.

**Evaluation of the project management**, methods, tools and processes should be also done at the end.

## 6.5 Final workshop

A lot of work that need to be done in the close-down stage of the project, like the checks of take-over protocols and quality documents, can be handled as separate work or within a small subteam. However, a better option for all tasks having a distinct evaluation value is a final workshop.

**The aim of a final workshop is a joint and formal closing of a project.**

The same hard effort, as was expended in the project start-up, should be also devoted to the close-down of the project. The quality of solution of the issues which are still open, summary and evaluation of the lessons learned as well as the final project evaluation acquire a distinctly higher quality if a number of various viewpoints of an interdisciplinary team are involved.

At least a part of the final workshop should be attended by the SPONSOR (internal ordering party) and the project board members. Linked with their point of view is also an analysis of results and evaluation of success. Besides that, a hand-over of subsequent activities within the enterprise (e.g. open issues) is improved, and discussion on the lessons learned as well as forwarding of the project team recommendations are made easier.

## 6.6 Final report

The final report of the project is actually the last status report from the project leader. It is basically a comparison of the project results achieved with the project charter, compilation of all the final documents and subsequent project evaluation.

The **final report** usually contains:

- An executive summary by the project manager
- An evaluation of the project benefits (business case)
- An evaluation of the project objectives
- An evaluation of the team performance
- An evaluation of the results/deliverables of the project
- Quality documentation
- Take-over and hand-over documentation
- Variance in specification (changes)
- Open issues and recommendations for follow-on activities
- Experience report (lessons learned)

Project definition documents and original plans are recommended as an attachment.







## 7. Further reading

SPPR - Spoločnosť pre projektové riadenie  
(Project Management Association of Slovakia):

<http://www.sppr.sk>

Comparison of various software tools:

<http://www.klambauer.info/pms.pdf>

### 7.1 Tools

A wide range of diverse software tools is available. An accurate requirement analysis is necessary prior to their selection. A short sample list:

Achievo:	<a href="http://www.achievo.org">http://www.achievo.org</a>
Activity Manager:	<a href="http://www.jfbrazeau.fr">http://www.jfbrazeau.fr</a>
AirToDo:	<a href="http://airtodo.sourceforge.net">http://airtodo.sourceforge.net</a>
Clarity:	<a href="http://www.clarity.com">http://www.clarity.com</a>
dotProject:	<a href="http://www.dotproject.net">http://www.dotproject.net</a>
Gantt Project:	<a href="http://ganttproject.biz">http://ganttproject.biz</a>
Microsoft Projekt:	<a href="http://office.microsoft.com/project">http://office.microsoft.com/project</a>
Microtool:	<a href="http://www.microtool.de">http://www.microtool.de</a>
Open Workbench:	<a href="http://www.openworkbench.ch">http://www.openworkbench.ch</a>
Projectory:	<a href="http://projectory.sourceforge.net">http://projectory.sourceforge.net</a>
Projectplace:	<a href="http://www.projectplace.de">http://www.projectplace.de</a>
Rapla:	<a href="http://rapla.sourceforge.net">http://rapla.sourceforge.net</a>
XPlanner:	<a href="http://www.xplanner.org">http://www.xplanner.org</a>

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## 7.2 Sources

Frank Boos / Barbara Heitger: Kunst oder Technik? Der Projektmanager als sozialer Architekt

Richard J. Hackman: Leading Teams. Setting the Stage for Great Performances

Peter Heintel / Ewald E. Krainz: Projektmanagement. Eine Antwort auf die Hierarchiekrise?

The IBM Business School: Principles of Project Management

Alfred Janes / Michael Schulte-Derne: Entwicklung und Irritation einer hierarchiegeprägten Unternehmenskultur durch hoch integriertes Projektmanagement

OGC: Managing Successful Projects with PRINCE2

Gerold Patzak / Günther Rattay: Projektmanagement. Leitfaden zum Management von Projekten, Projektportfolios und projektorientierten Unternehmen

SPPR: Slovenský výkladový slovník projektového riadenia

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2011

# Project

## Management