Bogdan Lent

Cybernetic Approach to Project Management

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To someone,
who made my own
My Dream Project
happen

Preface

Why This Book?

Addressing the Challenges

In managing various projects, at first small then becoming larger with time, I faced the deficiencies of common "great" management guidelines from renowned bodies. These guidelines and standards missed the point of competence focus, recurrence of processes, uncertainty and complexity in challenges, decisive human factors in projects and, most of all, the capacity for intuitive deployment. As DeMarco and Lister put it: you're like the vaudeville character who loses his keys on a dark street and looks for them on the adjacent street because, as he explains, "The light is better there" (DeMarco and Lister 1999). Being responsible for my small team of project managers in the company and for hundreds of my students on two continents, and striving to deliver ever-better managed projects to my customers and stakeholders, I felt it my duty to search for the keys where they were lost.

Role of Self-management

One of the key recognitions, and in consequence a distinctive feature of this book, is the impact that the personality of the project manager has on the fate of the project. I consider the project manager's successful self-management in work and life process to be as important in any endeavour as all the other project management processes covered by the above-mentioned standards and guidelines.

Focus on Reality and ISO 21500:2012

This book attempts to reflect as closely as possible the project reality, cover the newly published ISO 21500:2012 standard, benefit from the best contributions

worldwide and provide a concise yet powerful toolbox. It aims to be easy to use and intuitively supportive for project managers. The evidence so far indicates that these targets have been successfully met.

What Is New?

With the benefit of my professional experience, I scanned all current (and there are plenty of them!) contributions in the relevant fields. Very few covered comprehensive project management as I see and experience it daily. As a result, a number of innovative methods and techniques, highly practical and real-life oriented, have been conceived. You will not find them elsewhere:

- Project management is perceived as a set of processes – in accordance with the ISO 21500:2012. This is not the perception of most popular approaches so far.
- We do work in loops, continuously monitoring our performance and choosing what action to take. Project management should also be perceived like this: as a third-order cybernetic system. In contrast to the new ISO standard, the control process is itself subject to control (and adjusting action if wanted) so it is treated as a second-order cybernetic system. First-order systems feedback through the project and the third-order system is the person of the project manager (Kato and Smalley 2011).
- The second-order cybernetics, i.e. the project management processes, never really finish until the project is closed. The ISO standard admits this and yet groups project management processes into what resemble the project lifecycle phases rather than into concurrent processes: initialization, planning, implementation and closing (and controlling). In this book, all processes are balanced and treated equally. The project manager sets the priorities and activates them.
- A project manager should act, not carry around books of good advice. So, the simple mnemonic of a clock, the L-Timer®, is introduced to facilitate taking the right action at the right time and to keep all second-order cybernetic system processes perpetually running.
- The human factor, considered decisive for project success, takes a prominent place in this book. It is treated in processes in same way as the administrative (formulaic) issues. This allows a better balancing of the efforts of the project manager and the team.
- The 5W1H of Toyota is modified to 6W to better support the project manager in planning and scheduling.
- The activity/role model is considered best for organizing a project team because it facilitates higher coverage of all relevant project issues.
- Culture is taken into consideration when organizing the team, often beyond the scientific management rules.
- The project manager has to participate in procurement processes. The thoroughly discussed WTO/GPA rules offer an excellent base for private industry as well.

- Integration means integration of the three "P"s: the product, the process and the people.
- Knowledge management in a project is handled along the Nonaka and Takeuchi conversion model, with evaluation of operational sub-processes at each stage of the model supporting the project manager in facilitating the right processes.
- All projects benefit from a clear project management handbook. However, the decision as to what is included and what is omitted is mostly arbitrary. Here, the "in" comes from the customer demands mapped onto the L-Timer® processes. Each demand is weighted. This secures the comprehensiveness and fulfilment of all customer demands and dealing with them only once at the right place, and thus enables the project manager to balance priorities.
- Knowledge management is not documentation management! Both of these have different target recipients and different goals. In this book, they are clearly treated as separate processes.
- Personalities are evaluated along the MBTI (Myers–Briggs taxonomy) for their project role suitability. You may wish to check yourself or your team members and then consider the informal roles, which impact the performance of both you and your team. The integral humanism and Max Scheler value systems are viewed as the best choices for evaluating project manager moral behaviour. This is very seldom considered in project management and yet is crucial.
- Unique and efficient is the required evaluation of candidates for project roles. In most cases, the demanded capabilities are defined by the company HRM department and have weak or no relationship to the real project tasks. In this book, only the activities relevant to execution of the project management processes are taken into consideration and mutually weighted. The capabilities required to perform exactly these activities are named and also weighted against each other. In the next step, the candidates are evaluated. In this way, a clear picture of how candidates might perform needed actions is obtained.
- There is no project in which conflicts do not occur sooner or later. So, a project manager is well advised to prepare for this. The creative and useful PACTAR (Spanish: to negotiate) technique for conflict solution is conceived especially for dealing with project team conflicts.
- Communication is proven to be the key success factor in projects. An innovative communication model based on the transactional analysis of Eric Berne takes the MBTI personalities and the informal roles mutual relationships into account.
- All stakeholders watch the project manager. The self-management ability of the project manager impacts the project and the stakeholders' perception. A personality entities interrelation chain can be helpful here.
- The third-order cybernetics of the project manager gets us back to the project manager's mental model. This, combined with intrinsic motivation, impacts decision making. Careful and unique selection of techniques can help the project manager to balance the demands of work and personal life.

- A well-balanced project manager becomes a leader. The holistic approach of K. Candis Best matches the cybernetic view and results in the LEAD model: launch, engage, act and deliver.
- Sense-making intelligence distinguishes a leader. A project manager needs IQ to be an expert, EQ (emotional intelligence) to be a good manager and SQ (sense-making intelligence) to become a leader, i.e. to handle project uncertainty.
- The Motivational Factor Inventory, developed by the Swiss Military Academy at the renowned Federal Institute of Technology and co-authored by the author of this book, provides project managers and stakeholders with a powerful instrument for people handling. It is now widely used in several countries on three continents.
- This book is very well organized. All chapters follow the clock, starting from 07:00 Planning & Scheduling: P&S. You will find always a "Quick look" at the beginning of each chapter, then a description of the process, followed by methods and techniques with tools, templates and checklists.
- There is a bibliography of over 400, mostly actual, sources. You may wish to benefit from this inventory of current thinking on the subject.

  Isn't it enough to get into?

Who Should Read This Book?

Project Managers

Project managers facing complexity and uncertainty can find the right tool in this book. The logical and understandable guidelines and checklists cover all events in a project. The assessment of complexity and uncertainty is personality-based. This means that everyone can tailor their activities, methods and techniques to their own project and their own capabilities, yet keep the necessary balance through use of the weighting system. A specific project management handbook (charta) may be drawn along the structure of this book (I do this for my projects and have never missed anything so far).

Supplier and Purchaser Project Managers

The viewpoints of the project manager on the supplier side and the project manager on the purchasing side are different. The first has to structure the project along the technological and manufacturing issues, and the latter has to put the business case in the foreground. However, in most cases, a certain amount of technological integration with other parts of the project takes place on the purchaser side, so the challenges are ambiguously technological, organizational and social and go well beyond the project directorship. These project managers can find particular support in this book. The issues are addressed and efficiently supported with selected

methods and techniques. A complete chapter is dedicated to integration and another to WTO procurement rules, which have been adopted by most national legal systems. The management of planning, controlling, risk, change and a few others are relevant to both parties.

Experienced Project Managers

Project managers who already have some experience might find the human factor chapters highly conclusive and address their current needs. The chapters cover topics such as handling the informal roles in projects and empowering team members in leadership.

Students

The stepwise explanation of the project management processes and easy navigation through the material make this a comprehensive and understandable textbook for those acquiring basic project management knowledge.

Educators

Based on the logic presented in this book and an andragogic educational concept, a cluster of courses have been developed and are provided at several universities in Europe and Asia. PowerPoint presentations can be downloaded from the associated webpage. Educators may also find efficient support in their endeavours.

Female Project Managers

I know several highly successful female project managers and they should not feel ignored. I admire the Microsoft EMEA Enterprise Services Head of Public Sector Mrs Angelika Gifford, who lent her personality to open the Part II of the book dedicated to Human Factor Processes in Project Management. For simplicity of writing the masculine form is used, yet the intention of the author is to be gender-independent.

Content of This Book

The Introduction provides well-founded definitions, originating where available from the ISO 21500:2012 Guidance on Project Management (ISO 21500:2012 2012). Then, the basic concept of cybernetic feedback loop systems is explained and project management as a third-order cybernetic system described.

The existence of feedback reflects both its necessity and the successful practice of project management processes.

The structure of second-order cybernetic processes is further explained. To simplify memorization and application, the analogy to a watch was deliberately sought and the L-Timer® concept created.

Each of the other chapters is dedicated to a single project management process. They are sequentially ordered, beginning at 07:00 in the morning and closing 23 h later at 06:00. Every chapter has exactly the same structure:

XX:00 Quick look: What it is about?, Why it is important? What are the steps? How to ensure that the job is well done?
The process diagram with a feedback loop
XX:10 The goal of this particular process
XX:20 Selected methods for efficient process execution. The processes covered by ISO 21500:2012 are listed and later elaborated.
XX:30 Selected techniques and tools supporting efficient process execution
XX:40 Documentation of the process
XX:50 Activities (checklists) and deliverables of the process, assigned to the individual process phases.

XX is the hour associated with a specific process, e.g. 07:00 is linked with planning and scheduling (as in real life, when we start to plan the day) and 20:00 with human resource management.

An elaborate and vast list of current literature accompanies each chapter. An index closes the book.

Acknowledgements

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The person who from the beginning unceasingly supported me and strengthened my motivation was my father.

To all those named above I express my deepest gratitude.

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Contents

Introduction

<div style="text-align:right">**1**</div>

Why Projects?

Projects as singular endeavours, dedicated to the achievement of a specific goal, characterize our nature ever since the intelligence began to develop on the earth. There is no traceable evidence, but the artefacts testify their project nature: the plants and animals pursue their projects in securing the nutrition; humans realized the advantage of community development and set numerous projects in various areas of life. However, the endeavours were focused on goal achievements – the sooner the better, as long as the resources allowed for it. The price was often tremendous: up to 14,000 lives during the ancient Egypt Great Pyramid construction, 10 % (Romer 2007) of about 137,000 workforce at this time (Sweeney 2007).

With the advance of competition the price became an issue.

In a typical organization exposed to the competitive output generation, the job is managed in a department and the results passed to the next one in charge. The department manager cares about the area of his responsibility and once he produces the results, the matter is closed to him. The final product might have to pass several departments – and it does not need to be the manufacturing only: events organization, law formulation, organizational change.

The possibilities of process optimization within a single department have been today extensively explored. The world wide information and goods availability reduces to minimum the competitive advantage there. Any further optimization of the overall costs and performance improvement might be reached only by improved cooperation between the departments and between the customer or sponsor and the execution bodies – the departments.

The ever increasing easiness of the global logistics led to the worldwide optimization and the vast geographically distributed operations – the departments are moved where labour is advantageous and closer to the market. The cooperation is yet even more difficult: across the language and culture borders.

The challenges of management across the department and continents, the granulation and customization of the products and the social recognition that the goal

orientation through increased motivation contributes to the performance increase (Mary Parket Follet 1920 in Graham 1995/2003), accelerated the modern projects as the panacea for competitive edge accomplishment (Triebe and Wittstock 2003). Rollwagen speaks about the project driven economy with a growth projection in Germany only from 2 % of added value creation in 2007 to 15 % in 2015 and further continuing with the same rate until 2030 (Rollwagen 2010). Project generate benefits beyond the tangible results; the economy benefits and a new science of benefits management, which use projects as success story vehicles, emerges (Zwikael and Smyrk 2011; Bradley 2010; OGC 2006).

What Is a Project?

Over the years projects were defined along the German DIN standard 69901 (DIN 69901:2009-01 2009) stressing the uniqueness of the endeavour. The ISO 21500:2012 brings testimony to author's decade of pioneering clearly identifying project as a set of processes.

The full definition of a process according to this norm sounds as follows (ISO 21500:2012 2012):

- A project consist of a unique set of processes consisting of coordinated and controlled activities with start and end dates, performed to achieve project objectives. Achievement of the project objectives requires the provision of deliverables conforming to specific requirements. A project may be subject to multiple constraints, as described in 3.11. (several constrains are named in this chapter of this standard – comment of the author).

Although many projects may be similar, each project is unique. Project differences may occur in the following:
– deliverables provided;
– stakeholders influencing;
– resources used;
– constraints;
– the way processes are tailored to provide the deliverables.

A project with high level of complexity is characterized by the following traits (Pfetzing and Rohde 2001):
- Is innovative,
- Involves several departments of a company/office (concerns many people),
- Is interdisciplinary (many partners/specialists),
- Involves high level of risk,
- Demands substantial outlays (time, costs, financial expenditures),
- Has in most cases strategic meaning,
- Requires relatively fast realization,
- Is unusual, special, specific.

Due to the complexity many projects need special rules and procedures dealing with the specific problems and tasks.

Project environment is a set of factors (ISO 21500:2012 2012):

- Within the organizational boundary of a project such as e.g. strategy, technology, maturity, culture,
- And outside this boundary (e.g. socio-economics, politics, geography etc.).

Project governance is the framework, by which the organization is directed and controlled, especially concerned with the areas relevant to the project activities (ISO 21500:2012 2012).

What Is the Project Management?

Project life cycle is a set of processes which pass several phases between the project start and project end.

The management of a project is defined according to DIN standard is a set of measures, techniques, organizations and management tasks enabling the project realization (DIN 69901:2009-01 2009)

Management, in this context, means steering in the course of a project, of different, single processes and tasks focused on the achievement of an overall project goal (Frese 1971). Current ISO standard recognises this by defining the project management as follows (ISO 21500:2012 2012):

> Project management is the application of methods, tools, techniques and competencies to a project. Project management includes the integration of the various phases of the project life cycle, as described in 3.10 (Chapter of the standard with general description – comment of the author).
>
> Project management is performed through processes. The processes selected for performing a project should be aligned in a systemic view. Each phase of the project life cycle should have specific deliverables. These deliverables should be regularly revewied during the project to meet the requirements of the sponsor, customers and other stakeholders.

According to the author of the book, the term 'project leadership' reflects better than the term 'project management' the necessary orientation of the team stakeholders on the project goals and on the planned project outputs. In the following chapters the term 'Management' is used more in the context of the single project processes. These consist of recursive tasks, thus can be optimised, and thus can be managed (Chap. 13, 18.00 Balanced Scorecard).

However, as the ISO standard use the same term for process management and project management, less orthodox approach to the terminology is further adopted.

Benefits of Projects Management

Project management brings benefits already today and offer a suitable tool to handle the challenges of the future (Rollwagen 2010). The benefits, defined as the flow of value that arise, when desired outcomes of project are achieved form project, goes beyond the material outputs (Zwikael and Smyrk 2011).

Benefits of project management have been noted in numerous studies; the example below concerns projects in the scope of planning and construction of new products (Platz 1987):

Brandt applied the IDEA (Impact Detection and Assessment) concept to assess the benefits in today locally and sequentially organized value added creation project management (Brandt 2004):

- Direct impact
- Indirect secondary impact on involved processes
- Tertian impact on other processes

Following Brandt, Rollwagen and others (e.g. Newell 2005; Kerzner 2009) the direct impact project management benefits are:

- Higher degree of customer requirements fulfilment through improved communication between the producing team and customer
- Influence on the determination of project goal, higher quality of planning (reduction of mistakes in planning, later amendments and delays of time)
- Transparency of the processes of project realization (responsibility and processes gain on explicitness, become more comprehensible, and as a result are more acceptable)
- Effectiveness of decision processes (results of the delayed decisions in the course of a project are more visible),
- Employment effectiveness of staffing the predefined assignment of tasks
- Personality development of the staff towards active co-creators.
   In secondary area (indirect impact):
- Improved quality through better interoperation of departments,
- Time earned (reduction of the time of project's realization, better time management),
- Better handling of informal processes and networks,
- Better control over the security issues.
   The tertian impact on the organization leads to:
- Economic effectiveness (faster return on investment, savings of costs, lowering the level of capital engagement) in sales, marketing and services. The turn-over in certain project is improved by 2.5 % per year, the yearly effective capital costs return was 25 % (Brandt 2004),
- Better anticipation of the non-linear, fractural and de-central value-added creation (Rollwagen 2010),
- Better handling of ever increasing risk endeavours [ditto],
- Development of context sensitive management instruments [ditto].

A research was carried out in a company in which about 95 projects were realized with the annual budget in the amount of about 35 million marks (17.5 Million Euro).

A year and a half later after the implementation of regular project conduct, an inventory was made indicating that:

Delays of deadlines were limited by about 60 %,

Savings of costs were achieved by the improvement of quality by about 30 %,

It was possible to reduce costs of production by about 11 % with a high satisfaction of the project manager (Platz 1987).

Risks Induced by the Project Management

It would be a fairly story, shall the project bring the benefits only. One has to be conscious of the risks induced by the project management, too. They lay primarily in the management and human factor areas (Baker 2010; Kerzner 2009; Schelle 2003; Kloppenborg 2009):

- Increased number of management positions (usually leading to the higher total of the salaries)
- Project organizations emerge in most cases as parallel world to the functional organizations causing ambiguity of responsibilities and decision powers
- It is an act of balance to make all project and functional line managers enforced with right powers and cooperating together
- Project team members has usually several superiors – psychical orientation is made more difficult
- Accountability, mixed decisions and priority conflicts
- More difficult proliferation and consistency of organizational polices and governance
- Diverging line functional and project cultures
- Low level of knowledge transfer from projects

Critical is the project performance. As the accountability of project-wise work improves, the measured performance, in particular in intellectual projects, like e.g. ICT, despite all the measures taken, remain on the level of 30–40 % projects done on time and within the budget (The Standish Group 2010). The efforts to handle this issue are undertaken among others in this book.

Project Management Method

A method is a sort of standardized steps which according to Jenny may be defined as follows (Jenny 2001):

> Methods are procedures which are planned and justified and are focused on the achievement of certain goals.

Paris defines a management method in project as follows (Paris 1990):

> A management method is defined as a hierarchical network of project management activities.

The network originates from certain mental model. Wysocki identifies six questions which a project management method shall answer (Wysocki 2011):

- What business situation is being addressed?
- What do you need to do?
- What will you do?
- How will you do it?
- How will you know you did it?
- How well did you do?

We conclude with the following definition adopted in this book:

A project management method is a hierarchical network of project management activities, based on certain mental model, addressing the Wysocki's three "W" and three "H".

Applying certain project management method we use techniques.

Techniques of project management are certain procedures using, supporting and realizing the chosen methods of project conduct (Jenny 2001).

The Cybernetics of Project Management

Project Management is about control and communication with more or less well defined goal. Wiener named this field of theory, "whether in the machine or in the animal" cybernetics after the Greek steersman (χυβερνήτης) (Wiener 1948/1961). The general model of cybernetic system with feedback through the environment is depicted in Fig. 1.1.

This androgynous approach suits well the project management. Humans, aided with technical means attempt to bring project towards predefined goals. The Environment which provides the Feedback is the project, System Mechanics – the project management, Goal – the project goal. Wiener tried to express his cybernetic model with one equation. As it may be possible for logical variables (and still complex, (Lent 1989)), for multi value variables we obtain complex non-linear relationship (Wiener 1948/1961; Kaplan 1984/1991). Complex systems do not lock into stable state but also do not dissolve in chaos. They store the information and exchange it. Complex systems are spontaneous, adaptive and alive (Waldrop 1992). Usually the system theories view the cybernetic systems as closed systems with predictable equilibrium; in early approach through finite number of possible states. However, the non-linear nature exposes high sensitivity to the initial conditions and multiple equilibriums. Cybernetics treats the environment as a similar system – which is not the case (each project is different). In effect a finite models of dynamic systems are limited in their predictability leading to the unavoidable imprecision. Due to the phenomenon of chance, predictability is bound to the probability and hardly deterministic in such systems (Stewart 2002). Yet, the short term predictability is nevertheless feasible (Bousquet 2009), so it makes sense to try to exercise the project management in any case.

Von Foerster introduced 1974 the second order feedback loop: his observer (the system mechanics in the Fig. 1.1) is a cybernetic system with own loop itself (von Foerster 2002). By deploying a number of such second order cybernetic systems we attempt to view our first order system through the filter of particular second order sensors as shown in Fig. 1.2. It is a linearization of all other variables beside those, treated by the individual cybernetic system: the project management process e.g. P&S for Planning and Scheduling or L for Leadership.

The ISO 21500:2012 groups of processes presented earlier in this chapter implement the second order cybernetics. The Initialization, Planning,

Fig. 1.1 General
cybernetic model

Fig. 1.1 General cybernetic model
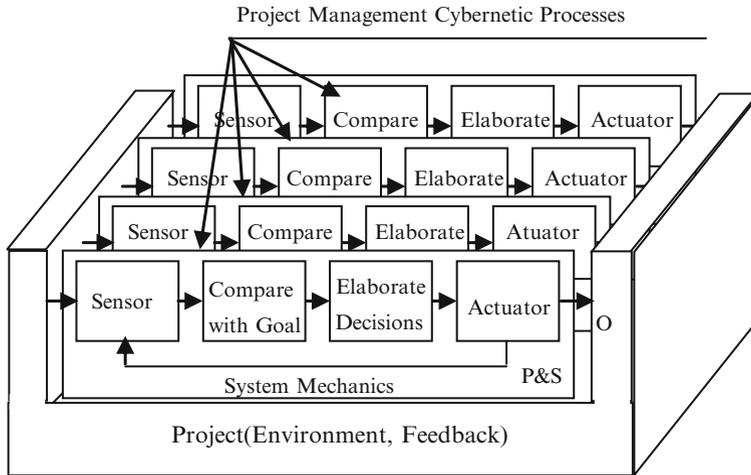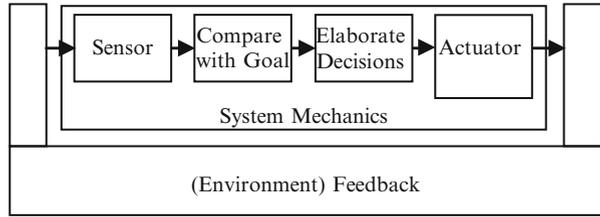
Fig. 1.2 Cybernetic model of project management

Implementation and closing are the project management processes, Controlling is the System Mechanics (Fig. 1.3).

ISO does not provide the Controlling Process Group feedback to the Initiating Process Group. As this group according to the standard contains at least three processes, a control feedback (e.g. with the costs of initiating activities) is certain. Also the very first incentive, which triggers the Initiation of a project comes from the project environment. Therefore, there is Input drawn from the Project (Environment) to this group, as well as to all others.

We observe that in this approach, the Controlling Process Group does not subject to the control mechanism itself, what might not reflect the reality of project management. The controlling activities, described hereafter in processes like Earned Value Management, Quality Management or Balanced Scorecard subject to the same closed loop system mechanics as the other processes of the project management. Further, the processes groups names suggest their temporal occurrence in specific project phases only. Nevertheless, the description of the individual ISO 21500:2012 processes directly or indirectly allows for recurrence in any phase of the project. Therefore, the model of continuously recurrent processes, including the controlling processes, is considered to be better reflecting the
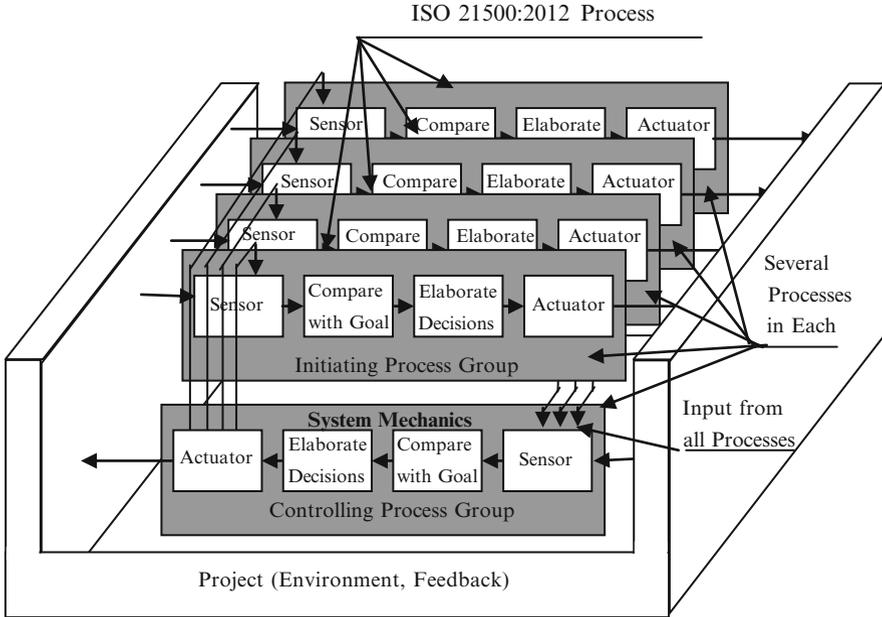
Fig. 1.3 Cybernetic model of ISO 21500:2012 project management
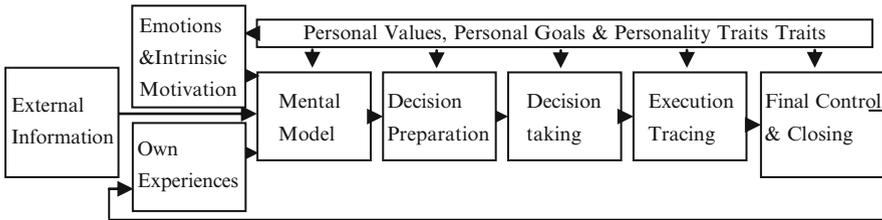
Fig. 1.4 Decision process

nature of the project management and the linearization done in each process during its execution. This facilitate the understanding of the project management processes and in consequence their easier handling.

Project Manager himself is the Von Foerster Observer (third level loop) in this second level project management processes' loop (von Foerster 1974). Project Manager cybernetic loop, where own experiences constitute the System Mechanics, are shown in Fig. 1.4. It holds true for all decisions taken by project manager in any project management process.

The details and further considerations concerning the third order cybernetics may be found in Chap. 18, 04:00 on Self-Management and Chap. 19, 06:00 Dedicated to the Leadership. This book is built around the second order cybernetics of project management processes, which jointly act in the first order system with the project

itself. The processes are introduced in the following Section and thoroughly elaborated in the subsequent Chapters.

The L-Timer® Mental Model

In search of mental model we focused on easy mnemonic, which should help to manage the complexity of project management. The time clock with processes assigned to full hours appeared to be the best choice here. There are 12, 18 and 24 options of process assignment.

An evaluation of project manager activities brought the number of up to 800 single actions with numerous linear and non-linear interconnections (Rufenacht 2005). The cognitive relationships indicated the selection of 18 processes to be the best option. The heuristic process selection is based on vast experience, literature study and an analysis of the interactions between the single actions. The results were verified in several studies and practical deployment in project management daily operations since 2003 (Rufenacht 2005).

In this approach the recurrence of daily cycle secures the minimal sensitivity of each process. The mental cycle must not be diurnal: the 24 h may go through within few minutes of project manager reflections on his activities or stretch over weeks and may occur in coincidental sequence. The key issue is recurrence itself.

L-Timer® system handles 12 administrative processes during the day time (like working day): each hour one process, in a logical sequence, which base on a macro linear interrelation; and bihourly six human factor processes (Fig. 1.5).

The Human Factor processes are aligned with relevant administrative processes with closest links (e.g. 20:00 Human Resource Management is triggered by 8:00 Organization Management). For readability the administrative processes are split into Tables 1.1 and 1.2. Table 1.3 lists the human factor processes.

Not coincidentally also the L-Timer® hands point at 6:30. With the last working day results closed before at 18:00 (Balanced Scorecard) we recall the project strategy and with Leadership approach we are ready to start the day with 7:00 Planning & Scheduling.

In the cybernetic system's approach the processes are not bound with specific project phases like in most recognized standards PMI (PMI 2008), IPMA (Caupin et al. 2006), but rather continuously work in loop between sensors and actuators. Obviously we distinguish the project phases, which each process passes. The Rubicon model of four phases is the model of choice presented hereafter in Chap. 2, 07:00 Planning & Scheduling: P&S.

A special characteristic distinguishing the method based on L-Timer® mental model from other methods is systematic and overall consideration of the processes of management connected with the so called human factor.

> Human factor defines the interrelationships and behavior of all project stakeholders in certain processes, which interact with administrative project management processes in cybernetic loops.

Fig. 1.5 L-Timer®
cybernetic processes system
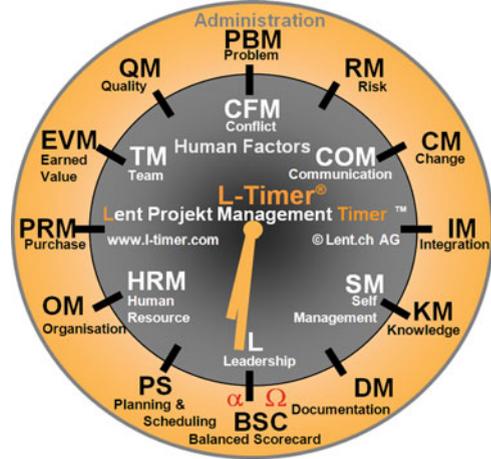
Table 1.1 L-Timer® administrative processes, part 1

Process	Name	Objectives
PS	Planning and Scheduling	You elaborate, structure and plan the objectives of your project. Project targets are aligned with the overall assignment specified by the customer and the higher-ranking enterprise strategy and are guaranteed over the entire duration of the project
OM	Organization Management	You define project roles, responsibilities and the form of the organizational structure for the successful realization of your project
PM	Purchase Management	Through formal relationship with suppliers over all phases of the project, you secure the proper procedures and optimal results, along the formal laws, regulations and enterprise guidelines
EVM	Earned Value Management	You control the activities in the project according to the result/deadline/cost stipulations set up in the Planning and Scheduling, with consideration for unforeseen events in the project
QM	Quality Management	You constantly monitor project results, project processes and the other characteristics for compliance with project target stipulations, project requirements and their implementation planning, and promptly draw attention to deviations
PBM	Problem Management	Together with your team and the applied methodology you master the technical or organizational problems within the cost and time-frame of your project

A human factor is considered to be a central element of the L-Timer®. It is a decisive factor in the success of project management and the realization of project tasks. However, today it is still not appreciated enough in practice.

Table 1.2 L-Timer® administrative processes, part 2

Process	Name	Objectives
RM	Risk Management	You minimize the overall risk to your project by permanent, creative and timely identification of potential risks, their analysis and the development of suitable countermeasures
CM	Change Management	You ascertain, assess and decide on the implementation of proposed changes with a systematic procedure, introduce them – keeping their effects to a minimum – to the planned project handling and have the updated configuration of the system continuously under your control
IM	Integration Management	According to the project plan and schedule you ensure that the elaborated solutions are embedded problem-free into the existing environment (organization, human resources, applications, platforms) and that a high level of client and personnel satisfaction is achieved with its introduction
KM	Knowledge Management	You acquire and store process experiences gained in the course of the project for its use in the current project and in other projects
DM	Documentation Management	You ensure the documentation and archiving of project results for ease of access during project realization, the successful placing in operation of the project results, cost-effective operation and full user satisfaction
BSC	Balanced Scorecard	You submit the results of your project to an internationally recognized, integral and comprehensive evaluation with the aim of making a permanent, positive contribution to the implementation of enterprise strategy in your company

Table 1.3 L-Timer® human factor processes, part 3

Process	Name	Objectives
HRM	Human Resource Management	You select personnel for appointment to the formal and informal project roles best suited to their skills and experience and promote their personal further development according to the enterprise strategy
TM	Team Management	You ensure the best possible efficiency of the complete project team measured against yielded performances, staff satisfaction client satisfaction and process improvement
CFM	Conflict Management	You promptly identify potentials for conflict in your team and in the overall project environment. You solve conflicts successfully with suitable methods and technologies
COM	Communication Management	You master the effective communication, including that of marketing, devoted to the achievement of project goals, both in the project and its environment
SM	Self Management	Your personal satisfaction and performance is very important. You promote it through effective self-appraisal and dealings with your own engaged resources
L	Leadership	You skillfully and consciously control the behavior of your team members to guarantee the achievement of the project goals

The Benefits and Advantages of the L-Timer®

Project management benefits from the L-Timer® in the following way:
- Project management is viewed as a third order cybernetic system with consequent feedback loops and clear distinction of relevant levels. This facilitates the understanding of the recurrence, the mutual impact and handling of each process.
- All processes are considered as second order cybernetic systems, allowing the control and management in each of them in distinction to ISO 21500:2012, where control process is in feedback loop and itself removed from the control feedback. This contributes to better performance of each process.
- All ISO 21500:2012 processes are mapped and referred to in the L-Timer® processes. The vocabulary of the standard is used through this book.
- Central element of the method is systematic consideration and support of the management processes referring to a human factor and the development of the motivation and abilities of project team members. The balanced approach may be reached this way.
- The system of processes is orthogonal: an activity is uniquely treated in only one process. The goal of this process is clearly formulated.
- L-Timer® is a method for practitioners created on the basis of the experience. It focuses on key success factors in a project.
- By setting the weights of each activity, L-Timer® can be adopted to specific needs of every company (e.g. special requirements of public procurement companies).
- By systematic treatment of each process with regard to the applied methods and techniques user finds always same class artifacts in each process.

The Logic of L-Timer® Processes' Execution

As it was already mentioned, the particular L-Timer® processes are constantly repeated in subsequent cycles, in analogy to any daily activity as e.g. everyday work, everyday lunch etc..

As the day commences so a project begins at 07:00 with P&S – Planning and Scheduling process, which takes the strategy of a company under consideration. At 18:00 we subsumes the day with the Balanced Scorecard, which originates from the strategy again. At the end of the project first order cybernetic loop stays 06:00 L – Leadership – with strategic development of the team. The cycle may start all over again from the P&S, and the subsequent processes and so on.

The basic advantage of this approach is the execution of the activity in a proper process at any stage of the project. Change of the scope during the implementation is treated back by the Planning & Scheduling process as opposed to waterfall approaches, where this action is executed other way, where the know-how from Planning & Scheduling might be missing.

The cybernetic loops may occur in any frequency: daily, irregularly, and sporadically. The key is their complete execution and recurrence.

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Administrative Processes

The following processes implements the second order cybernetic systems in administrative area of project management.

- 07:00 Planning & Scheduling: P&S
- 08:00 Organization Management OM
- 09:00 Purchase Management PRM
- 10:00 Earned Value Management EVM
- 11:00 Quality Management QM
- 12:00 Problem Management PM
- 13:00 Risk Management RM
- 14:00 Change Management CM
- 15:00 Integration Management IM
- 16:00 Knowledge Management KM
- 17:00 Documentation Management DM
- 18:00 Balanced Scorecard BSC

07:00 Planning & Scheduling: P&S

2

Quick Look

What Is It?

Planning & Scheduling P&S is a basic process where the project is built and maintained. Project results are atomized down to realizable units (Work breakdown structure WBS), which in turn are set into reasonable project activities. Duration of each activity is estimated and scheduled. Subsequently the costs and cost/benefits are evaluated.

Who Does It?

Planers and controllers are well suited to lead, yet project manager shall be involved, as he later bears the responsibility for the project overall results.

Why Is It Important?

P&S process is a cornerstone of any project. The WBS determines the usability of the project results. Project structure and time schedule determine the overall costs. Cost/benefits' relationship decide about the project fate.

What Are the Steps?

Evaluate the project goals in view of customer expectations and your company strategy. Set the project objectives and quantify the target values. Than break down the planned output (product objective) and simultaneously structure your project. Evaluate time and cost, verify the profitability. If necessary repeat these steps. Initiate few other processes if needed. Repeat this process periodically.

What Is the Work?

Project goals are general, project objectives, despite all efforts, always not enough specific. In a tedious work and several iterations you break down the project product, draft the project structure. You proceed with resources planning and time schedule getting the first financial project evaluation to learn, that yet another loop: WBS-Project structure-Resources-Time-Costs is needed and so on until all stake-holders accept the results.

How Do I Ensure That I Have Done It Right?

Choose the WBS and scheduling methods and techniques best matching the characteristics of the project. Plan sufficient resources for all project needed
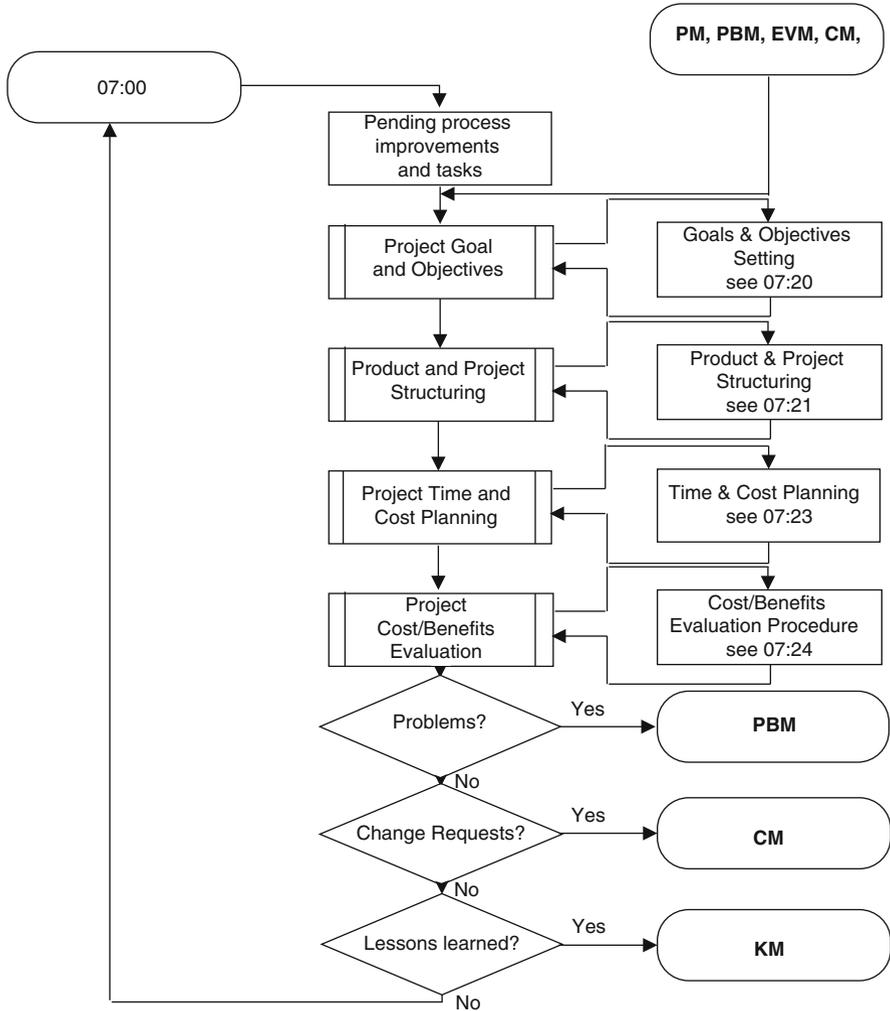
Fig. 2.1   The Planning & Scheduling process

activities: project output (product), tests, integration, human factor. Be honest and do always the cost/benefit evaluation – it pays back in critical project phases.

Process

Project goals and objectives drive product and project structuring, followed by time and cost estimation and cost/benefit evaluation. Problems, change requests and lessons learned initiate proper other processes. Planning& Scheduling process shall be periodically repeated with pending issues treatment; it may be initiated by few other processes, too. Figure 2.1 depicts this process.

07:10 The Goal of Planning and Scheduling

The process of Planning and Scheduling P&S elaborates the answers and maintains their actuality regarding the six "W": What shall be done?, Why shall it be done?, Who is going to do it?, When? Where will that be done?, and Which way (Requirements, Constrains and Methods) shall it happen?

07:20 Methods

The original 5 W, later extended to 5W1H, were conceived by Toyota in strive for better problem management (Kato and Smalley 2011). The "H" meaning "How" we further replace here with the sixth "W" staying for the sixth question "Which (way)?":

- Why is it necessary?
- What is its purpose?
- Where should it be done?
- When should it be done?
- Who is best qualified to do it?
- Which is the best way to do it?

The answers to each of the six "W" are not orthogonal: certain activities provide simultaneously answers to multiple "W"s; a comprehensive approach to each "W" calls for several different actions. Therefore, the sequence of operation in the P&S process is chosen as a backbone of the following considerations, delivering implicitly the answers to the relevant "W".

Planning and Scheduling in the initialization phase develops basic outline of the project called in ISO 21500 standard the Project Charter, what corresponds to the ISO 21500 processes: "4.3.2. Develop Project Charter". This document is in the planning phase refined to a list of project plans ("4.3.3. Develop Project Plans") with several other processes covered (ISO 21500:2012 2012).

- 4.3.11.Define Scope
- 4.3.12.Create WBS
- 4.3.13.Define Activities
- 4.3.16.Estimate Resources
- 4.3.21.Sequence Activites
- 4.3.22.Estimate Activity Durations
- 4.3.23.Develop Schedule
- 4.3.25.Estimate Costs
- 4.3.26.Develop Budget
- 4.3.32.Plan Quality (the initial demands)
- 4.3.35.Plan Procurement

07:21 Project Goals and Project Objectives

There is certain confusion in literature concerning the terms: goal, objective, target, scope, and result in reference to the project course. For the purpose of this book we apply the definitions given in Table 2.1.

Table 2.1 Terms used in project planning and scheduling

Term	Description	Example
Project goals	Focuses on "Why"? and to some extend on "What?" It results from opportunity identification (ISO 21500:2012 2012). Indicate rather a direction of expected results, tends to be general and unspecific. Should not be confused with the process goal	Project shall contribute to improvement in people communication
Project objectives	Specific SMART implementation of the project goals. Addresses "What?", "Where?", "When", and "Which?" and indirectly "Who?"	With a budget of 20 millions the city of 100,000 inhabitants shall get within 2 years complete coverage with 10 MB data network
Project results	Project deliverables, product, "Output" given by the project scope and project quality or target conditions of the endeavour (DIN 69901:2009-01 2009). Addresses "What?" and "Which?"	150 miles of Cat7 cabling and 120 active components with mean grade of service at the level not less than 98 %
Project scope	Deliverables, requirements and boundaries of the project objective "Output" bound to the quality (see Fig. 2.2 and ISO 21500:2012 2012). Addresses "What?"	150 miles of cable and 120 active components
Objectives' target values	Quantified objectives: output, time and costs. Addresses: "What?", "When", "Where?", "Which?", and indirectly "Who?"	The above project results within a budget of 20 millions and 2 years completion time

The particular target values can be defined independently (Grau 1999). However, there is certain interdependence between the target values; by changing one of them inevitable is the change in one or other two. When the project duration is cut, either more expensive will be it's realization or output has to be redimensioned. This interdependence called iron triangle was conceived 1969 according to Weaver by Dr Martin Barnes in a course he developed called 'Time and Money in Contract Control' and until the third edition was an "iron" component of the PMBOK (PMI 2013a). The original source of Barnes iron triangle could not be found. Indirect references are given a. o. by Weaver and by Lock (Weaver 2007; Lock 2007). As few other sources confirm 1969 as the origin date, Lock attributes it to 1980s. The reason may be a migration, done by the author himself from "Quality" in 1969 as a third objective beside time and cost, through "Performance" to final "Output". Figure 2.2 shows the interrelations between all terms listed in Table 2.1.

Grau classifies the Output objectives and target values as the category of project deliverables and time and cost rather as process describing category (Grau 1999). This matches well the later in Chap. 13, 18:00 Balanced Scorecard BSC presented twofold project evaluation scheme of Project Excellence (Project Excellence 2013).

Beside the main target of defining the project deliverables, the objectives fulfill additional functions in project (Grau 1999):

Fig. 2.2 The interrelationship between the project goals, objectives and target values
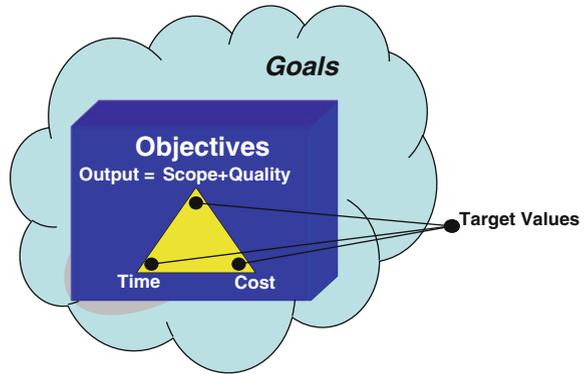
Table 2.2 SMART project objectives

Abbreviation	Description	Example
S	Specific	With a budget of 20 millions the city of 100,000 inhabitants shall get within 2 years complete coverage with 10 MB data network.
M	Measurable	Network: 10 MB data network
		Budget – 20 millions
		Coverage: the whole city of 100,000 inhabitants duration: 2 years
A	Attainable	Budget is secured by the city, technology is available, provider has technical capabilities to deliver, no obstacles from the inhabitants are expected
R	Relevant	Project objectives contribute towards project goals of improved people communication within the area with a positive impact on local economy
T	Time-bound	Project results are to be delivered within 2 years completion time

- Controlling
- Pointing activities direction
- Communicative
- Coordinative
- Selective

Proper project objectives are SMART. From a vast number of various combinations of meaning of this acronym, author tends to align with Philips and Gordon as presented in Table 2.2 (Phillips 2010; Gordon 2003).

Pfetzing and Rohde suggest further that the objectives shall be compliant to the strategy of major stake-holders (project sponsor and client), non-redundant, free of contradictions and neutral with regards to the possible solution (Pfetzing and Rohde 2001).

Compliance with to the stakeholders' strategy and opportunities identification (ISO 21500:2012 2012) suggests defining the objectives in alignment with the four evaluation strategies of Balanced Scorecard BSC (see Chap. 13, 18.00 Balanced Scorecard):

- Clients,
- Team,
- Processes,
- Company's development (among other things these are economic goals).

Lock extended the "iron" triangle of Barnes with component "people" in the middle between all other objectives making the triangle based objectives and target values compatible with the BSC evaluation. (Lock 2007).

Finally there are several standards and other restrictions supporting the successful objectives' elaboration:

- Company relevant standards
  - ISO 9001:2008 Quality Management Systems - Requirements (ISO 9001:2008 2008)
- Technical standards
  - ISO 10006:2003: Quality Management Systems - Guidelines for Quality Management in Projects (ISO 10006:2003 2003)
  - ISO 10007:2003: Quality Management Systems - Guidelines for Configuration Management (ISO 10007:2003 2003)
  - ISO 21500:2012: Guidance on Project Management (ISO 21500:2012 2012)
  - ISO 27003:2010 (BS/ISO/IEC) Information technology. Security techniques. Information security management system implementation guidance (ISO 27003:2010 2010)
  - ISO/DIS 31000:2009: Risk Management, Principles and Guidelines (ISO 31000:2009 2009)
  - DIN 69900:2009-01: Projektmanagement – Netzplantechnik; Beschreibungen und Begriffe (DIN 69900:2009-01 2009)
  - DIN 69901:2009: Projektwirtschaft, Projektmanagement, Begriffe (DIN 69901:2009 2009)
  - DIN 69901:2009-01: Projektmanagement - Projektmanagementsysteme (DIN 69901:2009-01 2009)
- Project management guidelines
  - IPMA Competence Baseline (ICB) (Caupin et al. 2006)
  - A Guide to the Project Management Body of Knowledge: PMBOK Guide (PMI 2013a)
- Standards concerning environment
  - ISO 14001:2004: Environmental Management Systems – Requirements with Guidance for Use (ISO 14001:2004 2004)
- Design and Exploitation standards
  - CMMI: Capability Maturity Model® Integration, e.g. CMMI for Development, V.1.3 (CMMI 2010/2013)
  - ITIL (ISO/IEC 20000-1:2011): Information Technology-Service management – Part 1: Service management system requirements (ISO/IEC 20000-1:2011 2011)
- Ethical recommendations
  - EU Ethikcharta (EU 2013)
  - PMI Ethics codex (PMI 2013)

To the particular "Which?" may belong e.g. demand of the client to present the project deliverables in a particular form etc.

Table 2.3 Objectives elaboration procedure

Step	Action
1	Search of possible project objectives
	Team's brainstorming
	Analysis of the needs of people who are vital for the project
2	Structuring of the elaborated objectives
	Determination of a catalogue of goals solution neutral
	Separation of objectives ("what?") and restrictions/framework ("which?") conditions
	Verification of the congruence with the project goals
	Elimination of discrepancies concerning the objectives
	Elimination of redundancy
	Searching for proper strategic terms
	Verification and eventual extension of strategic terms
3	Operationalization of the objectives
	Elaboration of the WBS and project structuring procedures
4	Quantification and qualification of the objectives
	Elaboration of the target values
	Qualification of the "must" and "nice to have" objectives
5	Elaboration of the catalogue of objectives
	Evaluation of the results and verification in relation to the project goals
	Prioritization and fine tuning of the objectives
	Time schedule elaboration ("When"?)
6	Documentation
	Final summary of all results and if needed their justification
7	Verification of the achieved results
	Retrospection on project goals and objectives, possible target values and assurance of all project team members acceptance
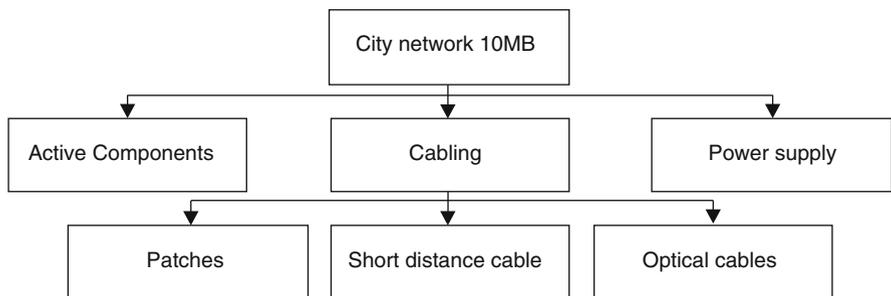
Fig. 2.3 Example of Work Breakdown Structure (WBS)

Whether the objectives are given by the client and/or sponsor in a project charter or only goals are defined and project team has to elaborate the objectives, it is in each case advisable to go with team through the project objectives. Pfetzing and Rohde suggest the procedure as shown in Table 2.3 (Pfetzing and Rohde 2001).
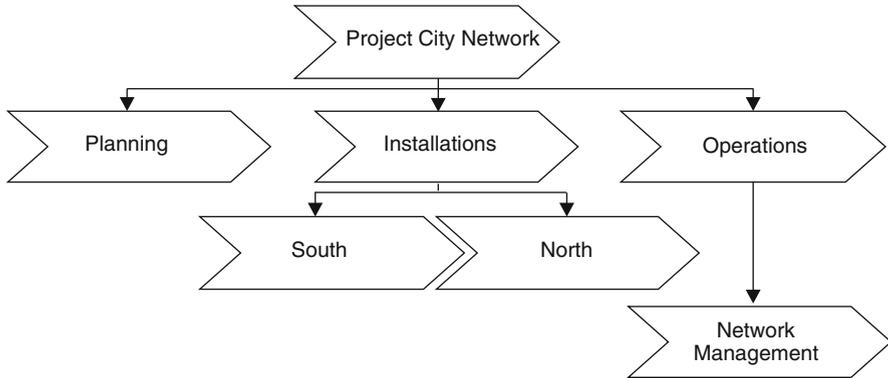
Fig. 2.4 Example of a project structure

07:22 Product and Project Structuring

Product Structure
Structuring of Barnes "Output" called hereafter "Product" and structuring project allow to divide the whole project in smaller tasks and activities with reasonable and manageable interdependencies (Caupin et al. 2006).

Product Structure reflects the technically determined interdependences between the identifiable singular components (see Fig. 2.3). The tree structure is better known as Work Breakdown Structure, WBS and the process which elaborates it is Process 4.2.12 Create Work Breakdonw Structure (ISO 21500:2012 2012). Yet the notion of "Work" implies certain misleading concepts of task breakdown – and this is the subject of project structuring. The criteria of structuring in both cases are different: product structure is determined by technical aspects, while project structure by organizational and capability based approach. Yet for the compliance reasons with ISO 21500 Work Breakdown Structure (WBS) is hereafter further used.

Project Structure
Project Structure is defined according to DIN 69901 standard as the overall of relevant relations between project elements (relations in organization as well as in project processes). Here ISO 21500 clearly names this process 4.3.13 Define activities (ISO 21500:2012 2012). An example related to the above WBS is given in Fig. 2.4.

Project Structure Plan PSP
According to DIN 69901 Standard the Project Structure Plan (PSP) is the description of a project with a hierarchical layered presentation of project activities (DIN 69900:2009-01 2009). In PSP we address "What?", "Who?", "When?", "Where?" and indirectly "Which?". Each task includes keywords of description, indication of attained results, eventually objectives, and the contents such as deadlines, duration, necessary resources, preliminary works and costs (Lewis 2011; Caupin et al. 2006).
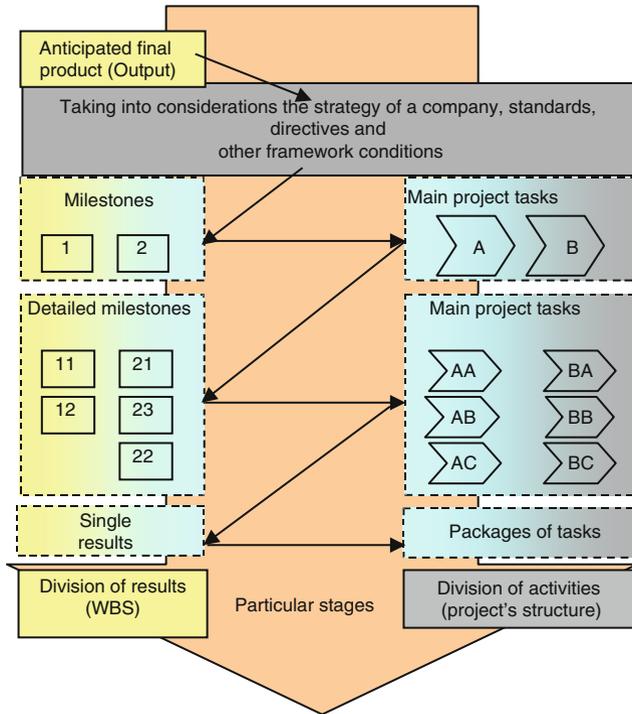
Fig. 2.5 Example of the recommended project structuring procedure

PSP may be either product (derived from Example Fig. 2.3) or project (derived from Example Fig. 2.4) oriented. Combinations of both leads in most cases to competence frictions and process deficiencies and therefore is not recommended.

The Goal of Project Structure Planning

In the PSP activities are hierarchically ordered i.e. the sum of lower level activities compose to the upper level group of activities, which may in turn build together with other group of activities another level of aggregated work and so on. ISO 21500 name this process 4.3.21 Sequence Activities.

Depending on the needs, the aggregated activities are divided back into single activities which allow to estimate time and costs of single activity in a good and unambiguous way (Lewis 2011). The critical path (longest time chain) helps to assess the project total time CPM, (Kelley and Walker 1959). The process is 4.3.22 Estimate Activity Duration acc. to ISO 21500.

The level down to which the structures have to be broken down is relative and depends on experience and knowledge of the team in charge of the structuring. It is advisable to go iteratively and in parallel with structuring of the product and of the project down to the level, where the heuristically estimation of the complexity, effort, methods and time needed may be done. Products structuring allows to define milestones, when specific component should be done. Figure 2.5 illustrates this case.

Table 2.4 Rules for PSP development

Pragmatic structuring	The division of work is done in a heuristic way. Tasks are organized according to certain hierarchy and divided into smaller units. We should also take into consideration project goals, framework conditions and the experiences of project participants
Taking into consideration personal resources	Tasks packages must be determined in such a way that it is possible to assign them to certain people or teams. We make such a choice of employees that we are able to use their abilities and professionalism in order to guarantee proper task completion
Proper level of expansion	Tasks should be divided on the basis of their complexity and innovative character of a project. In chase of innovative and groundbreaking projects it is advisable to present the issue in more details since it allows to keep flexibility during the project realization
Hierarchical analysis and synthesis of elements	The PSP shall be actualized concurrently with the following actions:
	Hierarchical analysis of tasks (goal, main tasks, packages of tasks),
	The synthesis of not systematized elements (tasks, restrictions, vital information) together with the results of hierarchical analysis into one, possibly cohesive, structure which result of hierarchical analysis
Using the technique of visualization	The creativeness and cohesion of team work are efficiently supported with techniques of visualization
Internal cohesion	A project should be divided in such a way so as the groups in a project and partial tasks do not have too many common points with external to project structures
Completeness of the tasks	In planning we should take into consideration as early as possible a complete list of tasks, since it has influence on the course of other connected undertakings
Task objectives	We should define objectives of each particular tasks. The objectives shall fulfill SMART criteria
Periodical PSP verification	The PSP shall be periodically (e.g. with L-Timer® trigger) verified and updated

Preparation of the Plan of Project Structure

Preparation of the PSP takes place during project's realization. Preparation of the first plan of project structure takes place already in the phase of the first ideas to take up a project (Project charter). The project structure plan is continuously updated according to the actual requirements in each phase of a project. According to ISO 21500 it is the part of the Process 4.3.3. Develop Project Plans ((ISO 21500:2012 2012). The effectiveness of work, reduction to a minimum of the inter-task dependencies and processes optimization are here the criteria.

Table 2.4 presents several practical rules which should be taken into consideration while preparing the PSP, modified and extended from (Pfetzing and Rohde 2001).
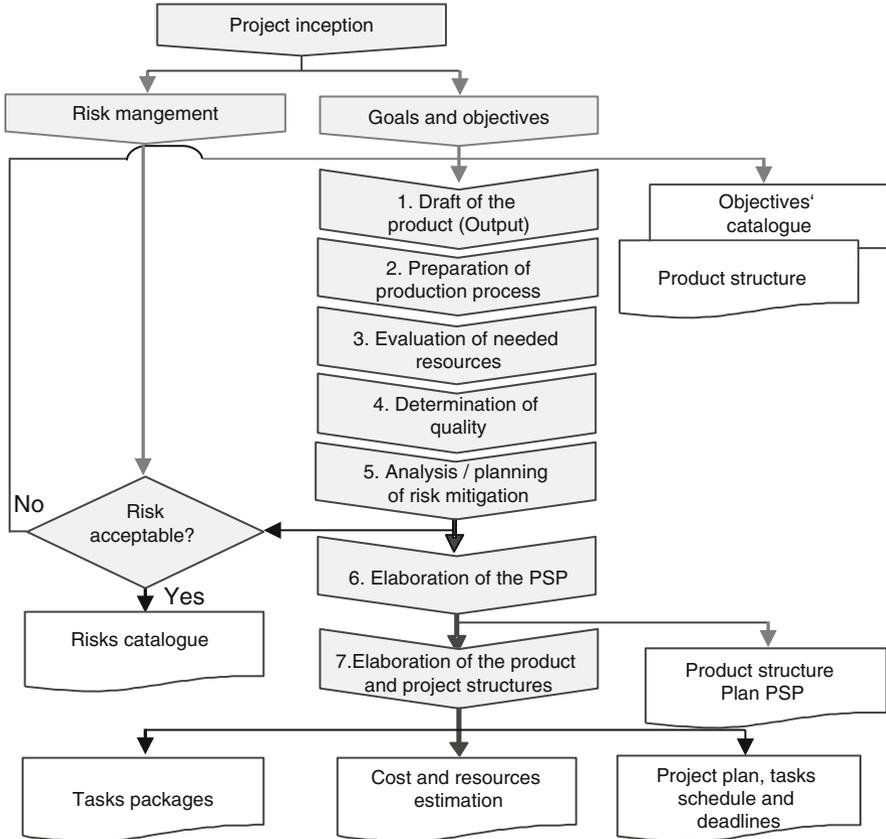
Fig. 2.6 Project structuring

Project Structuring

Project structuring is carried out in five stages. In the first stage tasks are planned according their functional interdependence. The first PSP is created. In the second phase (Chap. 3, 08:00 OM Process) we examine the following:

- Human resources,
- Necessary tools,
- Technical conditions,

and their impact on the first stage PSP (Process 4.3.16 Estimate Resources acc. to ISO21500). The third stage (Chap. 6, 11:00 Quality Management QM) focuses on quality (Initiation of the Process 4.3.32 Plan Quality acc. to ISO21500), and the fourth one on the risk mitigation (Chap. 8, 13:00 Risk Management RM, Processes 4.3.28 Identify Risks and 4.3.29 Assess Risks) and again their impact on the PSP. In the fifth, i.e. the last stage we verify if the final product, both project and PSP structures if they mutually match each other (Process 4.3.3 Develop Project Plans acc. to ISO21500). All stages are presented jointly in Fig. 2.6.

07:23 Conceptual Models of Project Work Planning

4-Phases-Meta-Model/Rubicon Model

Several conceptual models of project work planning are currently in use. Their common denominator is the meta-model of four phases of product elaboration, known in the psychology as Rubicon Model (Cadle and Yeates 2008; Heinz Heckhausen and Gollwitzer 1987):

- Initiation and consideration phase,
- Planning phase,
- Implementation phase,
- Closing and evaluation phase

Each project phase is clearly separated from the rest of project phases and is characterized by (Caupin et al. 2006):

- Planned time of realization,
- Detailed list of activities of a given phase,
- Detailed list of results of a given phase.

The only and major differentiation between all models is:

- The granularity of the meta-model
- Level at which the recurrence take place
- Number of iterations.

Selection of the appropriate conceptual model is project objective dependent: different for construction work and different for software development. Common models are evaluated hereafter.

Veni, Vidi, Vici: I came, I saw, I won
Gaius Iulius Cesar (100–44 B.C.)
©bpk/Antikensammlung, Berlin, SMB/ Jürgen Liepe
In the year 49 B.C. Gaius Iulius Cesar while being in the Province of Cisalpina (today's more or less northern Italy) was confronted with the unacceptable to him dictator Pompeius in Rome. The River Rubicon was a natural border between Cisalpina and those days Italy. Gaius Iulius Cesar was aware, that after crossing Rubicon there was no way to return and that the home war became inevitable. So he collected his legions and asked each soldier if it is worth for him to cross the river Rubicon. This objective consideration left all options open. The decision generated deep intrinsic motivation, needed to succeed. The initiation and consideration phase (later named just the Initiation only) was closed with famous Alea iacta est (the die is cast). The subsequent planning phase was subjective: all wanted to cross the Rubicon and conquer

> Rome; the question was only "how?", "which way is the best one?" This motivation build-up, based on objective considerations, against subjective success-oriented planning is the key differentiating factor and makes basic difference between the Initiation and Planning Phases. With the crossing of Rubicon the Implementation Phase begun. . . ... And ever since than the ruler of Roman Emporium bear the title of Cesar. . ...

Waterfall Model
Most common model of project work planning is a sequential waterfall model (Boehm 1981). In this model the phases do not necessary close before the next one starts; they may overlapped as shown in Fig. 2.7. As in the case of HERMES 2003 and HERMES 2005, the planning phase is split into the pre-analysis and concept phases (HERMES 2003 2003 and HERMES 2005 2005) (Table 2.5).

V – Model
V – model (see Fig. 2.8) allows to separate the production from control activities (Jenny 2001; Cadle and Yeates 2008) (Table 2.6):

Agile Model
Despite all the efforts in elaborating best possible business input, the indeterminacy in demanded features and subsequent realization led to number of agile models, targeted in better consistence of business requirements and project ("useful") results (Beck et al. 2001/2013; Jenny 2001; Cadle and Yeates 2008; Pressman 2010). The numerous iterations are in authors' view still better represented by the spiral model, which reflects the fact of inclusion of previous results, rather than e.g. SCRUM models, which awake an impression, that only the actual "sprint" is elaborated and tested. Table 2.7 and Fig. 2.9 give an overview of agile model approach.

Activity/Role Model
In a activity/role model all processes which occur in a project lifecycle are considered in the project structure and assigned to specific roles. The planning and realization phases in this model are not necessary strictly separated (see Fig. 2.10, Table 2.8). Depending on the project size one person (team member) can care about one or multiple roles.

07:24 Activity and Cost Planning

Work Breakdown Structure and project structuring delivered logically and unambiguously interdependent modules and activities (see section "07:22 Product and Product Structuring"). To develop the activities schedule (4.3.23. Develop
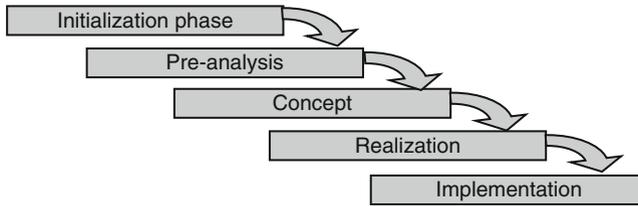
Fig. 2.7 Waterfall model

Table 2.5 Characteristics of waterfall model

Granularity	Single chain of phases
Level of recurrence	Highest level, realization in stages often practiced
Number of iterations	None on the highest level, few minor iteration in realization phase sometimes practiced
Initiation Phase	Initialization
Planning	Pre-analysis and concept
Implementation Phase	Realization and Implementation Phases
Closing and Evaluation Phase	-
Characteristics	Simple, clear,
	Sequential execution of the phases,
	Each phase is completed before the commencement of the next phase,
	There are certain results for each phase, the phases complement one another,
	Lack of correlation between the phases,
	Static,
	Does not take into consideration the changing goals and external conditions,
	Changes in the course of project realization have negative touch
Application	to HERMES 2003 and HERMES 2005 Project Management Method, construction projects, IT projects etc
Risks	Faulty results of one phase can lead to further mistakes of the subsequent phase,
	Cost consuming management of change process, hindered changes implementation,
	Late availability of the results impacts the users's acceptance

Schedule Process acc. to ISO 21500) and to assess the critical path (longest time chain) the following questions shall be answered (Jenny 2001):
• Which activities can be realized independently regardless of the other?
• Results of activities are necessary for other activities?
• Which activities take place directly after each other?
• Which activities can be grouped?
• Which activities can be incorporated into certain sub-projects?
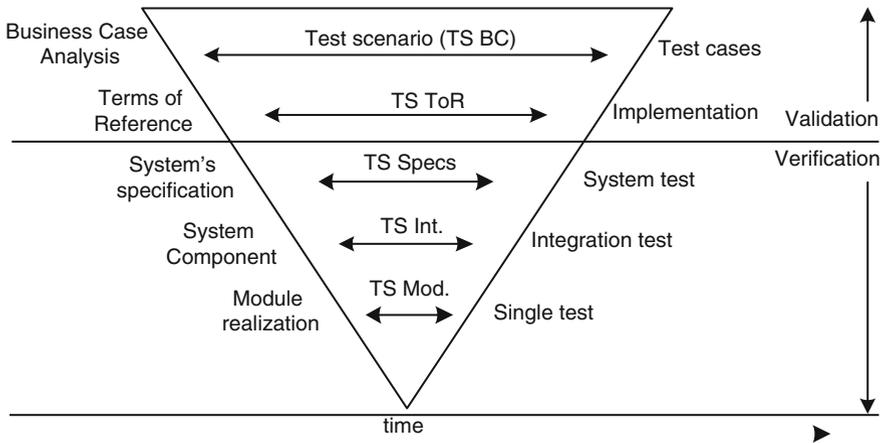
Fig. 2.8 V – model

The resulting modified Project Structure Plan PSP can be further modified according to the selected criteria (also Pfetzing and Rohde 2001). Few most commonly used are:

Scheduling of Activities
- Criterion of deadlines. The critical path (CPM) is optimised to meet the deadlines. Other tasks are scheduled to support the deadlines. Costs and ressources play secondary role
- Criterion of costs minimization. The costs of resources and overall investment is evaluated and optimized to deliver the project product at minimal cost
- Criterion of optimal deployment of the available resources. Either material or personal resources are balanced against the project needs and the activities are scheduled accordingly

Time Schedule Elaboration
Now the resulting PSP is again evaluated and with the use of some techniques presented hereafter in section "07:30 Techniques and Tools", final planning can be approached (see 4.3.23. Develop Schedule Process acc. to ISO 21500) (Klose 2002; Lewis 2011).
- Elaborate the sequential list of tasks and tasks' packages
- Assign the time necessary for the realization of each task and tasks' package.
- Plan the independent tasks in parallel as far as it is feasible from the resource's point of view
- If you use other than task/role models, add global task of project management with 10–20 % personal/cost and time resources evenly distributed in a project
- Set the deadlines in the planning
- Draft first sequences of the tasks and packages and verify if the partial results meet the deadlines
- Add 10–15 % time reserve to reach each deadline

Table 2.6 Characteristics of V – model

Granularity	Single chain of phases
Level of recurrence	On system component level and below several iterations to reach positive tests results practiced
Number of iterations	None on the highest level, increased number of iterations with the decreasing level practiced
Initiation Phase	Business case analysis
Planning	Terms of reference, system specifications
Implementation	System components and modules specification, elaboration, testing
Closing and Evaluation Phase	-
Characteristics	Sequential, rather static down to system level, multiple iterations on sub-system and module level,
	The product is structured under criterion of the verification and validation testing,
	The requirements are paired with test criteria
	The knowledge gained on lower levels supports the efficiency on higher level testing
Application	Systems manufacturing,
	Volume production,
	High reliability systems,
	V-Modell/XT (BBI 2013)
Risks	Late detection of system design errors,
	Laborious corrections of system errors
	Reluctance in improvements
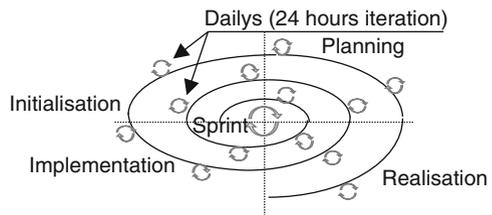
Fig. 2.9 Agile model

- If necessary redesign the PSP to meet the deadlines with necessary reserves or negotiate new deadlines
- Set the redesign plan and schedule the tasks
- Introduce milestones to measure project progress
  Figure 2.11 drafts this scheme.

Planning According to Milestones in Project Realization

Milestone is an event, usually marking the achievement of major result in project, after specified period of time, specified resources used, having a significant

Table 2.7 Characteristics of agile model

Granularity	Very high, up to all meta model phases in 1 day
Level of recurrence	Very low, down to single features, what is realizable in 1 day
Number of iterations	Very high, 30 for each 30 days sprint, numerous sprints in a project
Initiation Phase	Product backlog elaboration
Planning	Sprint backlog extended by the team with necessary support features
Implementation	Sprint/dailys initialization, planning, realization, implementation
Closing and Evaluation Phase	-
Characteristics	Product made gradually in multiple versions,
	Short term planning of the next sprint/current day activities,
	Every iteration is basically carried out in four phases,
	The risk mitigation management occurs in short dailys loop
	Highly flexible delivers useful results contrary to the initially planned results,
	Knowledge from the predecessor daily used in the following cycle,
	Changes are immediately implemented.
Application	Software development,
	Projects with numerous changes,
	Groundbreaking, innovative projects,
	XP, ASD, DSDM, SCRUM, Crystal, FDD, AM (Pressman 2010)
Risk	Still higher requirements,
	'Never ending story',
	Costs explosion, time unpredictability
	High requirements for the project management board

influence on the course of project realization (Lewis 2011; Klose 2002; Caupin et al. 2006; Lock 2007).

Basic milestone characteristics:
- Event with special meaning
- Beginning or end of project phase, task or package of tasks, relevant event with major impact
- Measurable
- With specified time deadline
- Explicit event
- Limited in number (in most cases between 4 and 20).
  Milestones aim at:
- Verification of project activities, accepted solutions and achieved results
- Enabling control of project progress,
- Structuring of the project
- Documentation of results
- Self-control
- Enabling decision concerning:
- – The beginning of the next phase
- – Repetition of the last or several last phases
- – Discontinuation of further project realization
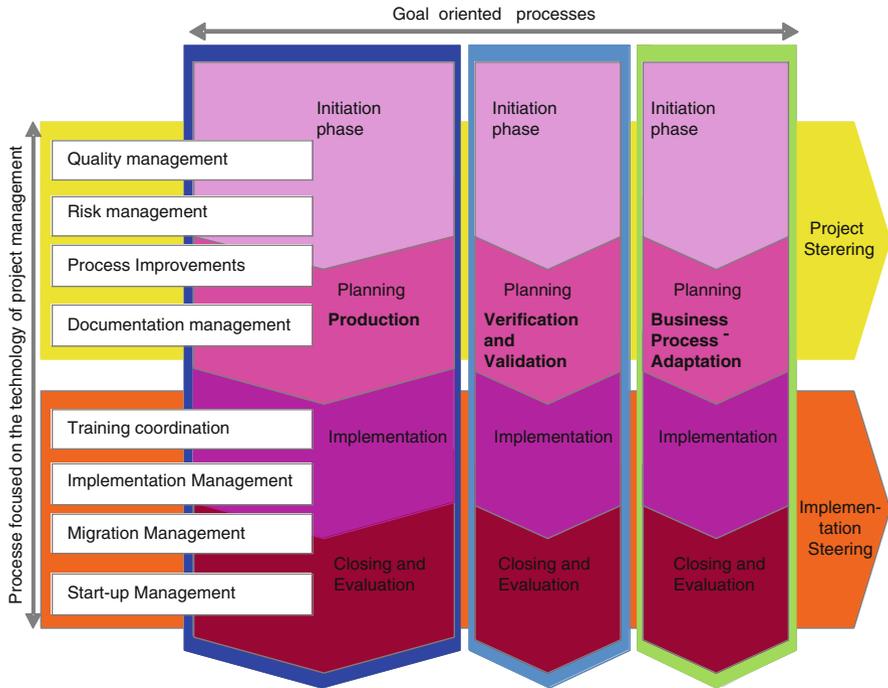
Fig. 2.10 Activity/role model

To reach the above objectives milestones should comply to the same SMART criteria, which are applied to project objectives (see section "07:21 Project Goals and Project Observations" above). While determining the milesstones it is advised to:

- Plan them in accordance with reality
- Plan them after the task completion in due time
- Plan the time needed for documentation
- Set the milestones in a clear structure
- After the achievement of every milestone it is purposeful to verify the plan.
  The third dimension of the project objectives are costs.

Top-down Cost Estimation/ROM Costs

Relatively early, in most cases prior to any initiation of the project first estimates of project costs are done (Process 4.3.25 Develop Costs acc. to ISO 21500). Costs origin mostly from the business objectives and expected project profitability. The estimations usually base on some reference models and thus contribute to the completeness of the considered costs (Lock 2007). These estimations are frequently called ROM: Rough Order of Magnitude, or Ballpark Estimate, and may deviate from the final costs by 50–100 %. (Schwalbe 2010).

Table 2.8 Characteristics of activity/role model

Granularity	Single chain of phases, planning and realization may occur recursively
Level of recurrence	On system component level and below several iterations to reach positive tests results may be practiced (agile approach)
Number of iterations	None on the highest level, increased number of iterations with the decreasing level practiced
Initiation Phase	Initialization phase
Planning	Concept
Implementation	Implementation
Closing and Evaluation Phase	Closing and Evaluation Phase
Characteristics	Model reflects all project occurences,
	High parallelism of 5 main processes,
	Every process includes several operations and takes into consideration one or more roles,
	Planning and realization may follow iterative recursive cycle,
	Each particular processes can be realized asynchronously,
	Every phase is completed before the commencement of the next phase, at least basic planning precedes realization begin
	Results of each phase are a basis for the next phases,
	Changes in the project are handled by asynchronous process
Application	Best suited for bigger, comprehensive projects,
	Undertakings characterized by significant changes introduced by a user,
	Undertakings with a required high level of integration with the environment,
	L-Timer® approach
Risks	Acceptance by the customer/sponsors of non-productive processes
	De-synchronization in case of deficient cooperation between the team members
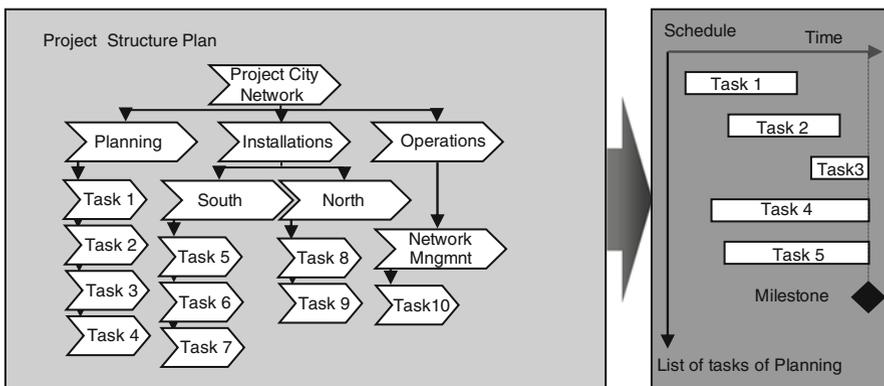
Fig. 2.11 From the PSP to a project time schedule

Bottom-up Cost Estimation/Budgetary Costs

Complementary approach of bottom-up cost estimation is done usually in the initiation phase and further precised with the progress of the project. These so called budgetary costs base on product WBS, project PSP, and schedule (Process 4.3.26 Develop Budget acc. to ISO 21500). An estimation of +/− 20 % is targeted. Several components of projects costs are listed below:

Tangible Costs

Tangible (monetary) costs are cost which can be expressed in financial means.

• Direct costs

By calculating an effort of each task in hours, multiplying by hourly rate, than adding all investments needed to perform the task, and adjusting the result over the years with interest rate we obtain roughly the total tangible cost of the project. In estimating the cost of single task learning effect of persons performing this task may positively impact the cost. On the other side, the unpredictability and unknown obstacles cause additional unplanned expenditures. So altogether it makes more sense to abandon the speculations about learning curve and calculate the project in fix indexed rates.

• Indirect costs

Beside those direct costs there are also indirect costs like electricity used, cleaning staff, and shared services in tangible costs.

Intangible Costs

Project causes also other, intangible costs. These are the costs which can not be easily expressed in financial means: like image win or loss, motivation gain or reduction. It makes sense at least to list those costs in risk catalog, as they may impact the tangible costs.

Reserves

Whatever technique will be chosen (see sections "07:30 Techniques and Tools" and "08:32 Project Role Description") to estimate the costs, the unpredictability of the project might exceed the gains of potential learning curve effect. So it is most recommendable, and simultaneously most difficult to gut through the project sponsors and client, to build a contingency reserve of arbitrary set at least 5 % of total tangible costs. The analysis of 200 projects done by HP in the early 1990 identified poor project cost estimation as the second major reason of massive costs overrun (Kendrick 2009).

Cost Baseline

The allocation of budget costs to project phases is called cost baseline. This time-phased budget serves primarily project cost control (Schwalbe 2010).

07:25 Costs/Benefits Evaluation

An investor expects some tangible or intangible returns from the project he finance. As a rule of thumb we may claim, that the higher are the returns from the project,

the higher is the sustainability of the project and the security of it's completion, at least from the financial point of view.

Therefore, it is most recommendable to elaborate profound estimation of all possible benefits from the project, and obtain the acknowledgment from the project sponsors /clients, in particular in all projects were seemingly intangible returns are expected. The weaker the financial tangible gain for an investor, the higher is a chance that project will be dropped at the first best occasion.

Several indicators and calculation techniques for cost/ benefit evaluation are used (see section "07:30 Techniques of Structuring"). Their actual deployment depends on the strategy of the investor. Therefore, no universal one-fit-all solution may be given here.

07:30 Techniques and Tools

07:31 Techniques of Project Objectives Identification

Creativity is needed on various stages of project definition. Few most common techniques are introduced hereafter. Further readings may be found in Ninck (Ninck 2004).

Intuitive Techniques
Brain-Storming
The technique was conceived by Osborn to stimulate the generation of ideas (Osborn 1957). The goal of 'Brainstorming' is to find possibly vast number of creative, sometimes unusual or new possibilities of a certain problem solution through mutual stimulation in a group. According to Osborn four to five well conditioned participants can generate 50–100 ideas within 30–60 min session.

In this procedure firstly the moderator, who collects the ideas and stimulates the work, is to be chosen. Then participants began to name their ideas related to the subject. It is important, that neither moderator, nor any participant attempt to evaluate the presented ideas. They should just be written down on a flipchart or any other suitable, visible for all mean. Moderator may drop few abstract yet real objects terms to forge the cognitive creativeness of the participants.

In the second phase moderator with participants analyze each particular idea, eliminate it's multiple occurrence, structure and evaluate it's usability (Schnitker 2007; MindTools 2013).

'Brainstorming' in groups should comply with the following rules:

- A moderator directs the brainstorming in such a way, that he at any time remains in control over the goal of the whole process. Longer discussion on one idea should be avoided. The moderator is also obliged to motivate the participants to contribute and to assure that the creativity of new ideas will get noticed.
- In order to acquire a maximum number of ideas the team should include people representing different disciplines.
- Moderator and participants should be careful so as not to kill their creativity in the germ. Thus, it is advised to create such conditions, in which every participant

do not have the feeling of domination of any other participant of 'brainstorming', hindering his own creativity. Playing 'brainstorming' can be helpful.

- Except creating new ideas partners can carryout analysis of already existing ideas in order to perfect them.
- In case of need we can visualize ideas. The notes and drafts of the moderator and the participants, also e.g. recordings of a session of 'brainstorming' can serve as a protocol.

635 Method/'Record of Thoughts'

635 Method, or in other words 'Record of thoughts' has been conceived by Rohrbach in 1969 (Rohrbach 1969). 635 functions similarly to 'brainstorming'. The ideas are not presented in oral form, but noted down by each participant, Therefore, they match well nowadays social network communities. The method functions in the following way (MethoDe 2013):

- Six participants writes down on a piece of paper three possibilities of solutions for one problem,
- Then the piece of paper is passed further and each participant tries to crystallize the ideas of the other one,
- Then the pieces of paper are passed further until every participant receives again the paper with his/her ideas,
- At the end the ideas are analyzed and the best ones are chosen as a solution for a problem.

In order for the presented procedure to function without a negative influence on the creativity we should take into consideration the following points:

- It is not allowed to talk during a session. We should write legibly in order to eliminate additional questions which disturb the course after the pieces of paper are passed around.
- During the whole process it is necessary to stick to the set time frames in order to avoid waiting and breaks in the access of creative ideas.
- To prepare a draft of three proposals being a solution we need 3–4 min. Then each participant receives at each phase two additional minutes to read the written text. Tight time frames allow to use the short-term memory better.

Discursive Technique
Morphological Matrix

Swiss astronomer Zwicky created morphological matrix for systematic problem solving (Zwicky 1948). His method is particularly well suited to elaborate a solution build from several components, each of which may have different qualities.

Zwicky conceived four steps:

1. Problem formulation.
   This is the project goal or part of it. E.g. City network example introduced earlier in this chapter.
2. Schematic representation of alternative qualities.

Table 2.9 Morphological matrix of the city network

City network	Source of power	Network design	Structure
Cable	Distributed	Star	1 Level
Radio	Centralized	Mesh	Multilevel
Satellite	Redundant		Structured
			Mix-structured
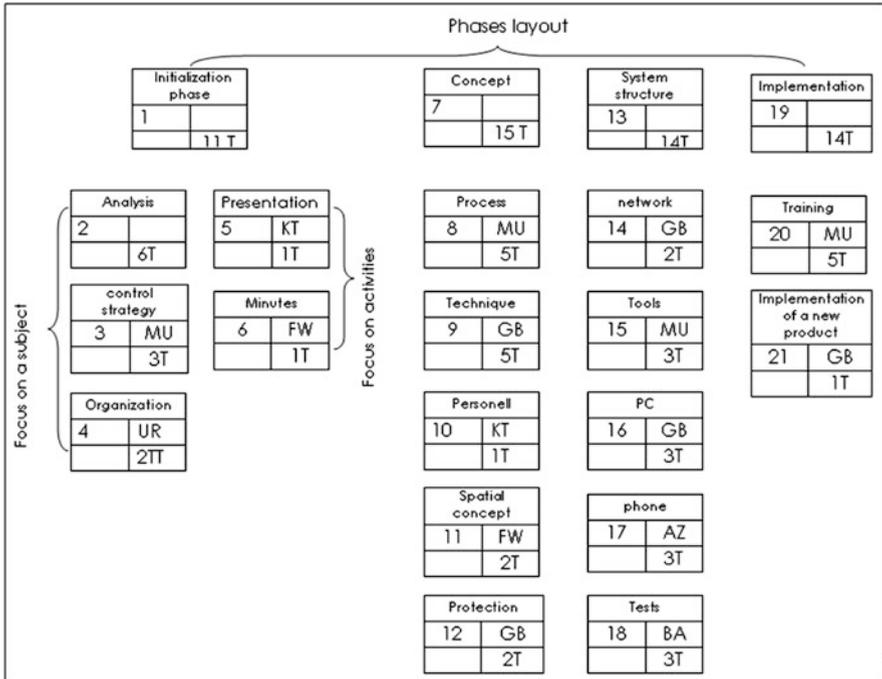
Fig. 2.12 Example of a project structure plan

All qualities of each component are listed and reasonable combinations of qualities of each element are built, e.g. Cable, centralized power supply, mesh network, structured (see Table 2.9).

3. Performance analysis of the selected combinations. Based on the adopted evaluation scheme all combinations are qualified and best is chosen.
4. Direct Action.
   Consequence of decisions taken in Step 3 shall be taken.

07:32 Techniques of Structuring

Project Structure Plan PSP

Project Structure Plan is a clear, planned, often graphical or text form of presentation of all activities, vital for project goal achievement. Vital activities are those which are necessary to make or achieve the project goals. Fig. 2.12 presents an example plan of project structure (Heeg and Friess 1999).
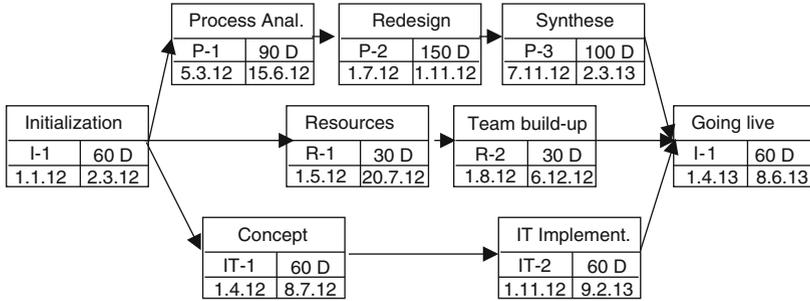
Fig. 2.13 PERT diagram

The criterion to prepare the PSP might be:
- The Work Breakdown Structure (WBS)
- The vital activities' structure
- Phases of a project.

The PSP Structure along WBS is typical for agile models. The additional for project realization necessary activities are at risk to be omitted. Structuring the PSP according to the project phases is a most often chosen model in the sequential models and V – model. In this book the structuring along Activity/Role Modell and L-Timer® processes is recommended for their completeness.

07:33 Scheduling Techniques

PERT Diagram

The research team, which worked in the late 1950s on Navy's Polaris Nuclear Submarine Programme, developed tool for easier presentation of the interdependencies and time progress (Sharma 2006; Stires and Murphy 1962). Known as PERT: Program Evaluation and Review Technique tool views the individual activities as events. Various parameters may be associated with each activity:
- Identification number (mostly in certain numbering system)
- Short denominator/name
- Deadline
- Start date
- Duration
- Optional fields like risk assessment, resources etc.
  An example is given in Fig. 2.13.

Beta Time Estimation

Beta process of time estimation was used in PERT to elaborate an approximate duration of a task or package of tasks on the base of an experience of an expert. For each activity the following three time assessments are done (Schwalbe 2010; Sharma 2006):

- Optimum time (OT) of activity realization: it determines the necessary time minimum (assuming optimal work conditions),

  Approximate duration of activity ''i''
  $$Ti = ((OT + WT)/2 + 2MT)/2 = (OT + 4MT + WT)/6$$

- Most likely time (MT) of activity realization: indicates most likely time needed under standard work conditions,
- Worst case time (WT) of activity realization: time spent in case of simultaneous occurrence of all negative factors at the same time.
- The mid-point (OT + WT)/2 is considered only half weight of the most likely time.

  Time for one activity is estimated as follows:

  This equation results in a curve which reflects the frequency of particular time estimations (Beta distribution). We should also point out that the MT value does not have to reflect the arithmetic mean of OT and WT. Thus, it is highly possible that the curve will be dually asymmetric.

  Estimation of the overall time needed for a single sequence of activities can be made as a sum of standard estimations with summary deviation of time estimations with the assumed level of probability.

Standard deviation of each single time estimation:
$$\sigma i = (WT - OT)/6$$
Variance $Vi = \sigma i^2 = ((WT - OT)/6)^2$
Total time of chain of activities
$$Tt = \sum Ti$$
Summary deviation in a single sequence of activitie:
$$\sigma = (\sqrt{\sum} \sigma i^2)$$
Standard normal deviate:
$$Z = (T - Tt)/\sigma$$
Approximate total duration time estimation with 99.74 % level of probability:
$$T = Tt +/- (3 \times (\sqrt{\sum V^2}))$$

Table 2.10 illustrates the exemplary Beta calculation for a sequence of three activities. Values OT, MT and WT are given for three activities in working days. The result of the calculation is the average time of the realization of all activities, in total 1,040 h. The total approximate time of realization of all activities will most likely be 1,040 +/− 172 days with the probability at the level of 99.74 %. The reason of such significant deviation is the accumulation of average values and variances.

Table 2.10 Example of beta process (all data calculated in days)

Package of tasks	Optimum time OT	Most likely time MT	Worst time WT	Average time T_i	Standard deviation σ_i	Variance $V_i = \sigma_i^2$
A1	260	300	400	310	23	544
A2	350	400	540	415	32	1,003
A3	220	300	470	315	42	1,736
Total	830	1,000	1,410	1,040	97	3,283
Standard deviation σ						57
Estimated time assessment with the probability of 99.74 % (interval) T				1,040	+/−	172
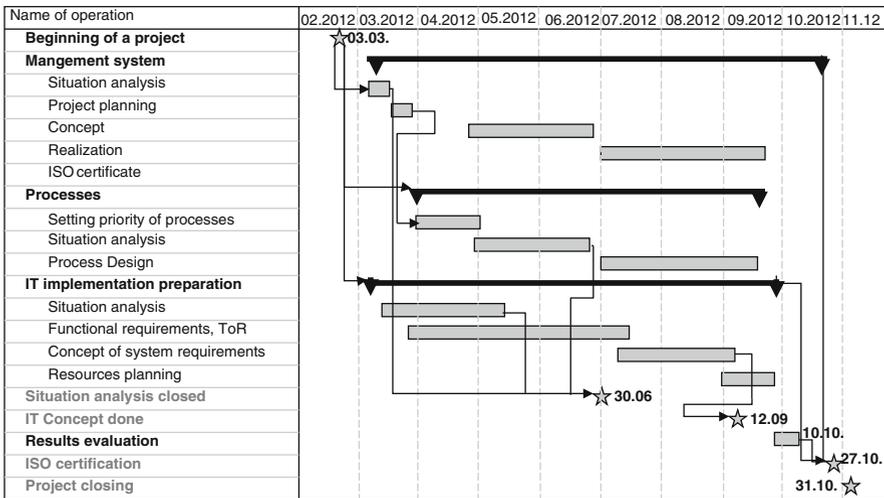
Fig. 2.14 Deadlines planning with the Gantt diagram

The other more sophisticated time assessment methods demands higher efforts (e.g. Schwalbe 2010). However, the indeterminacy of project scope and it's realization make these higher precision tools obsolete.

GANTT Time Diagram

Once the duration of each single activities is determined and their mutual interdependence is set, the time schedule diagram may be drafted.

Most popular and widely used is GANTT diagram (Clark et al. 1922; Lock 2007). On the horizontal axis is the time scale drawn, and the vertical axis individual activities. In the next step the interdependencies are noted, either in a column (like in e.g. MS Project), or directly by binding predecessors with successors. An example is shown in Fig. 2.14.
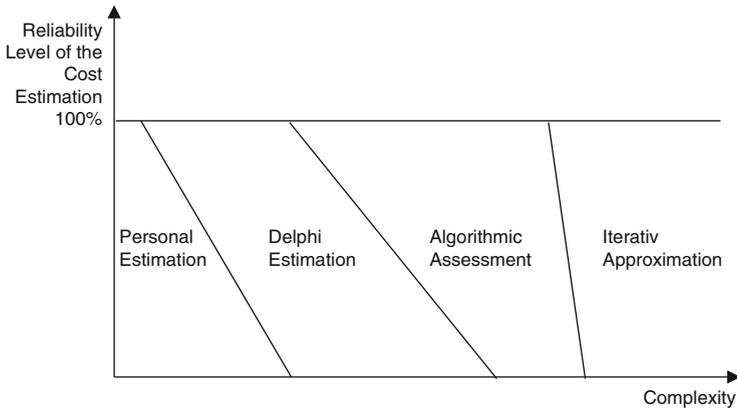
Fig. 2.15 Reliability of cost estimation techniques

Several commercial and open source products support the development of Gantt diagrams. Free of charge complete package supporting project management is available from the Swiss Governmental IT Authority (ISB 2013).

07:34 Project Cost Estimation

An effort in cost estimation shall be in some relation to the total costs under consideration and the associated risks.

Small projects, where project manager or someone, who conceive the endeavor feel competent, can be with reasonable reliability estimated by that person. However, with the increasing complexity the reliability of the estimation is decreasing.

Complexity is determined by it's cybernetic nature (see Chap. 1, Introduction, here above), emergence and unpredictability (Erdi 2008). Therefore, the more complex they are, the longer is their description and their analysis is more challenging (Gell-Mann 1994) (Fig. 2.15).

Delphi Procedure
So as the complexity increases an involvement of additional experts might help to assess reliably the costs. In so called Delphi procedure at least two experts shall be consulted. Variations include independent anonymous opinions and open dialog Delphi procedure, where experts mutually can exchange their views (Häder 2009).

COCOMO® II
Also Delphi approach reaches it's limitations with still increasing complexity, the algorithmic assessment might be in place. Their accuracy of estimation judged by the evaluation of numerous projects is high enough: e.g. in so called COCOMO® II

approach (Constructive Cost Model (Boehm 1981)), the in 68 % of cases, the deviation of budget and real costs was less than 20 % (Hummel 2011).

Typical approach is the definition of certain mathematical formula with some variables and some constant parameters, which are set to customize the case.

The procedures are business specific. In the above mentioned COCOMO®II algorithm for systems' and software evaluation the formula is as follows:

$$E = C{*}M^{\,0.91+0.01{*}\,\Sigma SFi} * \Pi\,EMt$$

Where:
- E is en Effort in Man-months
- C is yearly updated Calibrating constant (currently 2.94)
- M Size of system (software) in units (lines of code)
- SFi – scale factors
- EMt – effort multipliers.

Sackman's Second Law

Both SFi and EMt are taken from the tables which assess the factor or multiplyer value in dependence of the complexity assessment on the Lickert scale. What is relevant, is that COCOMO®II include in the total cost estimation also the impact of human factor (Sackman's Second Law, (Sackman et al. 1968))

COCOMO®II calculators are available free of charge (a.o. Research Methods Consortium 2013; University of Southern California 2013).

Putnam Myers Estimation

Universality character has the formula of Putnam and Myers (Putnam and Myers 1992).

Effort $=$ (Size/Productivity) * (1/Development time)*β

Where:
- Productivity varies and is business specific
- β is a value derived from comparable projects and is size sensitive (in Software: 0.16 (small project)– 0.39 (big one))

In the above estimation the project costs excluding the production and series manufacturing are considered.

Whereas there is a relatively broad area of ambiguously efficient personal estimation/Delphi and Delphi/algorithmic assessment, relatively sharp is the limitation of the algorithmic assessment in complexity surmounting. Up from certain level of complexity the cognitive capability to assess the inaccuracy and variability

of the project limits the reliability of any of the above estimation techniques. Examples are innovative or research projects.

In this case the estimation may be done in the learning process of iterative approximation adapting the Putnam Myers formula.

In the specified period of time the productivity of team is carefully assessed. Than the total size is divided by the productivity to assess the unconstrained effort needed.

In the next step the development time is verified. If shorter than the effort of the available resources allows, arbitrary β shall be set and the estimation of the next phases may follow. Procedure is biased with the short term observation and missing reference models so shall be repeated iteratively to obtain best possible cost estimation.

07:35 Project Business Case

Project manager is frequently facing the task of delivering the project following an arbitrary investment decision. It is highly recommended particularly in these cases, where clear financial evaluation of the endeavor has not been performed before the project start, to elaborate the project benefits and, in the best case, to obtain an acceptance of the results by project sponsors. The praxis demonstrates, that those project, which has been initiated without a prior cost/benefit evaluation are first to be dropped upon any obstacle.

In a survey of Graham and Harvey, 392 CFOs choose always or almost always the capital budgeting techniques as presented in Fig. 2.16 (Graham and Harvey 2002). These techniques will be further briefly presented hereafter.

It shall be noted, that the popular Return on Investment ROI is not among those most frequently used anymore. The reason might be that it is too static and under performs as compared to the other techniques, listed in Fig. 2.16.

Internal Rate of Return IRR
Internal Rate of Return IRR is a measure of profitability of a project before the costs of capital are considered. If IRR is higher than the cost of capital – project shall be accepted. It reflects the discount rate on investment obtained during the period of it's total compensation by the achieved revenues.

It is calculated by setting the Net Present Value NPV to zero (see below NPV).

- $0 = CF0 + CF1/(1 + IRR)1 + CF2/(1 + IRR)2 + \ldots + CFn/(1 + IRR)n$
  Where:
- Index 1,2, ...n is the year of project life cycle
- CF – cash flow
- CF0 – initial capital engagement
- IRR – sought Internal Rate of Return
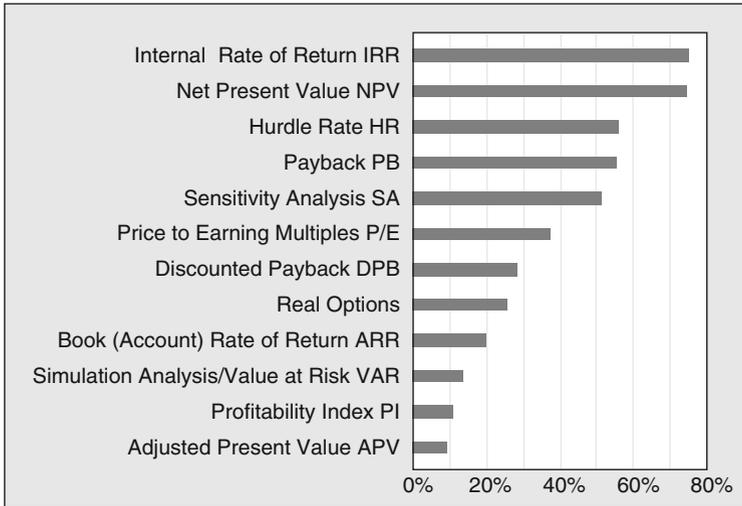
Fig. 2.16 Capital budgeting techniques and percentage of CFO's who always or almost always use a given one (Graham and Harvey 2002)

IRR takes time value of money and risk into account. IRR is unreliable in projects where negative cash flow e.g. major investment in one of the project phases: IRR has different values each year – it may be below cost of capital in 1 year, above in another. However IRR seems to be better to communicate: it is easier to understand the potential return of x% instead of the future value in today's money. Therefore most likely, it is the preferred technique of capital investment evaluation (Hawawini and Viallet 2011; Bitz 1998).

Discount Rate DR
Cost of capital engaged in a project is expressed by it's discount rate DR. Discount rate reflects the risk assessment: the higher the risk, the higher the discount rate. It is set for a specific period of time, usually 1 year (e.g. 10 % p.a.).

Discount Factor DF
The discount factor reduces the value of specific amount over the period of considerations:

$$DF_i = 1/(1 + DR_i)$$
for the period i.

Present Value PV
Present value PV of the project is the future value FV (e.g. cash flow) at the time if it's (present) evaluation.

$PVi = FVi /(1 + DRi)$
  for the period i.

The Net Present Value NPV is a total of initial capital engagement and present values of all future values FVi at the cost of capital at that given period (Heldman 2009; Webb 2000; Hawawini and Viallet 2011; Schwalbe 2010).

$NPV = CF0 + \Sigma PVi = CF0 + \Sigma (FVi \text{ x } DFi) = CF0 + \Sigma (CFi \text{ x } DFi) =$
  $CF0 + CF1/(1 + DR)1 + CF2/(1 + DR)2 + \ldots + CFn/(1 + DR)n$
  Where:
- Index 1,2, . . .n is the year of project life cycle
- FV – Future Value (e.g. cash flow)
- CF – cash flow
- CF0 – initial capital engagement (usually subtracted value)
- PV – Present Value
- NPV – Net Present Value
- FV – Future Value
- DF – Discount Factor
- DR – Discount Rate

Table 2.11. shows an example of a project, where 3 years investments brought positive revenues from the fourth year onwards. The total project life cycle is 7 years.

NPV is in this example positive – project shall be started. However, it shall run at least 6 years as only then the NPV reaches the positive values.

NPV is the measure for value creation (if >1). It adjust to time capital expenditures, with discount factor adjust to the project risks, is additive, favours investments with faster cash return. It's drawback is certain resistance to change adjustments in project (Hawawini and Viallet 2011).

Hurdle Rate HR
Whenever the cash flow varies and have several ups and downs (non-linear) the Hurdle Rate HR is applied. HR defines the minimum total gains on the engaged capital. It may be e.g. expressed as NPV at certain value related to the capital engaged or cumulative discount rates against the cost of capital (Bragg 2011).

Payback PB
In Payback PB the total of all capital outlays is related to the total of gains in subsequent years. The period until the year, when PB reaches zero is called payback time.

In our example total capital outlays are:
  $\Sigma CFi = 1 + 1.8 + 0.5 + 0.2 = 3.5$ (Mio.)

(continued)

Total gains in the fifth year: 1.8 + 2.5 = 4.3 (Mio.), what would indicate, that project already in fifth year reaches payback. However, as payback does not account the discount, ignoring the risks and the time value of money, the real net benefits starts first in the sixth year (see NPV).

Sensitivity Analysis SA
At any selected model of financial project evaluation Sensitivity Analysis SA allows to predict an outcome as a consequence of certain changes. The independent variables are modified and an impact on dependent variables is tested, e.g. discount rate impact on NPV (Fridson and Alvarez 2011).

Price to Earnings Multiples P/E
Price to Earnings Multiples (also Price/Earnings Ratio) P/E is a benchmark of market values of the companies, in our case of a project (Brigham and Ehrhardt 2011). As projects are unique and seldom sold during their life-cycle, is this measure not truly considered as useful in the project profitability evaluation.

Discounted Payback DPB
Much more valuable and close to the reality is the discounted payback. It is still the static view of the project, yet with the expenditures and earnings are rated with the applicable cost of capital engaged (rate). (Brigham and Ehrhardt 2011).

In the example from Table 2.11, with cost of capital equal to discount rate 10 % we add the capitals revaluated each year with 10 % until the positive cash flow is registered. In this example we obtain after 4 years 5.9 Mio. Of discounted capital balanced by cash back first in the sixth year (it was fifth year in regular payback calculation).

DPB corresponds with the NPV project evaluation. Yet for the difficulty of explaining how the discount is calculated is this techniques less frequently used.

Real Options RO
Next in the series of applicable tools is a comparison of real options. This classical approach in make-or-buy decisions is helpful also in assessing various project implementations. Here various other techniques are used to evaluate and compare the options.

Book (Account) Rate of Return ARR
The average (meaning arithmetical mean) operating profit of a project is related to the book value (account) of the investment. It has to be noticed, that the assets are after depreciation and amortization, while future profits are speculative. It

Table 2.11 NPV calculation example for a project

Year	Cash flow CF (in mio.)	DF @ RF = 10 %	Present value PV (in mio.)	Net present value NPV (in mio.)
0	−1	1	−1.000000	−1.000000
1	−1.8	0.9091	−1.636380	−2.636380
2	−0.5	0.8264	−0.423200	−3.059580
3	−0.2	0.7513	−0.150260	−3.209840
4	1.8	0.6830	1.229400	−1.980440
5	2.5	0.6209	1.552250	−0.428190
6	2.5	0.5645	1.411250	0.983060
7	0.9	0.5132	0.461880	1.444940
Estimated NPV of 7 year project @10 % RF p.a.				1.444940

resembles the payback calculations, however due to underestimated risks, favours higher risk decisions as opposite to rather conservative decisions taken by payback evaluation (Needles et al. 2011).

> In our example 3.5 Mio. Investment over 4 Years gives about
>   0.9 Mio./Year. Average income 7.7 Mio., also over 4 years, gives
>   1.9 Mio./Year. The ARR is over 200 %.

Simulation Analysis/Value at Risk VAR

Value at Risks VAR measures the volatility of investment to various factors and therefore is usually performed through simulation. With usually higher level of confidence (95–99 %) the potential worst case negative influences on project financial outcome are examined to assess the risk of the project (Brigham and Ehrhardt 2011).

Profitability Index PI

Useful yet seldom used is the Profitability Index PI. It reflects the present value at the time of the evaluation related to the initial capital engagement (Hawawini and Viallet 2011; Brigham and Ehrhardt 2011):

$$PI = (\ (CF1 \, {}^*DF1) + \ldots + (CFn \, {}^*DFn))/CF0,$$

If PI is bigger than one project shall be continued. PI is relative same as IRR, contrary to the absolute value NPV. It may be compared to benefit-to-cost ratio; the benefits shall exceed the costs. PI expresses monetary this ration.

Adjusted Present Value APV

The last of the most frequently used techniques: the Adjusted Present Value APV is the NPV financed solely by equity and present values, allowing to include the

additional effects of debts, like tax-deducible discount rates (Brigham and Ehrhardt 2011). This instrument is applicable if financing is mainly secured with external sources.

Intangible Attributes Balance

Business case of certain projects can not be measured satisfactory with the financial instruments only. All public administration investments can only partially be financially justified. Higher level of clients' satisfaction through faster service, new markets potential, but also a danger of losing motivation by the employees or being dependant on a sole supplier are to be mutually weighted. These intangible attributes may substitute the project financial evaluation. Both advantages and disadvantages have to be assessed and balanced.

Functional Value Analysis

In some projects the achievement of certain functional benefits can be more important then the achievement of economic results. Certain methods of the analysis of functional value are presented in Chap. 7, 12:00 Problem Management: PBM, section "12:33 Solution Assessment and Selection Techniques" hereafter.

07:40 Templates

07:41 Project Documents

Planning and Scheduling process shell answer all 6 "W". It is useful to verify the mapping: which "W" where treated is and if the answer is satisfactory. The Table 2.12 below shall help to trace the achievements.

7:42 Documentation of the Project Results

The basic output of this process is Project Charter, refined to Project Plans. Project Charter has several inputs. It contains the name of project manager and authorizes him to deploy the resources. Main outputs define the project. The last section provide the space for those responsible to sign-off project to sign it off and to put their comments. As the INPUTS and OUTPUTS might be several voluminous documents themselves, it is suggestible to make the Project Charter in a form of Guide documents with references to individual composing files (Table 2.13).

07:50 Activities and Deliverables of Project Phases

07:51 Initiation Phase

Tasks
- Determine the goals and their relation with the strategy of a company and overall results assessment
- Analyze the goals and identify the objectives

Table 2.12 Example

No.	Result	What?	Why?	Who?	When?	Where?	Which?
1	Goal						
2	Objectives						
3	Output						
4	WBS						
5	PSP						
6	Schedule						
7	Costs						
8	Profitability						
9	. . ...						

- Identify the stakeholder needs, restrictions and limitations
- Draw a draft of product and project structures
- Draw a draft of basic methods, key techniques
- Identify core capabilities and core roles
- Formulate the target values of objectives and criteria of their achievement
- Carry out the assessment of economic profitability and secure the financing of the project

Results
- First Project Charter with outlines signed-off
- Drafts of Product and Project Structures accepted by the client
- Core Roles and Responsibilities defined

07:52 Planning Phase

Tasks
- Reevaluate the objectives
- Carry out the changes in the results of the Initialization Phase
- Develop the Work Breakdown Structure WBS (structuring of a product)
- Analyze of the procedural dependencies between the tasks and packages of tasks
- Develop a plan of production processes operations
- Develop a plan of validation processes operations
- Develop a plan of operations in the business process modifications
- Develop a plan of project management processes
- Develop a plan of project implementation processes
- Develop schedule and milestone deadlines
- Develop the Project Schedule Plan PSP
- Define all roles and responsibilities
- Carry out the assessment of economic profitability and secure the financing of the project
- Elaborate the definitive Project Charter

Table 2.13 Example

No.	Object	Ref. document	Updated	Comments
1	Project title			
2	Project manager			
INPUTS				
3	IN: Project statement of work SoW			
4	IN: Business case			
5	IN: Contract			
6	IN: Enterprise environment			
7	IN: Organizational assets			
OUTPUTS				
8	OUT: Objectives			
9	OUT: Costs			
10	OUT: Time schedule			
11	OUT: Profitability (business need)			
12	OUT: Success criteria			
13	OUT: Who is authorized to accept and sign off project			
14	OUT: Stakeholder needs met, restrictions,			
15	OUT: Roles and responsibilities			
ACCEPTANCE				
16	Sign-off section			
17	Comment section for stakeholders			

Results
- Project Plans (revised Project Charter) with all due documents signed-off
- WBS and PSP accepted by the client
- All Roles and Responsibilities defined
- Project business case revised and accepted

07:53 Implementation Phase

Tasks
- Carry out the changes in the results of the Planning Phase
- Secure the Project Charter and Project Plans Conformity

Results
- Validation of the results of planning phase and their appropriate adjustment according to the decisions in the Implementation Phase

07:54 Closing and Evaluation Phase

Tasks
- Carry out the changes in the results of the Implementation Phase
- Evaluate the conformity with the Project Charter and Project Plans

Results
- Validation of the results of planning phase and their appropriate adjustment according to the decisions in the Implementation Phase

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08:00 Organization Management: OM

<div style="text-align:right">**3**</div>

Quick Look

What Is It?
Organization management process OM shall design the project organizational structure, which will target the best possible effectiveness, measured by the overall positive perception by the stakeholders.

Who Does It?
Project manager with his initial (core) team, aided, if feasible, by the stakeholder, who is familiar with the environment and local culture.

Why is it Important?
Project will not perform if the activities will not get structured and the structure not supported by the stakeholders. The overall positive perception is the goal of this process – the appropriate structure secures it.

What Are the Steps?
Identify and register all stakeholders. Draft then the functional process derived structure. Adapt it according to the local culture prerogatives, assure the right stakeholder relationships. Design carefully the project structural modifications and provide for the efficient team extensions. Split in separate projects of a programme if justified. If necessary repeat these steps. Initiate few other processes if needed. Repeat this process periodically.

What Is the Work?
Not all stakeholders are known when project starts. Sometimes the objectives and the solutions are misty. Take some effort to best possible accommodation of all known stakeholders, decide on their management strategy in dependence of the objective/solution mix. The process derived structure goes fast, but cultural adaptation needs the highest attention – and that costs time. Time and attention are needed for any structure modification/team extension: plan it.

How Do I Ensure That I Have Done It Right?
Do not rely on functional, process derived structures only. Overall perception of all stakeholders is decisive for the project fate – so take care to identify them, continuously actualize their register, design and maintain the efficient and well

time-furnished relationships. Adjust the structure to local culture – learn it. Design and allow time for any structure/team extensions if they should be productive later. Effectiveness not the efficiency is the primary issue.

Process

First the project objectives and stakeholders has to be identified. Than the project processes' functional organization is conceived and adjusted to project environmental culture and team extension. The process shall be periodically repeated with pending issues treatment; it may be initiated by few other processes, too. Figure 3.1 depicts this process.

08:10 The Goal of Organization Management

Organization Management shall assure best possible overall perception of the project achievements through right structure of all mutual relations between project team members and external stakeholders, with best possible management of the available resources.

08:20 Methods

ISO 21500 defines project organization as a temporary structure that include the project roles; responsibilities; and levels of authority and boundaries that need to be defined and communicated to all stakeholders of the project (ISO 21500:2012 2012). Organizational structure reflects pattern of relationships within and outside of the project.

This definition, which wins my fullest support, indicates revolutionary view on the organization design.

Organizational Efficiency Versus Effectiveness

The primary target of an organization is not efficiency: rather effectiveness in meeting various stakeholders needs, measured by a degree to which an organization achieves it's goals (Daft 2009).

Up to the latest organizational handbooks of the renown organizations like e.g. that of IPMA, ICB V3.0 the organizational efficiency, measures by the amount of used resources (Daft 2009) is advocated (Caupin et al. 2006). Still today there are projects oriented on efficiency solely (Doerffer et al. 2010).

The efficiency is primarily achieved by Taylor's optimization of the chain of the activities (Daft 2009; Larson 2007). As this might work well in single processes like production line, it poses certain challenge in project due to their uniqueness and
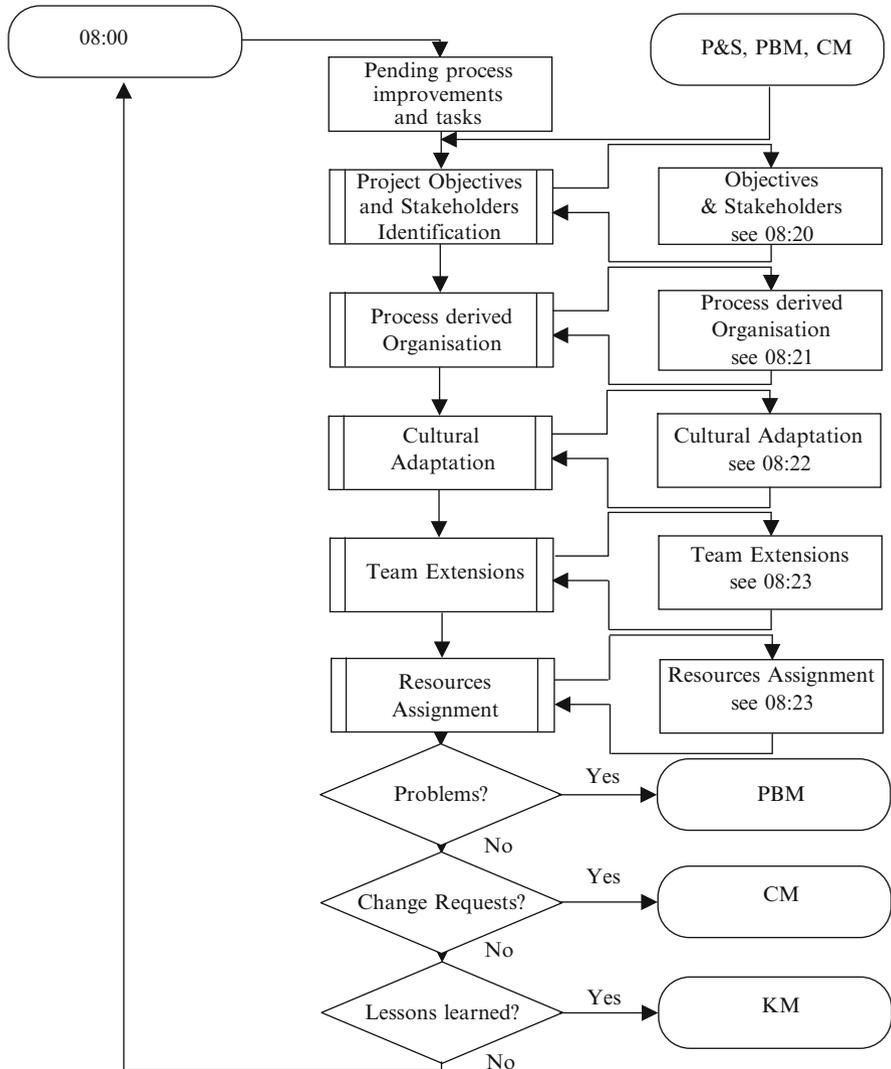
Fig. 3.1 The organization management process

high uncertainty. Therefore, designing project organization along the efficiency criterion only is doomed to fail (Larson 2007).

ISO 21500:2012 Project Organization Management Processes

In this chapter we cover the following ISO 21500 processes (ISO 21500:2012 2012):

4.3.9. Identify Stakeholders

4.3.10. Manage Stakeholders

4.3.16. Estimate Resources (adaptation)

4.3.17. Define Project Organization (develops role description and project organi-
zation chart)

08:21 Objectives and Stakeholder Identification

Already in early project stage the first organization is drafted (Dinsmore and
Cabanis-Brewin 2011). In most cases the initiator, later project manager or sponsor,
make his core team for the first stage of project initialization. In most cases these are
the prospective key project team members.

Holistic View of Project Organization

In a holistic view of ISO 21500:2012, shared a.o. by Bourne (2009), Taylor (2006;
Daft 2009), stakeholders become the focus of the project organization. Bourne
defines stake-holder as someone who has an interest, rights (moral or le-gal),
ownership or contributes in the form of knowledge and own resources to the
endeavor (Bourne 2009).

ISO/DIS 21500:2011 Stakeholders

The following typical stakeholders are named in ISO 21500:2012 (ISO
21500:2012:2012).

- Project Manager – leads and manages project activities and completion of the
  project deliverables
- Project Management Team – supporting the project manager in fulfillment of his
  tasks. The standard consider it optional, yet even in small project it is recom-
  mendable to involve team members in project management decisions
- Project Team – contributes to the project success by performing specific project
  roles. It worthy to notice, that the standard does not impose any functional
  restrictions over the roles in a project
- Project Management Office – according to the Standard supportive in wide
  variety of activities, in this book localized in Project Knowledge Management
  and Communication. Considered to be additional outside the project team by
  Standard; in authors view it is a part of the team.
- The above stakeholders, on a distinct understanding, that Project Management
  Office is additional, form together the project organization.

The second group of stakeholders envisioned in the Standard is led by the project
Sponsor. His role is defined by the standard as follows (ISO 21500:2012 2012)

- Project Sponsor – directs, justifies, authorizes resources, facilitates and supports
  the project. Makes executive decisions and solves problems and conflicts that
  cannot be handled by the project manager.
- The main, and focal to the project fate, relationship is build between Project
  Sponsor and Project Manager. Quality of this relationship, trust and

effectiveness is decisive to the successful project perception by the first. Option-
ally by Standard and again mandatory in my view is the institution of a steering
committee or board. It may be just one advisor to the sponsor, yet this sparring
partner is inevitable in finding the right solution to eventual project challenges.
According to the Standard:

- Steering Committee or Board (Optional) – contributes to the project by
  providing senior level guidance to the project. High maturity guidance would
  be here a better choice.

Project Sponsor, eventually aided by the Steering Committee or Board
incorporates and bear the responsibility for the maintenance of the project
Governance:

- (Project) Governance is the framework by which (Project) organization is
  directed and controlled. It includes aspects such as defining the management
  structure; the policies, processes and methodologies to be used; limits of author-
  ity for decision-making; stakeholder responsibilities and accountabilities; and
  interactions such as reporting and the escalation of issues or risks.
- Governance with mission, vision, strategy, goals subject to maturity model
  evaluation (Cleland and Ireland 2006).

There are two other groups of relevant stakeholders: on the project passive
recipient side and project active contributors.

In the first group the most prominent stakeholder is customer.

- Customer or Customer Representative – contributes to the project by specifying
  project requirements (Terms of Reference, authors comment) and accepting the
  project deliverables (Output, see Chap. 2, 07:00 Planning & Scheduling: P&S).

Other roles on recipient side, depicted in Standard, yet not specified are (ISO
21500:2012:2012):

- Other roles on recipient side, depicted in Standard, yet not specified are (ISO
  21500:2012:2012)
- Special Interest Groups – related to the project course or deliverables – may
  positively or negatively impact project fate
- Public – broad mostly anonymous group, which may take indirectly by e.g.
  changes in law a major influence on the project.
  Active contributors are:
- Finance Provider – mostly, but not mandatory represented by the Sponsor.
  Secures the financial project backbone and liquidity.
- Shareholders and employees – those of the project environment, who actively
  influence the resources' availability
- Business Partners, Suppliers – Which Standard identifies as contributing to the
  project by supplying resources to the project.

The last and most general term is project environment. No definition is provided
by the Standard. Governance and Environment build contextual dimension of the
project organization (Daft 2009). How well the project matches the environment is
decisive for it's contingency (Daft 2009). Indirectly from Figures and descriptions
the following definition may be drafted (ISO 21500:2012:2012):
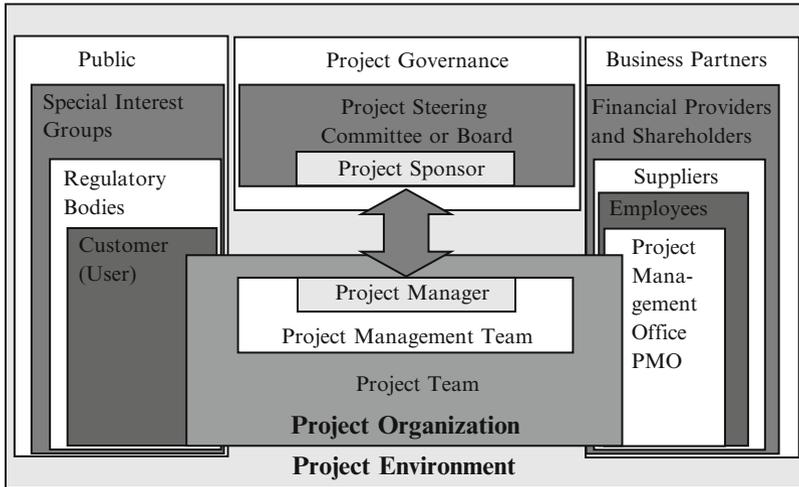
Fig. 3.2 Project stakeholders (ISO/DIS 21500:2011 2011)

- Project Environment – is created by the organization in which project is embedded on the base of business opportunities and expected deliverables. It comprises the Project Organization, Business Case, and Project Governance, and includes other stakeholders named above. It is influenced by factors outside the organizational boundary such as socio-economic, geographical, political, regulatory, technological and ecological and by factors within the organization such as strategy, technology, project management maturity, availability of resources, organizational culture and structure

   The relationship between all stakeholders, which are named in Standard ISO 21500:2012 is shown in Fig. 3.2.

Superiors as Stakeholder

Three relevant stakeholder roles are not mentioned in the Standard:
- Line superior of the project manager
- Line superiors of the team members
- Project coach.

   The project coach role is described more thoroughly in section "08:28 Project Coach" hereafter. Both superior roles and their impact on the organization are presented below. Project organization and people do not pop-up from nowhere. In most cases they are assigned to the project from either dedicated organizations or functional organization, temporarily joining the project team. Their salary, coaching, personal matters are in most cases handled further by their parent units. Same refers to the project leader, drafting de facto matrix organization of the project (see Fig. 3.3.).
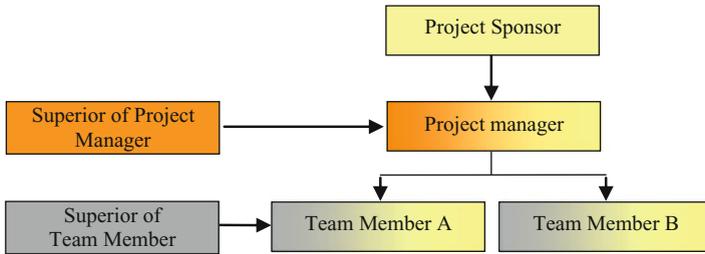
Fig. 3.3 Stakeholders classification (Roberts 2007)

Fig. 3.4 Stakeholders classification (Roberts 2007)
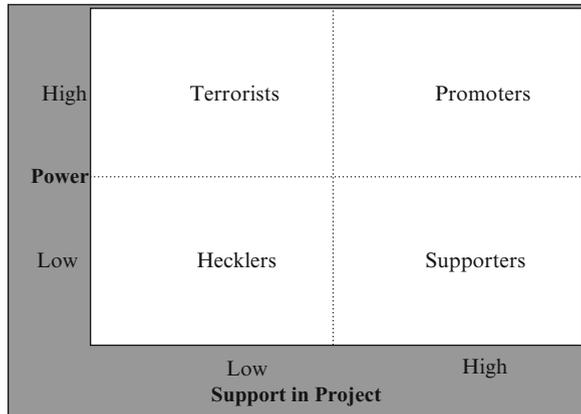
Once we identified the stakeholders, their impact on project shall be analyzed and jointly registered in stakeholder register. Project manager tends to assess stakeholders as positively contributing. Unfortunately, there is a considerable number of stakeholders in the project environment with contra productive impact on the project. Useful here is the classification of Roberts, shown in Fig. 3.4 (Roberts 2007).

Stakeholder Strategy

Project manager shall avoid hecklers, anticipate terrorists, court the supporters and truly care about the promoters. The stakeholder strategy sets the rules here.

At the end it is not possible to satisfy all stakeholders same way – so the art of making right decisions in fate of the uncertainty draws the profile of the successful project manager.

08:22 Process Derived Organization

Standard ISO 21500:2012 views projects as processes and defines the project management processes screening off what it calls product and support processes (ISO 21500:2012 2012). However, the inclusion of the last in a project is admitted.

Fig. 3.5 Roles creation
process
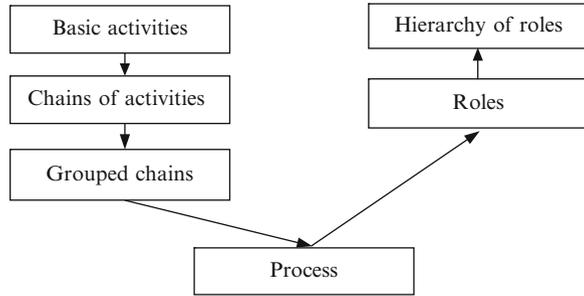
Starting from the Work breakdown structure WBS the activities needed to deliver the outputs are elaborated in Planning & Scheduling (see Chap. 2, 07:00 Planning & Scheduling: P & S), going beyond the limitations of the project management processes in the sense of the ISO 21500:2012.

Activities are bound into chains, than groups and finally the processes are elaborated.

Taylor's Scientific Management

Ever since Frederic Winslow Taylor analyzed the process of unloading of iron from the railcars in 1898 the efficiency of process derived, functional organizations is known as scientific management and managers are those, who are responsible for the efficiency of the endeavor (Daft 2009). Hierarchy of roles is created (Fig. 3.5).

The activity derived scientific management does not take into account the human capabilities of those involved, in particular handling of the limited number of interrelationships.

Span of Management

Graicunas introduces what he called span of management and defined three types of interrelations between the superior (project manager) and his subordinates (team members), which superior shall control (Graicunas (1937/2005); Singla 2010):

- Direct relationship: project manager with one team member
- Group relationship: project manager with one team member while the other (others) are present
- Cross relationship: between team members, about which project manager shall be aware.

  The resulting number of interrelations is:

$$\text{Number of interrelations} = n^*\left(2^{n-1}+(n-1)\right)$$

In otherwise good work of Mullins is this form erroneously quoted (Mullins 2006/2008).
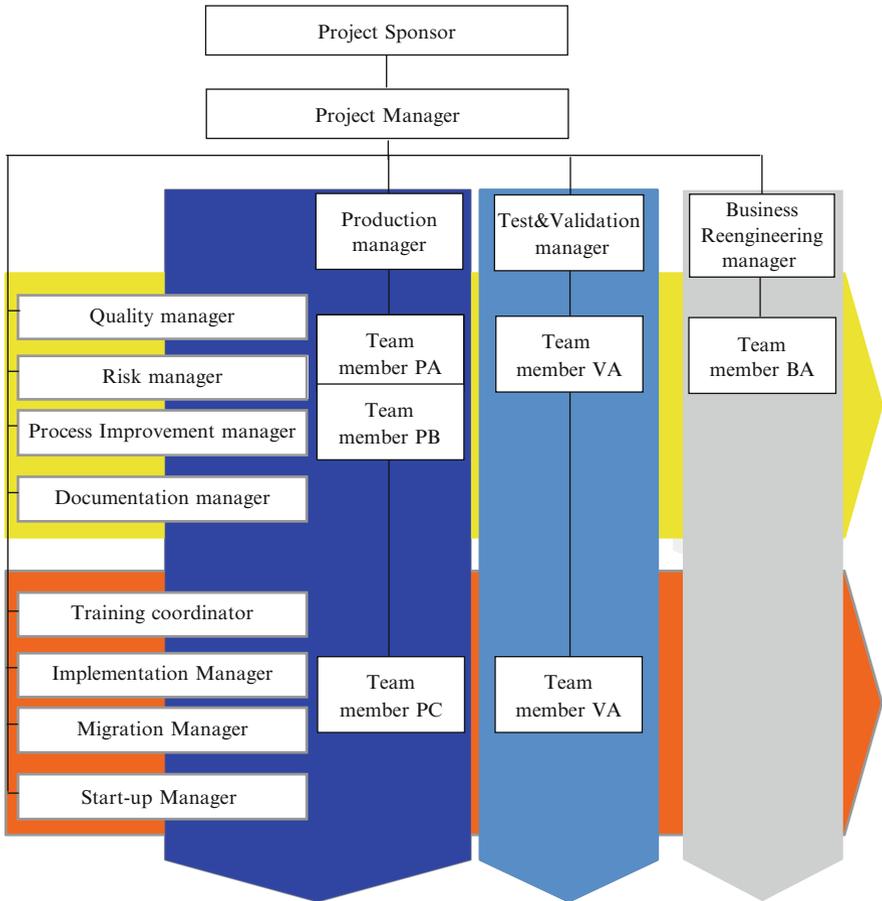
Fig. 3.6 Activity/role model project organization

Graicunas considered as manageable the number of six direct subordinates (222 interrelations) on a higher level and up to 20 on the lower level (Singla 2010).

The effective number of subordinates depends strongly on the type of project, project management style, communication style, geographical and psychological availability of the resources treated in the following Chapter. The functional organization drafted on the base of the activity/role model elaborated in section "07:23 Conceptual Models of Project Work Planning" is shown in Fig. 3.6.

08:23 Cultural Adaptation

Project organizations unfortunately do not behave like Newtonian automata implementing the specified processes. Unpredictability of the outcome of complex interrelation-ships, contextual impact of the environment and team members' behavior have impact the effectiveness of the project organization. These factors are called cultural dimension (Schein 2010) or contextual dimension (Daft 2009).

The best matching definition of culture in the context of project management organization developed Schein from the classical anthropological models. He defines culture of a group as:

Project Team Culture

"A pattern of shared basic assumptions learned by a group as it solves its problems of external adaptation and internal integration, which has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (Schein 2010).

The organizational culture validates the governance of the project and the governance of the project incorporating organization through the following three levels of attributes (Schein 2010):

1. Visible artifacts
   - Observable behavioral regularities
   - Shared meanings and integrating symbols like project name or project symbol
   - Shared deployed technologies
   - Embedded skills of team members
   - Interaction climate between the stakeholders
2. Espoused values
   - Formal philosophy of the project team (shall be encapsulated in project governance)
   - Espoused values (values which project team declares as worthy achievements like e.g. quality)
   - Project team norms, standards and rules of game
3. Tacit assumptions
   - Habits of thinking, mental models, linguistic paradigms

Culture Determined Project Organization

To design the effective project organization one has to go through the profound analysis of all three levels of organizational culture and review the functional process-derived project organization under the criterion of the best effectiveness of the project organization in a given environment. For example in large projects, in an environment, which puts value on quality and has elaborated change management culture, the project management team presented in Fig. 3.7. Supporting the project manager might be suitable to extend the activity/role model organization drafted in Fig. 3.6.

Sponsor-Superior(s) Project Manager Power Play

The culture of the project hosting environment in most cases determines how the project organizational structure is embedded. It may be viewed as a power play and balancing act between three parties (Fig. 3.8):

- Sponsor
- Superiors (line managers in charge of project manager and team members)
- Project Manager
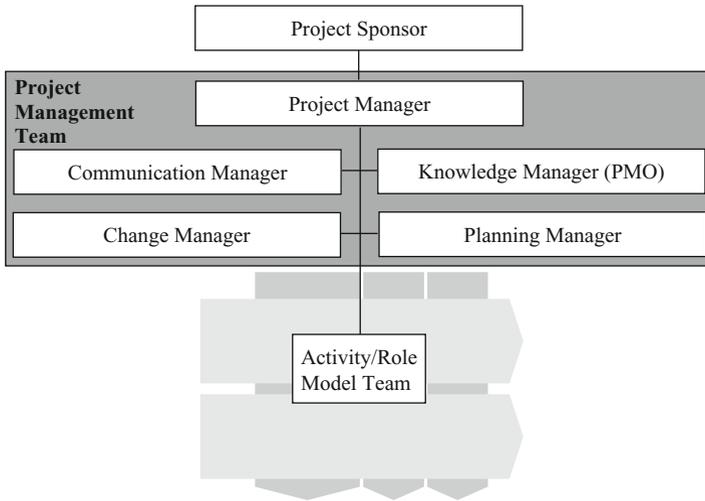
Fig. 3.7 Activity/role model project organization
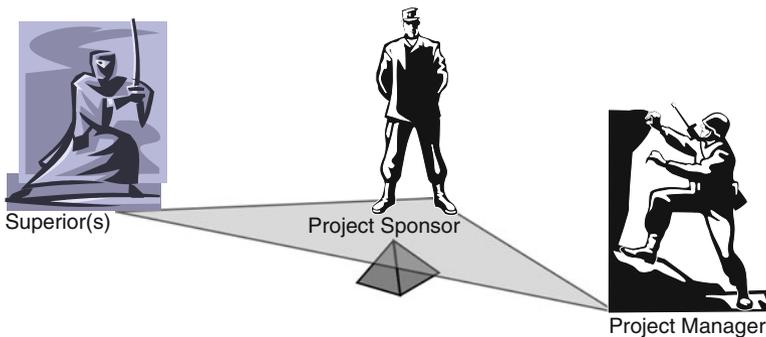
Fig. 3.8 Power play balancing sponsor-superior(s)-project manager

Project Manager as Staff Function

Strong Sponsor (Strongest ❶) and strong line managers (superiors, second strongest ❷) dominates the project fate with project manager placed as a coordinator to the sponsor (❸). Team members with partial or even full time project assignment remain in their original departments (Fig. 3.9). Applicable successfully for small, experimental nature projects.

Project Manager as Line Manager

The situation improves for the project manager in hierarchical equalization of his position as line manager (see Fig. 3.10). The team members are assigned to this project manager structure and their former or current superiors can exercise less influence than project manager on their activities. In some constellations project
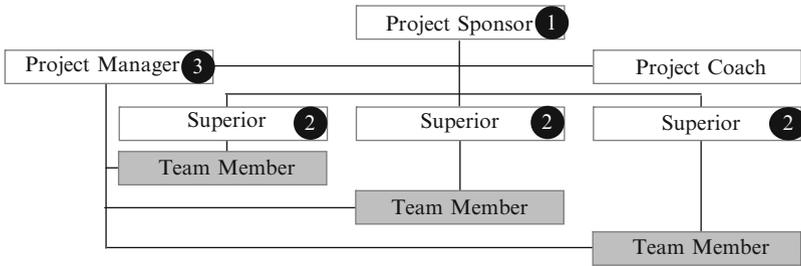
Fig. 3.9 Project manager in staff of sponsor or superior
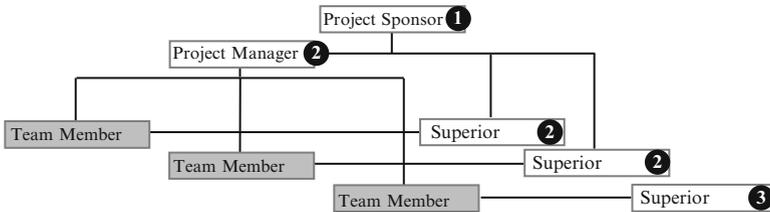
Fig. 3.10 Project manager as line manager
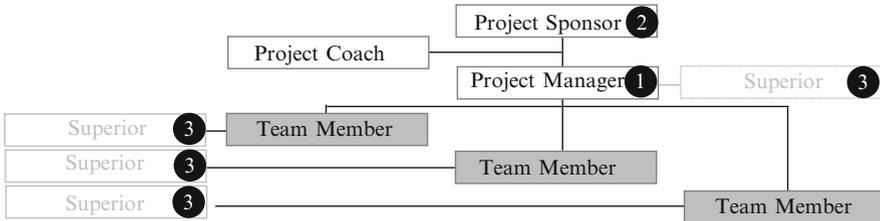
Fig. 3.11 Project manager as primary and only partner of sponsor

manager rapports to his superior (e.g. projects department chief) as well. This is most common project placement within the environment with team members in substantial partition of their time working for the project.

Project Manager Directly and Solely Reporting to the Sponsor

The last constellation is the one where project manager exercise the dominating power. The line superiors, if present at all, plays here minor role. Big, long time projects with a large project team are best suited for this type structural embedding. An example is the worldwide longest Swiss Railway NEAT Gotthard tunnel: project with couple thousands of employees, hundreds of suppliers, six billions CHF budget and 25 years duration time (Fig. 3.11).
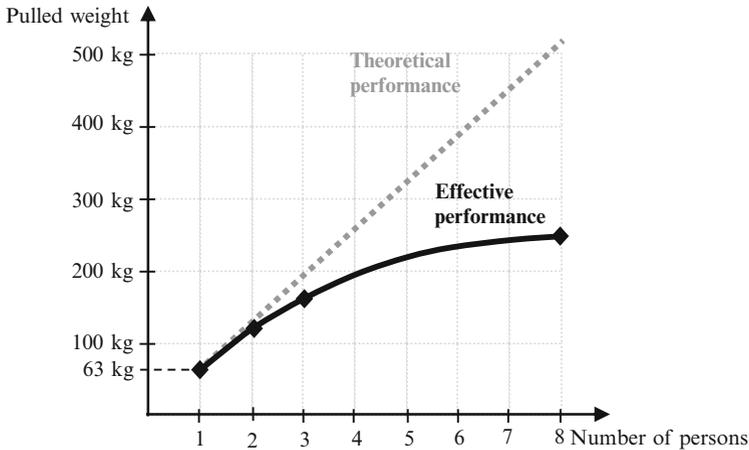
Fig. 3.12 Ringelmann effect (Ringelmann 1913; Nijstad 2009)

08:24 Team Extensions

Very seldom project starts in a complete team and close as such the endeavour.

Typical project is initiated by small group on the base of business opportunities. Soon the project core team emerges: in most cases representative of sponsors or customer and nominated project manager. In some cases other stakeholders irrespectively of their hierarchical position, based on their contribution towards project goals join this core team.

Already this core team implicitly creates a culture and project roles are shaped along the current needs of the activities adjusted to this unspoken culture.

Defining a new role in a project it is not only the question of the WBS-derived activities to be done – a complex iterative process is triggered.

New team member passes the process of socialization and what Schein calls "Acculturation" (Schein 2010) – assimilation of the core team culture.

However, each new team member means eventually new stakeholders in a project, redesign of the project structure plan, cultural impact. Obviously in a team of 100 the 101st member has lesser impact, than the sixth person in a team of five.

Ringelmann Effect

Unfortunately due to the social loafing with the increasing number of team members the overall efficiency decreases (known as Ringelmann effect). Ringelmann noticed, that while single person may pull 63 kg, the team of eight pull only 49 % of theoretically expected result of $8 \times 63 = 504$ kg (see Fig. 3.12), (Ringelmann 1913; Nijstad 2009). This loss of performance is a consequence of diminishing motivation and increased coordination effort and is registered also in other disciplines (Nijstad 2009).

The motivation does not significantly fall if there are more than three team members (Ingham et al. 1974); it may even increase if the task is attractive (Zaccaro 1984).

All losses in teams of more than three team members may be thus attributed to the increased coordination efforts, what Ringelmann concluded in his experiments, too (Ringelmann 1913).

In conclusion any new project team extensions shall set the initial conditions and provide the information to initiate the second run of the Organization Management process: new stakeholder analysis, process derived organization modification, cultural adaptation, management span and role hierarchy adaptation and finally – the resources management.

08:25 Resources Assignment

Resource

The ISO 21500:2012 defines the process "4.3.16 Estimate Resources" but not the resources as such. IPMA ICB 3.0 defines resources as embracing people, materials and the infra-structure (such as materials, equipment, facilities, services, information technology (IT), information and documents, knowledge, funds) required to carry out the project activities (Caupin et al. 2006).

In Process of Planning and Scheduling the budgetary values has been elaborated in order of overall project profitability.

In the process of Organization Management the final project organization is elaborated and only than on the level of al-most individual activity the required resources can be estimated (Müller-Ettrich 1999). Resource requirements and resource plan are elaborated.

Human resource requirements are defined by the role description (see section "08:30 Techniques and Tools" hereafter) and resource plan. The human resources allocation is a complex process treated in Chap. 14, 20:00 Human Resource Management HRM. Once the role owners are selected their availability has to be assessed and a revised human resource plan done.

The materials, equipment, facilities and services are planned depending on their relative value and availability.

The personal access to information technology, desk or office appliances are considered as marginal value as compared to the human resource cost. So not surprisingly many in project team have permanently one or more office spaces and IT-infrastructure to their individual disposal. Here the demand is unconditionally met.

Resources which are rare or highly expensive are shared – here the time-based resource plan is drafted.
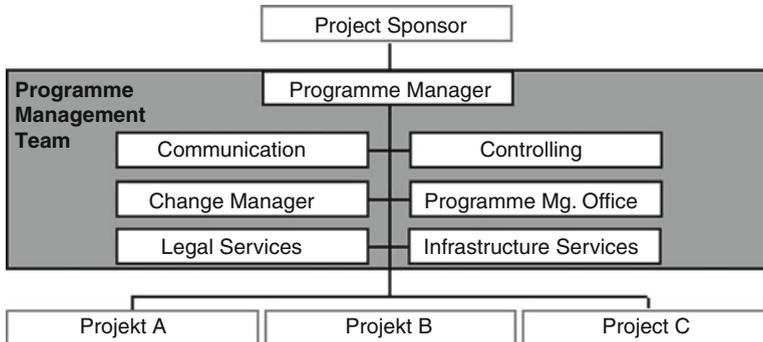
Fig. 3.13 Organization of the projects' programme

08:26 Managing Complex Projects

Projects like city telecommunication network (see Chap. 2, 07.00 Planning & Scheduling P & S), Swiss Gotthard tunnel or World Football Championships with large amount of activities and participating persons can be better manageable by splitting the whole endeavour into several projects with a common goal – programme (see Chap. 1, Introduction for definition).

Programme of Projects

A Programme, according to the ISO 21500:2012, is generally a group of related projects and other activities aligned with strategic goals. Programme management consists of centralized and coordinated activities to achieve the goals (ISO 21500:2012 2012). Programme coordinates the course of several independently managed projects. As each project runs against own time schedule, yet the changes impact the whole endeavour, the common governance, financial and deliverables' achievement controlling, communication and infrastructure management, including project management office PMO are the challenges of programme manager. His programme management team secures adequate handling (see Fig. 3.13). Frequently project managers of programme projects are part of the programme management team.

> **Programme NEAT Alptransit Gotthard.**
> (Alptransit Gotthard 2013)
>
>   After many years of political uncertainty 1992 the Swiss population and 1998 Swiss Government gave green light to this six billions Swiss francs, project. Over 200 major tenders were issued so far. Starting 2016/2017 cargo and passenger trains speeding up to 200 km/h will cross this 57 km longest worldwide tunnel.
>
> *(continued)*
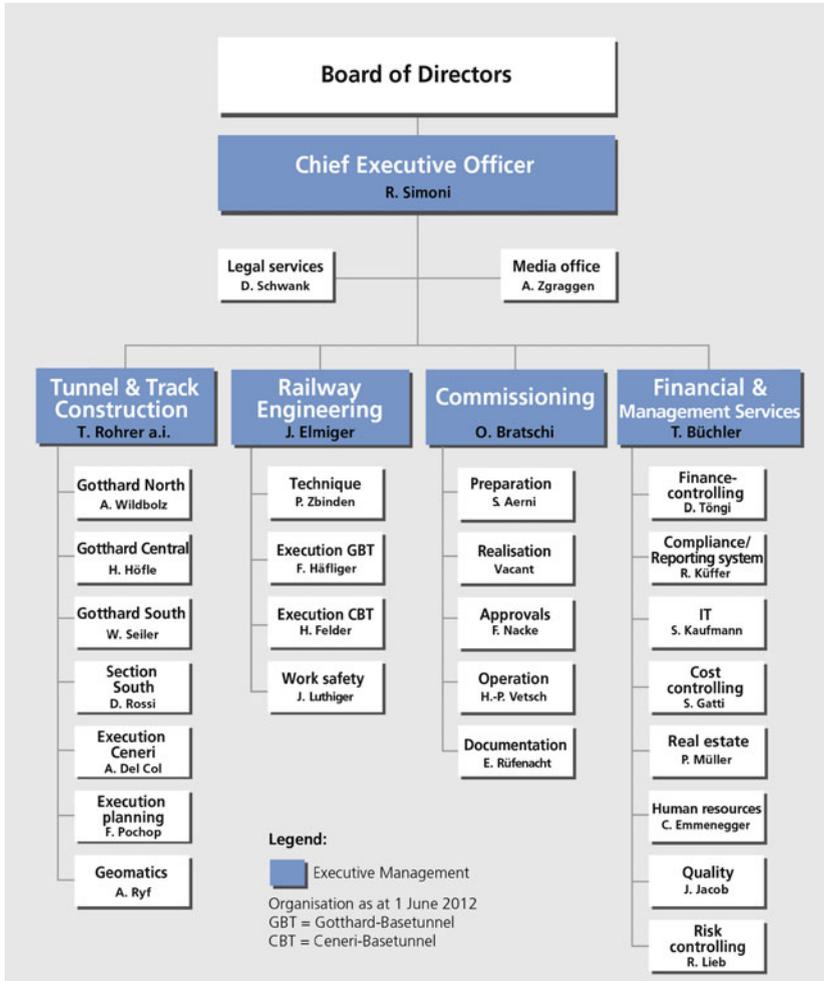
Fig. 3.14 Organization Alp Transit Gotthard Ltd.

To manage this 25 years endeavour a subsidiary of Swiss Federal Railways, Alp Transit Gotthard Ltd has been founded. The company is organized like programme of in fact three other huge sub-programmes.

Board of Directors, consisting of seven members, represents the sponsor.

Company (programme) management under CEO Renzo Simoni includes the three sub-programmes managers and financial and management services manager. They are supported in management team by legal services and media office.

Two sub-programmes: Tunnel and Track Construction Gotthard and Ceneri have several complex by themselves individual projects. The Railway Engineering sub-programme is organized functionally, handling several individual projects in parallel (see Fig. 3.14).

Table 3.1 Project organizational maturity terms

Term	Definition	Example
Best practice	Optimal way recognized by industry to achieve a stated goal or objective	Establish internal project management communities
Capability	Incremental steps that lead to the best practices	Facilitate project management activities
Outcomes	Results of applied capabilities	Local initiatives, meaning the organization develops pockets of consensus around areas of special interest
Key performance indicator (KPI)	Criterion user to determine the degree to which the outcome associated with capability exists	Community addresses local issues

08:27 Organizational Maturity Assessment

Industry best practices may help to assess own project organization and eventually lead to the adjustments targeted in higher effectiveness.

Organizational Maturity

Maturity indicates both the richness and the consistency with which certain practices are applied across the organization. Project Maturity becomes an indicator of process capability (Nandyal 2003). Capability determines the project outcomes, which in turn can be measured by Key Performance Indexes KPI. Table 3.1 gives the definitions and example from OPM3 (Schwalbe 2010).

The measuring of an actual project organizational practices against recognized and comprehensive set of best practices is a goal of several standards. They differentiate in number of referenced practices (586 in OPM3) as well as in levels of maturity (three in P3M3, five in People CMM). Some examples are given in Table 3.2.

Basic weakness of all maturity models is missing deterministic, proven track of impact of the practices/attributes on project performance. They assume that the best practices do deliver, what may not be true under specific project conditions (Davies 2007). Therefore, the usability of these maturity models is rather to be sought in certain equalization of project management practices than in the project performance improvements.

08:28 Project Coach

In higher developed project-conscious organizations the project teams, and in particular project manager, are supported by a project coach. Project coach acts on behalf of project sponsor, his tasks, however, differ substantially. As in the sports, coach is judged by his win-lost record not how well he planned the game

Table 3.2 Examples of organizational maturity evaluation models

Abbreviation	Full name	No of practices	No of levels	Reference
OPM3	Organizational project management maturity model	586	Four: Standardize, measure, control, improve	Bourne 2009; Schwalbe 2010
PCMM	People capability maturity model		Five in process organizational development	Nandyal 2003
P3M3	Portfolio, programme and project management maturity model	About 600 generic and specific attributes, six descriptive elements	Five: Avareness, repeatable; defined, managed, optimized	OGC, P3M3 (2011)
PMOM	Project management organizational maturity	Not available	Not available	Caupin et al. 2006
P2MM	PRINCE2 maturity model	Same as P3M3	Three (first three of P3M3 levels)	Blockdijk 2008; Hedeman et al. 2006

(Schwalbe 2010). So the coach sole goal is to lead the project team towards successful project realization.

Emerson and Loehr identify three key success factors, leading to what they call the success equation (Emerson and Loehr 2008). However, the factors are rather bound by the mutual multiplication than by simple addition as in Emerson and Loehr approach.

> Level of Success in a Project = Aptitude*Attitude*Available Resources.
>   Where:
> - Aptitude: the intellectual capital build of capabilities and capacity of an individual to complete the task at hand
> - Attitude: intrinsic motivation (see Chap. 18, 04:00 Self Management (Work & Life Balance): SM), confidence and focus on task accomplishment
> - Available Resources: tools, equipment, time to perform the task.

As unimaginative project managers believe that aptitude coupled with sufficient available resources leads straight to the project success, it is a common sense that without a right attitude it is forlorn hope; an attitude play here a decisive role.

An aptitude may be developed through learning; the resources can be made available. The right attitude can be best developed through the coaching.

The coach recognizes which of the above factors impacts the current project situation and he acts accordingly:
- Leads the coachee to acquire the necessary knowledge, develop the abilities, leverage talents, and skills if aptitude deficiencies endanger the project success.

Table 3.3 Coach' challenges

Strength		Weakness
Persistent	becomes	Stubborn
Easygoing		Pushover
Enthusiastic		Unrealistic
Reliable		Slow to change
Spontaneous		Inconsistent
Smart		Know-it-all
Likable		Conflict averse
Dynamic		Overbearing

- Support project manager in obtaining the required resources, is it personal time management improvement, or sponsor allowance demand.
- Attitude: works on coachee intrinsic motivation (see Chap. 18, 04:00 Self Management (Work & Life Balance): SM, sections "04:21 Personality Entities Interrelation Chain" and "04:24 Intrinsic Motivation"), confidence and focus on task accomplishment

The coach helps project manager and project team members to "reach higher effectiveness by creating a dialogue that leads to awareness and action" (Emerson and Loehr 2008). He acts like a mirror to the project stakeholders: he encourages to step back, look at oneself, analyze, What happens?, analyze, What is the situation? Coach manages the project stakeholders weaknesses and finds the opportunities (Ralston 2007). It is a fine balance act for the coach, demanding high degree of trust between the coach and coachee to play the strengths and carefully avoid the weaknesses, as easily the advantages become the handicaps (see Table 3.3) (Ralston 2007):

The dynamics of personality development and project progress is met through the larger vision and micro-plan of its realisation, adjustable to the current situation (Morgan et al. 2005). Authors own experience strongly advocates this role.

08:30 Techniques and Tools

08:31 Techniques of Roles Identification and Creation of Organizational Structures

Procedure of Roles Identification

The effectiveness of a role is relative to the functional demand, abilities of the existing team, culture, communication willingness and last not least capabilities of the prosperous role owner. Therefore, common elaboration of the role definition in project team as proposed by Weaver and Farell and shown in Table 3.4, is considered to be the most sustainable approach (Weaver and Farell 1999).

Table 3.4 Role finding technique

Step	Description/actions	Questions to be answered
1	Project team brainstorms possible roles	
	Moderate brainstorming responses to questions 1 and 2	1. What key roles do we need in order to achieve the project objectives?
		2. For each role: what skills, knowledge competences, and abilities are required?
2	Project team sorts and assigns roles	
	Moderate brainstorming responses to questions 3 and 4. Than have them assign roles to members by discussing question 5	3. Is this role necessary? (consider each role one at a time. A role with a "no" answer is discarded)
		4. Is the entire set of roles sufficient to achieve our purpose? If not: What roles must be added?
		5. Who should be assigned to each role?
3	Project team defines roles	
	Help individuals to define their roles. Ask the team to reach consensus on the role definitions	6. How do I describe my role?
		7. What skills, knowledge, competences, and abilities do I think my role requires?
		8. How does my role help the team to reach project objectives?
		9. How does my role coordinate with other roles?
4	Project team aligns the project objectives with the roles	
	Ask the team to review its set of objectives and roles. A matrix some-times helps this analysis	10. How do our objectives align with our roles?

08:32 Project Role Description

A role, originally a dynamic aspect of a status (Kendall 2010) became a synonym of project job description, incorporating both: the role (we play) and the status (we occupy). The relational character of the role better reflects the mutual interdependence in a team, than the absolute job description model. The dynamics of a role matches also better the temporary character of project organization.

In strive of a comprehensive and consistent role description we apply the same approach as in the activity description (see Fig. 3.15).

Closest to this concept is the Position Analysis Questionnaire (PAQ) (Grant 1989). PAQ recognizes work input, work output and relationships, misses, however, the preconditioning with offered status, which significantly impacts the performance of the role owner. The relevant ISO 21500:2012 specify solely the classes of expected competences of roles owners without a clear role definition (ISO 21500:2012 2012). These classes are later extended with expected cognitive competence of PAQ. Job context and other job characteristics of PAQ are included in the status hereafter. Status comprises also the authority (meant as competences in HERMES 2005 (HERMES 2005 2005)). The responsibilities are part of an output.

Fig. 3.15 Role definition model
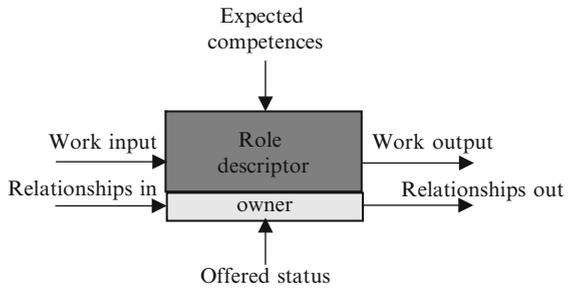
Table 3.5 Role description: role, inputs and outputs

No	Parameter	Definition	Example
1	Role descriptor		
1–1	Short	Descriptor used in daily communication in project	PM project manager
1–2	Full description	Correct context relevant role description	Net Supplier Inc.Fun City ICT network project manager
2	Owner		
2–1	Formal titles	Academic, company awarded titles	PhD, Net supplier fellow
2–2	Names	Names as used in project environment	Juan Maria Gonzales
3	Work input		
3–1	Physical inputs	Results of someone else work, problems to be solved	Financial data from company services
3–2	Mandatory data	Project rules, regulations, governance	Project budget
4	Relationships In		
4–1	Stakeholders In	Stakeholders, who may contact role owner as provider	Financial department clerk
5	Work output		
5–1	Responsibility	Group of deliverables or project activities which role owner incorporates towards other stakeholders, usually going beyond his own deliverables	City ICT Network delivery as scheduled
5–2	Physical deliverables	Expected output from the role owner. The status, which might be the result of the activity of role owner, is considered to be physical deliverable, too	Project WBS, PSP, Organisation, Project efficiency control
5–3	Set priorities	Priorities between deliverables of the role set by the superior	Priority 1: ICT network delivery Priority 2: efficiency
6	Relationships Out		
6–1	Stakeholders out	Stakeholders about whom the role owner should take care	Lord Mayor of the Fun City, Project team leading staff

Table 3.6 Role description: expected competences and status

No	Parameter	Definition	Example
7	Expected competences		
7–1	Technical competences	Competences for delivering projects in a structured way, including the project management processes defined in this standard (ISO 21500:2012 2012)	Project Manager Education, min. a certificate, desired university degree in the field
7–2	Behavioural competences	Competences associated with personal relationships within defined boundaries for the project (ISO 21500:2012 2012)	Extrovertive, capable to motivate and to lead the negotiations
7–3	Contextual competences	Competences related to the management of the project within the organizational environment (ISO 21500:2012 2012)	Experience with the Net Supplier Inc. products and processes, at least 1 similar project done
7-4	Cognitive competences	Reasoning, decision-making, analytical, reflexion capabilities (Grant 1989)	Risk-conscious, well founded decision making, learning-improvement approach
8	Status		
8-1	Role related titles	Titles authorizing to justified authority and privileges	Vice-President in charge of Municipal ICT networks
8-2	Direct superior	Position of the superior, to whom role owner reports	Net Supplier Inc. Company President
8-3	Authority	The business areas, where role owner decide on behalf of his employer	All technical and organizational project matters, financial matters um to 1 million US$
8-4	Remunerations	Financial and non-financial rewards	Annual salary of xxxx plus family insurance
8-5	Work conditions	Set-up in which the role owner is supposed to perform his job: office, equipment, tools, infrastructure, temporarily and spatial limitations	Individual office with meetings space, full access to company infrastructures, 40 h weekly at minimum
7-6	Deputy	Define role in a project, which take care about the work output and relationships in case of unavailability of role owner	Manager of the project infrastructure

Definitions and an example are given in Tables 3.5 and 3.6. Suitable subset may be used in role advertisement.

08:33 Techniques of Analyzing Goal/Solution Impact on Project Structure

Projects by nature are unique and only few of them have clearly specified objectives and the solutions, how to reach them. This has consequences on the project organization. Different measures has to be taken to mitigate the effectiveness of the project team.

Fig. 3.16 Objectives/
solutions taxonomy of
Wysocki (Wysocki 2011)
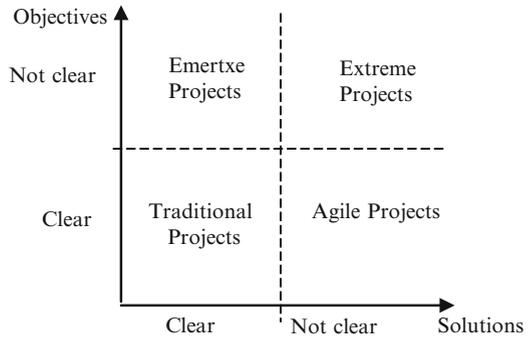
Wysocki taxonomy classifies projects along the degree of the clarity of the project objectives and project solutions (Wysocki 2011) (Fig. 3.16).

It is a qualitative evaluation yet helpful in determining the appropriate project organizational structure.

In what Wysocki calls "Traditional projects" the vertical organization with clear structure, efficiency and control provides for stability and reliability (Daft 2009). Unfortunately only few projects may claim to be "traditional".

Projects with clear objectives and unclear solutions are best structured as agile project at the expense of cost and objective stability. Agile manifesto put "useful" results before "contractually agreed" objectives (Beck et al. 2001), cost control excluded.

The "Emertxe Projects" aims at finding new application areas for available solutions. Also here the costs and time are variables.

The extreme projects target the goals with unclear objectives and unknown solutions. This situation can be best mitigated by a horizontally oriented network o cooperating team members, each of them flexible and together as a project structure capable to learn and adjust. Even if we recognize, that learning contradicts the efficiency, we shall notice, that the informal processes (relationships in and out) contribute to the efficiency here (Moore 2010).

As the project develops also the objectives and solutions may change – both from clear to unclear and opposite. Thus the changes in the organization and structure of the projects shall be anticipated.

08:40 Templates

08:41 Project Documents

Determination of roles in a project team is an important process, which in any of projects in the Wysocki's project type taxonomy, contributes to the efficiency due to the optimization of the learning effects and increased motivation of the participating team members. However, the changes destabilize all procedural interdependencies and working relationships leading to the efficiency losses.

Table 3.7 Organization improvements meeting

Project organizational structure change meeting			
Reasons/purpose			
Participants	Role, role owner		
Absentees	Role, role owner	Risk for the decision	
Stakeholder change	Role (owner)	Class power/support in project	
	Relationship In	Relationship Out	
Current organizational deficiencies	Team proposals to close the gap		
	Proposal	Anticipated quality	
		Solution A Solution B	Solution C
1	1	1 1	1
2	2	2 2	2
3	3	3 3	3
New structure	Description, chart		
Affected stakeholders	Relationship In	Relationship Out	
Role description	File x.x		
Change request	Submitted to . . . . on.		

Table 3.8 Stakeholders identification

Stakeholder register entry No. . .	
Stakeholder role/position	Role/position owner
Contact data	
Relationship In	Superior
Class power/support in project	Current strategy

Therefore, these changes shall be particularly meticulously registered and in the Chap. 9, 14:00 Change Management Process CM duly directed to the careful risk assessment (see Chap. 8, 13:00 Risk Management RM).

The template, Table 3.7. serves this purpose.

08:42 Documentation of the Project Results

Basic outputs of this process are:
- Resource requirements (ISO 21500:2012 4.3.16 Estimate resources). Refined after considerations regarding the stakeholders and relationships in this chapter
- Resource plan (ISO 21500:2012 4.3.16 Estimate resources). Human and material resources allocation
- Role description (ISO 21500:2012 4.3.17 Define Project Organization), as shown above in Tables 3.4 and 3.5.
- Project Organization chart (ISO 21500:2012 4.3.17 Define Project Organization). Describes the formal project structure as discussed above in this Chapter
- Change Requests in stakeholder management (ISO 21500:2012 4.3.10 Manage Stakeholders). These are results of e.g. meeting as presented above in sections "08:10 The Goal of Organization Management" to "8.41 Project Documents".
- Stakeholder register (ISO 21500:2012 4.3.9 Identify Stakeholders). Exemplary template is given hereafter in Table 3.8.

08:50 Activities and Deliverables of Project Phases

08:51 Initiation Phase

Activities
- Identify the core team and first key stakeholders
- Identify the governance
- Draw the first organization chart
- Verify and adjust the organization chart to the culture
- Set the rules of organization structure extension
- Estimate roughly the resources based on Project Charter

Results
- First stakeholder register
- Core team organization
- Organization structure extension rules
- First resources estimates
- Change requests regarding the organization structure extension elaborated and reported

08:52 Planning Phase

Activities
- Identify possibly all stakeholders
- Classify stakeholders and strategy of their management
- Elaborate the process derived organization
- Analyze the culture and adjust the organization for the best stakeholder management and cultural integration
- Refine the rules of organization structure extension
- Refine the resources and elaborate the resource plan

Results
- Comprehensive stakeholder register
- Project team target organization chart
- Roles descriptions
- Refined organization structure extension rules
- Resource requirements
- Resource plan
- Change requests regarding the organization structure extension elaborated and reported

08:53 Implementation Phase

Activities
- Stakeholder management and register actualization
- Project organization continuous evaluation of it's effectiveness
- Resource plan actualization
- Change requests regarding the resources
- Change requests regarding the organization structure extension

Results
- Stakeholder register maintained
- Effectiveness of the organization verified
- Change requests regarding the resources and project organization structure elaborated and reported
- Resource requirements adjusted
- Resource plan adjusted
- Change requests regarding the organization structure extension elaborated and reported

08:54 Closing and Evaluation Phase

Activities
- Release resources
- Collect final lessons learned for Knowledge Management Process

Results
- Released resources
- Final lessons learned document

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Quick Look

What Is It?
Procurement Management (PRM) is the process leading to the selection of the lowest price or most advantageous supplier through carefully prepared and planned tendering procedure. The resulting contract between the involved parties is administered during the project and managed afterwards.

Who Does It?
The optimal tender management team consist of procurement specialist, project manager, application and solution specialists, representative of the purchaser, document list and a challenger.

Why Is It Important?
Purchaser expects the best choice of the supplied project parts. The public procurement demands lawful and justified selection along documented process and the awarding algorithm.

What Are the Steps?
Basic steps are: plan, select supplier, administer contract. Planning resemble P&S Process: Work Breakdown, Team roles, Scheduling, Make or Buy decision, elaboration of the awarding algorithm. Tendering and evaluation lead to the contract awarding. This is then to be managed.

What Is the Work?
Good planning (Work breakdown of what has to be done to procure?) and a competent team are cornerstones of the success. The most critical are proper, function and not product oriented technical specifications – the evaluation is easier and less prone to claims. So take time to do it right. Highly intense is the elaboration and commitment of all stake holders to the awarding algorithm. It is also worthy to give some more considerations to the procurement procedure as it is a trade-off between the time needed for the evaluation, duration of the selection and effort put in by the procurement team.
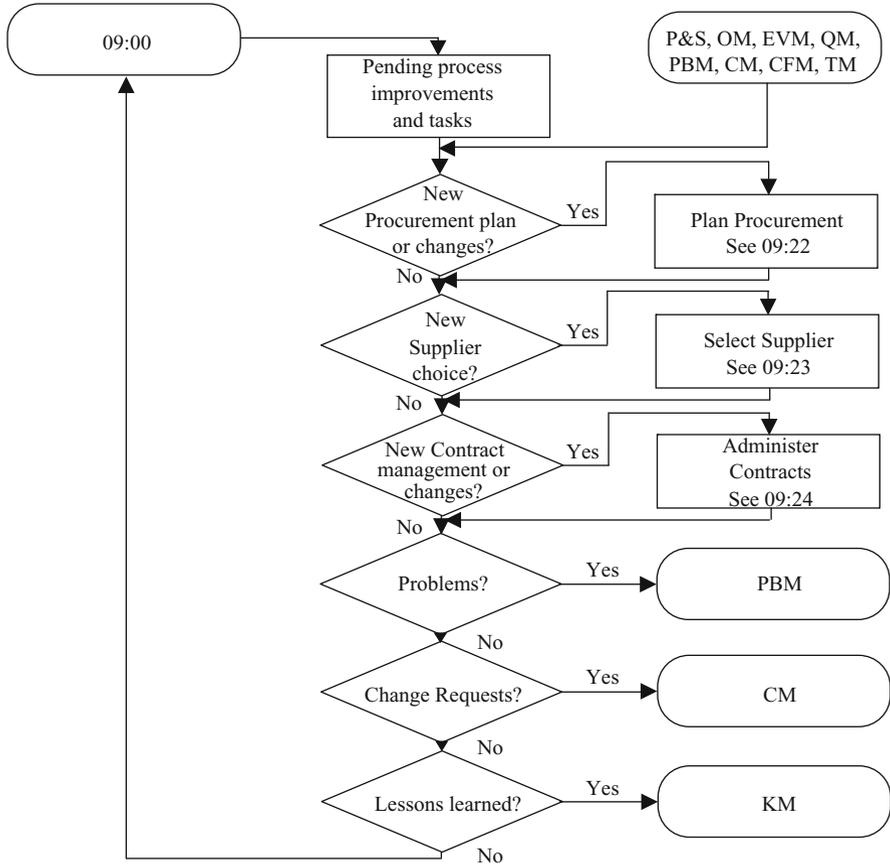
Fig. 4.1   The procurement management process

How Do I Ensure That I Have Done It Right?
Plan realistic – it takes months to make the right choice, but it pays back in years
afterwards. Build a competent procurement team. Obtain the consensus and accep-
tance of the technical specifications and awarding algorithms from the relevant
stake-holders. Bear in mind that the supplier is your future partner not an enemy.

Process

Regularly pending issues shall be solved. Shall new procurement be planned or
changes in the current one be pending, the "Plan Procurement" sub process shall be
started. Subsequently the supplier selection and supplier contract are to be treated.
The new emerging problems, change requests and lessons learned initiate the
corresponding process. Figure 4.1 depicts this process.

09:10 The Goal of Procurement Management

Procurement management shall secure an efficient, sustainable, lawful, and compliant with the relevant regulations and project needs, handling of the suppliers in all project phases.

09:20 Methods

ISO 21500:2012 Processes

The ISO 21500:2012 defines three relevant processes (ISO 21500:2012 2012):
• 4.3.35 Plan Procurement
• 4.3.36 Select Suppliers
• 4.3.37 Administer Contracts

They reflect most closely the authors' own view on procurement management in a project. First the procurement has to be planned, suppliers selected and the resulting contracts administrated. The contract administration in the Draft of the above Standard is explicitly foreseen in the control perpetual loop. The other two ISO 21500:2012 processes are in the process groups, which are admitted for renewed execution, yet the descriptions do not cover changes or adaptations in these processes. This may lead to false conclusion, that the activities in those processes are executed once only. In most cases, a project subjects to re-planning once a supplier is selected. The cases of procurement specification change or supplier replacement, and others, which occur during the project realization, are not indicated in the said document.

To underline the perpetual sequential character of all three ISO 21500:2012 processes, they are bound as sub-processes into a singular chain of cybernetic loop procurement management process.

09:21 Procurement Process and Contract Management

The Outputs of the project in most cases outlive the project duration time. The relationship between the purchasing party and the supplier continues past the project closing and has to be regulated. Therefore, we distinguish the process of contract management, which goes beyond the project and takes over the outputs of the procurement process, in particular the "Administer Contracts" sub-process. The contract management is relevant to the project but is out of scope for the project; all relevant project issues regulate the "Administer Contracts" sub-process.

The supplier may be bound into the project course in two different ways:

General contractor

1. The purchasing organization cedes all financial and legal aspects to the project organization. The project organization manages all aspects of the supplier relationship, and bears the formal and legal responsibility for the project outputs.
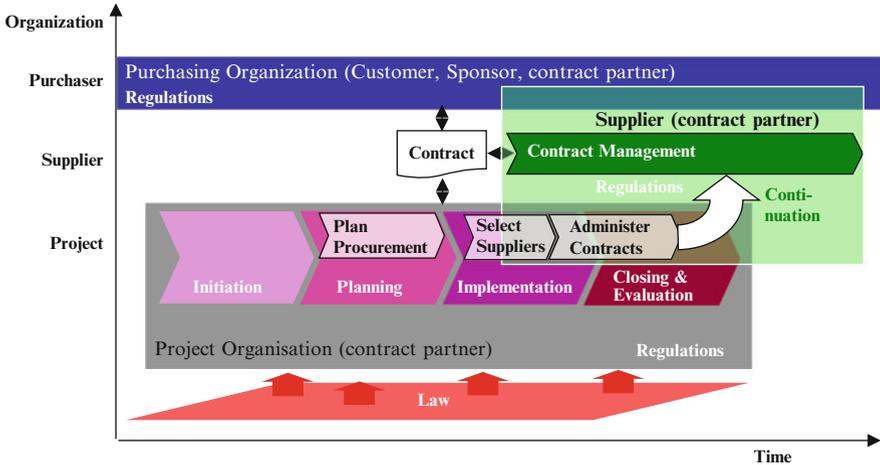
Fig. 4.2 The interrelationship between the project goals, objectives and target values

The project organization or project handling organization is or becomes a legal entity and is a general contractor towards the purchasing party.

Authorized Purchaser Representative

2. The project as an entity represents the purchaser with an authority to decide and negotiate contract. The legally binding contract and remunerations are regulated between the purchaser organization and supplier directly. The project organization as a purchaser representative in charge of the project may be but must not be a contract party.

Clear bipolar relationships between the project stakeholders and supplier on one side, and project manager and project sponsor, who represents the purchaser, on the other side, support the positive development of the social relationship in a project. In the second case the position of project and project manager is weaker – there is a developing or already developed relationship between the project sponsor and supplier, which may affect the project course.

Due to this ambiguity the supplier is shown between the purchaser and a project, tending towards one or other side (see Fig. 4.2).

The whole process is time-related. Purchasing organization is the longest existing in this social network. It creates the project, which, in the implementation phase, initiates the working relations with the supplier. Closing of the project passes all contractual claims and rights to the contract management of the supplier or purchasing organization. Therefore, we differentiate the sub-process of contract administration (ISO 21500:2012 4.3.37 Administer Contract) from the product life-cycle relevant contract management of purchaser and /or supplier (Gallagher et al. 2011).
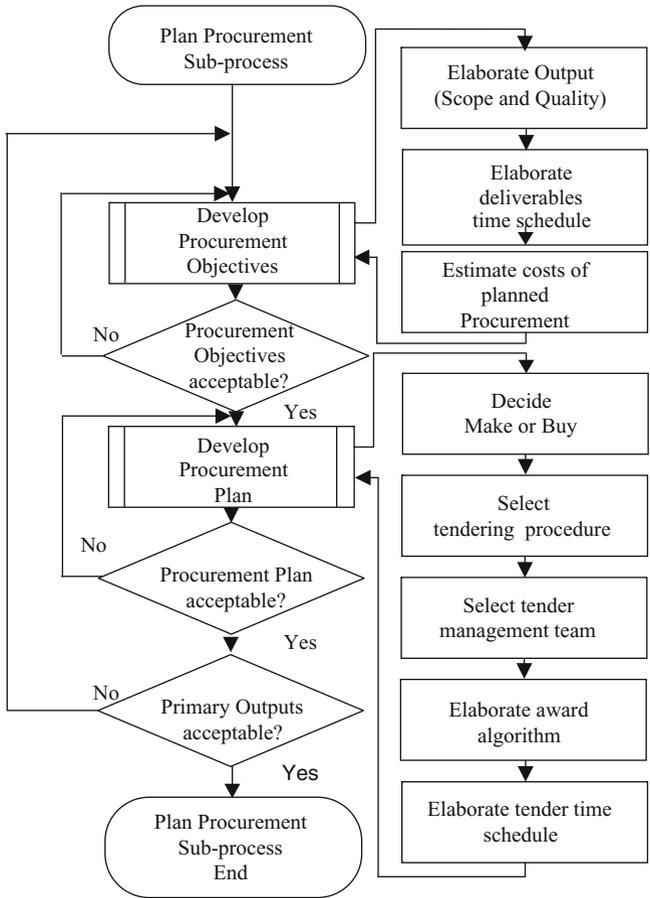
Fig. 4.3 Plan procurement sub-process

09:22 Plan Procurement

Two major steps are performed in procurement planning (see Fig. 4.3):

Process 4.3.35 Plan Procurement
- Procurement Objectives Development
- Procurement Plan Development

Procurement Objectives Development
Planning & Scheduling process 07:00 elaborated product structure. Parts or complete product may be supplied by a third party. The specification of planned supplies reasonably follows the same iron triangle, which was introduced in Project

Objectives specifications in Chap. 2, section "07:21 Project Goals and Project Objectives":

Procurement Objectives
- Outputs (Scope and quality of expected deliverables)
- Time schedule of deliverables
- Cost of planned procurement (deliverables' cost).

The specifications of Outputs, even if they describe the human labor services, are called in several regulations "Technical Specifications" or "Terms of Reference" (Neumann 2008). However, in international disputes the term "Terms of Reference" is a compulsory document containing the identification data, claims and issues of the contract parties (Schäfer et al. 2005). As this is broader meaning than the Technical Specifications, we restrain hereafter to use the term "Technical Specifications" only.

The definition of the Technical Specifications in e.g. European Public Procurement law, in various Appendices, says that these are prescriptions of the intended procurement, which permits the procured work, a material, a product, or a supply to fulfill the use for the purchasing organization (Hebly 2008). To keep all options open, unless purchaser or project regulations restrict them, the Technical Specifications shall apply whenever possible standards and rather describe the desired performance of the planned procurement, not the possible solutions (Quigley 1997). Performance is given by:
- The needed functionality (e.g. network shall be fully operational at minimum 2,000 users simultaneously)
- Non-functional demands (e.g. only earth cabling admitted) and
- Given quality of the delivery (Quality of Service 98 %).

Time schedule of supplies subjects to several modifications during the project life cycle. Nevertheless, the project needs elaborated in the PSP project schedule plan are the starting point here. The demanded deliveries shall be foreseen as late as possible, yet with a sufficient buffer for the eventual delays.

Once the desired timing is elaborated, it shall be validated by the market potential and the whole project schedule adjusted if necessary (e.g. Implementation of the network by majority of suppliers takes 12 months in minimum, whereas the city originally planned 4 months only. The whole project needs an extension of at least 8 months).

Now, having the technical specifications and the reviewed timing ready, the costs of the prospective supply have to be elaborated. The cost assessment is relevant to the feasibility evaluation and budgetary procurement limits. The selected techniques are given in Chap. 3 09:00 Purchase Management PRM, section "09:31 Content of Invitation to Participate or Call for Tenders".

At this stage one or more of target values of procurement objectives might not be acceptable due to e.g. too high costs or to long supply delivery time. In a consequence the procedure has to be repeated: scaling down the targeted procurement, changing the project objectives, etc. so long until acceptable procurement objectives will be reached.

Table 4.1 Make or buy evaluation

Id.	Name	Solution A (buy)	Solution B (make)	Limits
C1	Fix costs	6,000,000	7,200,000	7,000,000
C2	Variable costs/unit F1	130,000	100,000	100,000
C3	Variable costs/unit F2	0.03	0.02	–
F1	60 (years)	60	60	70
F2	100,000 (cars)	100,000	100,000	120,000
O1	Total costs of ownership 60 year	13,980,000	13,320,000	–
S1	Uniqueness of solution	2	10	1
U1	Geological tsunami risk	3	4	0
U2	Trend towards car-sharing	3	3	–1
S1	Local employment	1	5	0
E	Final evaluation		Preferred if investment can be increased	

Procurement Plan Development

Procurement Plan contains all the information about how the intended procurement shall be conducted. The basic decision which influence the following procedure is:

Make or Buy

From the methodical point of view, it is an evaluation of two or more alternatives. Table 4.1 summarizes the criteria.

Three parameters define the financial break-even between the alternatives:

Fix Costs + Variable Costs * Frequency.

In projects, the variable costs have higher impact on the break-even than the fix costs; primarily due to the non-tangible variables and uncertainty immanent to the project nature.

The frequency variable has two dimensions:

1. The product life-cycle, i.e. the total time of usability of the project outputs
2. The physical quantity of any unit involved in the exploitation of the project outputs.

For example, bridge construction shall serve 60 years (life cycle) and let 100,000 cars pass through (physical quantity). For the simplicity of this example we restrain from involved capital calculations presented in Chap. 2 07:00 Planning & Scheduling: P & S, section "07:35 Project Business Case".

The non tangible variables in projects are (Nienhüser and Jans 2004):

1. Specificity: the more the intended procurement is purchaser specific, the higher is the dependence on the supplier and risk of his desire to capitalize on this dependence (e.g. by increased costs of maintenance).
2. Uncertainty: parametrical (environment, technical (e.g. tsunami impact) and behavioral (e.g. social negative perception of individual car usage 40 years from now on)).

The experience of the author suggests the third dimension:

3. Current project set-up, which may favor one alternative against the others (e.g. free trade economic zone, preference for "Make").

Each parameter and each dimension may be compound of numerous variables: e.g. car weight dependent fare or complex maintenance calculation scheme.

We register, that the non tangible variables can be either evaluated along the order scale (first choice, second choice, etc.) or cardinal scale upon assessment with e.g. values 1,5,10 on a scale 0–10.

After identifying the key relevant variables the upper or lower limits may set them jointly e.g. yearly variable costs of bridge maintenance can not exceed 100,000 US\$ or individually, allowing the tender management team to fine tune the evaluation criteria.

The analysis of the make or buy criteria (see Table 4.1) allows to determine the next following procedure:

Select Tendering Procedure

In the following considerations the rules of the World Trade Organization will be taken under considerations. The signatures of the WTO plurilateral trade agreements (Appendices II–IV) agree to handle their procurements in accordance to the agreed rules. Governmental spendings contribute 10–15 % of GNP. Therefore, they are relevant stimulant of the global economy (WTO 2013). Majority of public founded entities beside the governments comply to the WTO rules, too. The limitations and practice evaluation may be found in Evenett and Hoekman (Evenett and Hoekman 2006).

The procedures adopted by WTO are worthy to be applied also in private sectors as they proved to be efficient, neutral and conclusive; the rules in private sector may be set without the restraints of WTO agreements.

The GPA (WTO GPA 2013) foresees three tendering procedures:

(a) Open tendering procedures, unrestricted, where any supplier may submit a tender,

(b) Selective tendering procedures where selected suppliers are invited to submit the tender.

(c) Limited tendering procedures (extensions to the contracts awarded according to procedure a or b, exclusive rights, urgency, innovations, absence of tenders in procedures a. or b., commodity market, exceptionally advantageous conditions, results of design contests).

In 2006, after accepting several provisions to GPA, in particular in Doha Development Agenda, (Wunsch-Vincent and McIntosh 2004)

(d) The electronic bidding process has been adopted. Quotations in reverse auction lower the prices on-line, the lowest bidder is awarded the contract.

GPA (Article XIV) admits in selective tendering as well as in other forms in case, when no obviously most advantageous tender may be selected, to conduct.

(e) The negotiations. However, they shall be focused on identifying the strengths and weaknesses of the tenders, not on the prices.

Most countries adjusted their national laws to accommodate the above procedures and simultaneously regulating the procurement in the areas below the threshold values of WTO (e.g. GSA, DoD, NASA FAR 2005; Sejm polski UPZP 2013; Schweizerische Eidgenossenschaft, BöB 1994; Thailand PMO 1992).

(f) Dialog with potential tenders. The unclear issues are mutually clarified. The dialog shall secure the GPA rule of transparency. The tenders are subsequently invited to submit their offers. Applied in the USA to single source contracts and in Mini Bids (Phillips 2004).

(g) The negotiations of contract conditions with invited tenders. Usually the minimal number of competing tenders is required

(h) Free hand contracting. Selected supplier is invited to negotiate the prospective contract and submit and negotiate the offer during the negotiations. Applied in a sole source contract and preferred sources in the USA (Phillips 2004)

(i) Price inquiry. Applied mostly to commodities.

(j) Multiple awards. Applied among others in the USA when it is the most practical and economical alternative, in particular to promote the small business participation in the governmental contracts (Phillips 2004).

World Trade Organization (WTO).
(WTO 2013)

On 15th of April 1994 vast number of countries signed the preliminary agreements. The so called Uruguay Round 1995 established the World Trade Organization (WTO). WTO, domiciled in Geneva, Switzerland is since 1.1.1996 in force.

The relevant Agreement on Government Procurement (GPA) was already negotiated during the Tokyo Round and entered into force on January 1981. The agreement in its present version negotiated in the Uruguay Round, has only 28 members (not all WTO countries), therefore it is an attachment to the WTO Agreement.

The basic objective of the Agreement is to guarantee fair and non-discriminatory conditions of international competition through transparency of all public spending.

The threshold value for procurements which subject to the Agreement is currently 130,000 so called SDR (Special Drawing Rights) SDR were created by the IMF (International Monetary Found) and allocated to the member countries proportionally to their IMF quotas (IMF 2013). The quota for construction works is five millions SDR. One SDR is currently (2013) 1.154190. Euro or 1.537040 UCS$.

The organizations issuing the tenders in the member countries are obliged to award the tender to the lowest bidding or most advantageous bidder, who is capable to realize the tender according to the evaluation done by the tender issuing organization.

There are other ongoing works on transparency and service procurement at WTO.

Tender Management Team

Tender management team does not necessarily have to be composed of project teams members only. Neither WTO nor national legislatures prescribe the teams. The experience from the tenders managed by the author indicates the optimal tender management team to include the following competences:

1. Project manager, responsible for later Outputs
2. Public procurement officer or layer representing the management of the procuring organization
3. Responsible for the procurement application
4. Competent in the evaluation of the procurement solution
5. Sparring partner from the project core team
6. Documentalist, Project Management Office
7. Responsible superior in the purchaser or project management organization (optional)

The total number of persons shall not exceed seven to warrant the efficiency of the team (see Chap. 15 22:00 Team Management: TM).

Award Algorithm

The evaluation of tender in any of the above described procedures follows two steps.

1. Evaluation of the eligibility of tender.

Here the criteria, advisably set in accordance with the WTO rules, can lead to only binary decision: comply or not comply. In public procurements typically these are on-time submission, the formal authorization to the business activity in a given area, regulated relation to the tax office, social insurances, sometimes clear criminal record in respective area. It may also demand the proof of financial or technical capability to deliver. In a selective procedure can this be done in the primary qualification of the bidders; in other procedures upon reception of the offer.

2. Evaluation of the value of tenders.

WTO article XIII, P.4 b admits the awarding of the contract either based on (WTO GPA 2013):

- "Lowest Tender" meaning that the basis for awarding contracts is the lowest price among the tenders. It is applicable to the commodities and very good specified procurements, or
- "Most advantageous", in the USA known as "Best Value" offer, which optimizes quality, cost and efficiency, among responsive and responsible bidders. Such basis shall reflect, wherever possible, objective and quantifiable analysis. (Phillips 2004).

In Staffordshire County Council approach the best value is a ratio of costs and quality (Staffordshire County Council 2013). The result is given by the weighted and normalized approach:
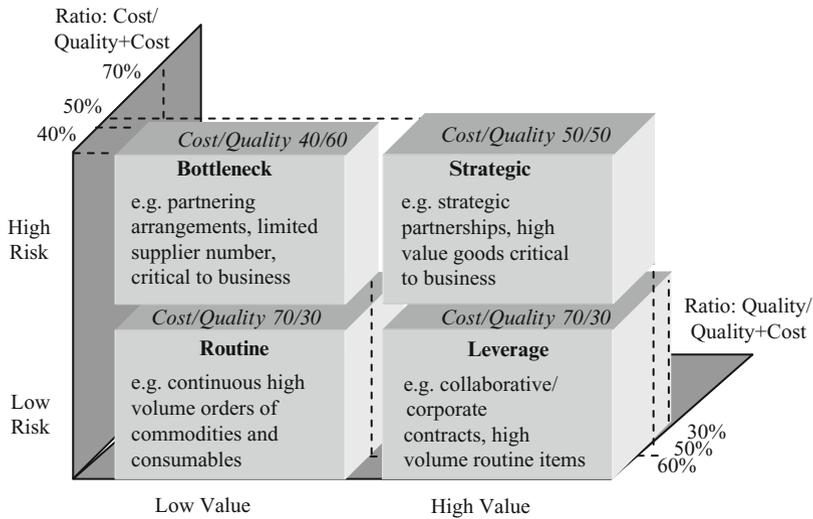
Fig. 4.4 Suggested cost/quality ratios (Staffordshire County Council 2013)

Best value = ratio costs * costs spectral + ratio quality * quality.
Ratio is the weight usually expressed in percentage.
Costs spectral and the quality are normalized to values between 0 and 1.

Cost spectral is the positioning of the analyzed tender cost among other tenders. In section "09:32 Evaluation Scales" hereafter, the applicable calculation schemes are presented.

Depending on the project type and risk Staffordshire County Council [ditto] suggests the relations between the expected cost and quality ratios in tender evaluation as shown in Fig. 4.4. (e.g. Costs to Quality ratio 40/60 in bottleneck supplies):

Certain difficulty poses the cost evaluation. In the intention of purchaser is to include all costs incurred by the tender (product life cycle costs or total costs of ownership, see section "09:31 Content of Invitation to Participate or Call for Tenders" hereafter).

However, in the estimation of ex-ante transaction costs only best practice approach is feasible, thus subjective to whatever estimation. To warrant equal treatment of all tenders and justified award, the author recommends to split the costs into two groups:

(a) Costs which are measurable, both fix and variables, transaction and ex-ante transaction, to be specified by the tender and evaluated in the cost spectral.

ratio costs * cost spectral = ratio fix costs* fix cost spectral +
+ ratio variable costs* variable costs spectral
whereas ratio costs = ratio fix costs + ratio variable costs

(b) Estimated project and later ex-ante costs, in thoughtful evaluation of items, which are solution independent and can be equally calculated in all tenders, and the tender specific items, which shall be with best possible objectivity assessed and included in the quality part of evaluation of each tender.

ratio quality * quality = ratio fix same costs* fix same costs +
                          + ratio variable same costs* variable same costs +
                          + ratio fix estimated costs* fix estimated costs +
                          + ratio variable estimated costs* variable
                                     estimated costs +
                          + ratio other quality* other quality
whereas ratio quality = ratio fix same costs+
                          + ratio variable same costs+
                          + ratio fix estimated costs +
                          + ratio variable estimated costs* +
                          + ratio other quality

"Other quality" criteria shall be primarily derived from the technical specifications. In the same weighting scheme as above, the performance, qualifications, quality of supplies, design alternatives, safety or environmental aspect, but also time and other issues as national preferences, may be taken under considerations (e.g. Scott 2006; Thailand PMO 1972).

Tender Time Schedule
In the awareness of the work to be done in the tendering process and the compliance with GPA rules, the following heuristically set time estimations shall be taken under considerations in the project time schedule:
(a) Procurement Planning Process (Table 4.2)
(b) Select Suppliers Process (Table 4.3)

The procurement preparation and planning process is not a fast track exercise: somewhere between 6 months and 6 years shall be taken into consideration during the project planning. And yet, the delivery time starts first with the contract signing ….

Table 4.2 Time estimation for the procurement planning process

No.	Activity	Best case time (days)	Worst case time (days)
1	Develop procurement objectives	40	1,000
2	Obtain purchaser/superior acceptance	1	60
3	Decide make or buy	7	60
4	Select tender procedure	7	40
5	Select tender management team	2	40
6	Elaborate tender time schedule	10	30
7	Obtain purchaser/superior acceptance	1	60
	Total procurement planning process	68	1,290

Table 4.3 Time estimation for the select suppliers process

No.	Activity	Best case time (days)	Worst case time (days)
8	Prepare and issue the call for tenders	5	30
9	Select the potential suppliers (optional)	25 + 10	25 + 60
10	Do changes due to challenges (optional)	7 + 20	7 + 20
10	Wait due time for bidders to submit offers	7	40
11	Evaluate the offers	7	180
12	Obtain purchaser/superior acceptance	1	60
13	Time for challenges of award	7	30
14	Final contract negotiations and signing	1	30
	Total select suppliers process	85	482

During this process, considerable resources may be bound: somewhere between 60 and 1,000 Workdays of the tender preparing organization shall be calculated and added atop of the procurement costs.

If the procurement plan and the expected primary outputs are acceptable, the subsequent sub-process of supplier selection may start.

09:23 Select Suppliers

Select suppliers sub-process may take somewhere from 3 months to 4 years (see section "09:22 Plan Procurement" above).

In some organizations it takes several weeks to collect all the necessary acceptances for call for tenders or an invitation to tender only.

All call for tenders shall be published to attract possibly vast number of bidders. If the WTO/GPA threshold value is exceeded, it shall be published in one of publications listed in the attachment to this agreement.

Whenever the selective tendering procedure is chosen, the WTO/GPA member countries are obliged to publish the awarded along this procedure contracts exceeding the threshold values in one of the acknowledged in the appendix to the GPA
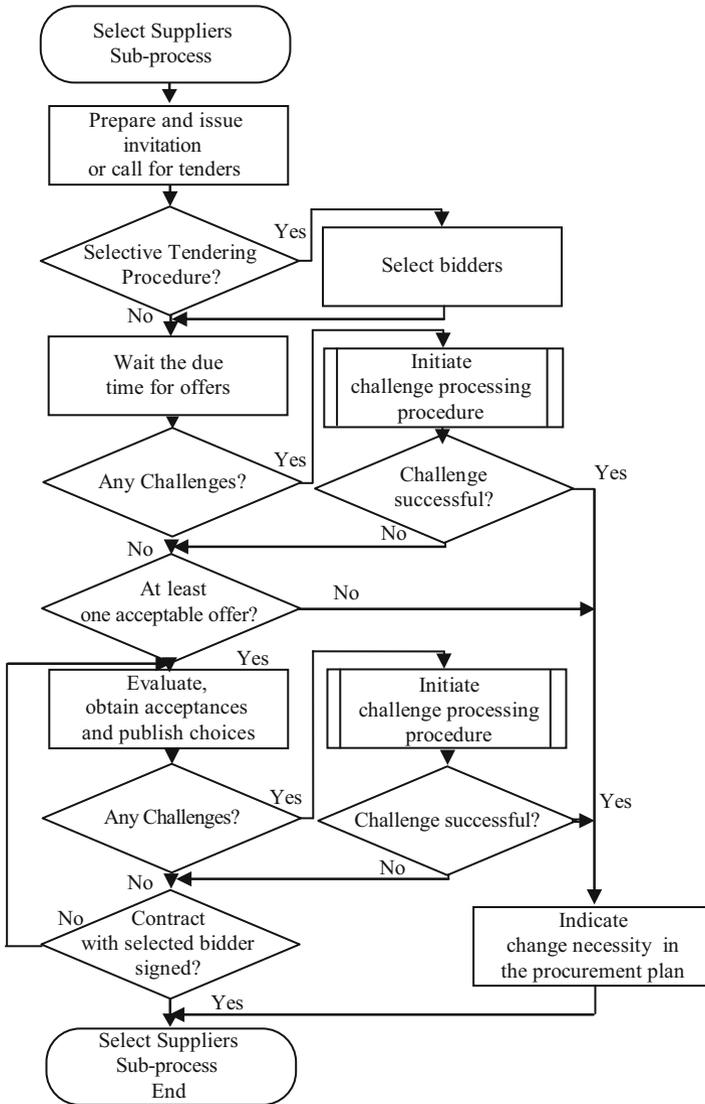
Fig. 4.5 Select suppliers sub-process

publications. There is a minimum time of awaiting for the responses to the invitation in dependence of the threshold value of 5 respectively 30 days.

Time for tender submission in most cases should not be shorter than 5 days below and 40 days above the threshold value. Usually it is shorter for the tender submission in selective tendering procedure and in case, when advanced information about the planned call for tenders has been published.

The complete sub-process of selecting suppliers is given in Fig. 4.5.

An invitation to tender and call for tenders may be challenged as to:

- Tendering procedure (challenger considers it not appropriate)
- Technical specifications (e.g. not functional, brand naming, product specific, beyond the target)

seldom in:

- Eligibility Criteria (mostly classification issues in specific procurement programs, financial demands or too broad law obedience demands)

WTO/GPA, Article XX, demands from the membership countries to establish the domestic bid challenging systems (WTO 2013). In the USA these are the procuring corresponding area agencies, the GAO – Government Accountability Office and procedures (US GPO 2009). In Poland it is the Krajowa Izba Odwolawcza and law regulations (Sejm polski UPZP 2013).

Formal protests, even if reported firstly orally, have to be submitted in written form within, in most cases, 5 working days (7 calendar days) from the relevant publication to the corresponding national regulator bodies.

The solicitation is taken within 10 days by the authority named in the procurement and may be again challenged by the procuring organization within the set time limits (e.g. 15 days in case of Polish law ditto Art. 189.P1).

Still the challenging party can escalate the protest within the few days (seven in case of Poland) to the next level – mostly it is the claim at local court. The court has usually 30 days to decide upon the claim. (e.g. Sejm Polski 2013) In several countries the proximity to the reason of claim, yet without formal time limitation in particular as far as the procuring governmental agency is involved, allows all involved parties, bidders as well as procuring organization to rise the claim. However, the policy e.g. in the USA, is to engage the involved parties firstly in so called ADR – Alternative Dispute Resolution, before the court is involved (e.g. GSA, DoD, NASA FAR 2005).

Changes resulting from the successful challenges call for ex-tended duration times of call for tenders or invitations; usually not shorter than 10/20 days (e.g. Sejm polski 2013).

If all challenges are finally resolved the submitted offers are to be evaluated against the budget, foreseen by the procuring organization. The laws in majority of countries allow to cancel the tendering process if all offers exceed the foreseen budget.

After successful pass of this step, the evaluation according to the selected and published algorithm (see section "09:22 Plan Procurement") may follow. In principle, the list of the selected suppliers ranked according to the evaluation results does not need to be agreed upon with any further persons. In praxis, the evaluation team acts on behalf of the person responsible for the procuring organization. Therefore, the results of the evaluation need to be accepted by the superiors from the purchasing and/or procuring organization. This may take several weeks in a complex project.

Agreed results have to be published according to the same rules as in case of the call for tenders/invitations.

They challenges may be submitted and are resolved in the same procedure as described above. Again weeks and months may pass away.

The national laws put a limitation on the duration of the time elapsed from the tender collection and final contract awarding. Usually it is the time of 30–60 days. However, the authors' praxis in several countries indicates, that every second process takes longer and the bidders are requested to prolong the validity of their offer as well as of bid bonds.

The contracts are basically to be signed according to the proposal published in call for tenders. In several procurement procedures, the negotiations still take place. Important aspects are regulations and procedures regarding the changes, extensions and adaptation of the contract during the contract administration (project life cycle) and contract management (post-project maintenance). They should be included in the contract proposal published with the call for tenders already.

If the awarded bidder, due to e.g. changed business conditions over the long time of the procurement process decides to withdraw, basically the contractual negotiations begin with the second ranked bidder. In some cases, it is, however, advisable to re-evaluate the offers and verify the reasons of withdrawal. In any case, the final awarding is to be published and subject to the same challenging procedures as all other aspects of the procurement.

Successful signing of the contract finishes this sub-process.

09:24 Administer Contracts

Contracts are short or longer term relationship between the three parties: the procuring organization, the purchasing organization and the supplier.

The sub-process regulates the concurrent progress in the contract realization and all the relevant changes with respect to the contract adjustments (Cibinic et al. 2006, page 1 cont.).

CMMI for Acquisition, as well as CMMI for the Development and CMMI for Services Standards encompasses all issues of project-wise contract elaboration and broad approach to contract execution, however, it does not provide the practices for contract administration, which may be aligned with the ISO 21500:2012 (Gallagher et al. 2011; SEI 2010).

Saxena (Saxena 2008) suggest to deploy the Six Sigma basic approach of DMAIC (Define, Measure, Analyze, Improve, Control). "Define" is handled according to the adopted ISO 21500:2012 standard as a part of the Plan Procurement sub-process (see section "09:22 Plan Procurement"). The other four DMAIC tasks are executed in various other L-Timer® processes.

The Administer Contracts sub-process, dedicated solely to the issue of contracts' handling, is illustrated in Fig. 4.6.

Irrespectively of the size of the project a role of contract administrator is helpful to handle this sub-process (US GPO 2009). The choice of the procurement officer from the procurement team as a subsequent contract administrator secures the efficient know-how transfer and continuity.

The Team Management Process (see Chap. 15, 22:00 Team Management TM) supports the development of mutual trust, confidence, cooperation and good faith,

Fig. 4.6 Administer
contracts sub-process
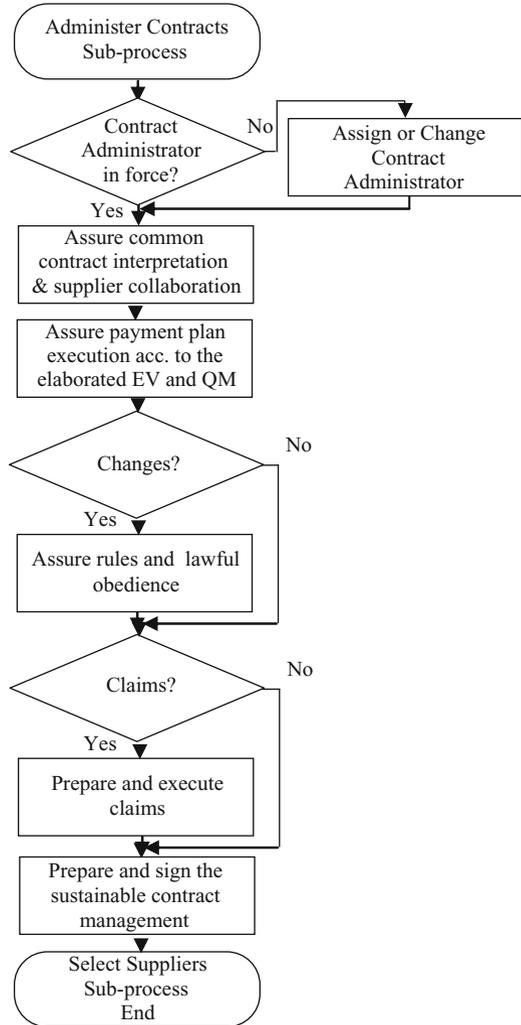
between all the parties, needed for common interpretation of the contractual agreements and to resolve all the unspecified issues in the original contract as well as all changes during the contract realization.

The Earned Value Management process (see Chap. 5, 10:00 Earned Value Management) delivers the current assessment of value reached at the specified time. From Quality Management (see Chap. 6, 11:00 Quality Management) comes the assessment if the agreed standards have been met. Jointly it allows to evaluate if the contractual obligations are met by the supplier and to execute the contractually agreed payments. This sub-process manages all financial relations between the parties: also performance bond and claims.

The financially relevant changes demand particular attention for their conformity with the law and rules adopted during the contract awarding.

Table 4.4 Procedural and general information about the scope (expected output) in call for tenders/invitations

Block	Subject	Id.	Contents
P	Procedural information	P1	Issuer of the call/invitation
		P2	Purchasing organization
		P3	Tendering procedure
		P4	Deadline for submissions
		P5	Place for submissions
		P6	Other conditions like multiple offers
		P7	Admission of consortia
		P8	(Option) Bid bond
		P9	(Option) Protest/challenge procedure
		P10	Other conditions like multiple offers
G	General information about the scope (expected output)	G1	Subject (expected outputs) and timing
		G2	Evaluation criteria
		G3	Contract proposal
		G4	(Option) Follow-up orders

Table 4.5 Information contents of invitation or call for tenders-eligibility and technical specifications

Block	Subject	Id.	Contents
E	Eligibility criteria	E1	Legacy of business activity
		E2	(Option) Regulated taxes
		E3	(Option) Regulated social insurances
		E4	(Option) No relevant law perjury
		E5	(Option) Technical capability
		E6	(Option) Financial capability
T	Technical specifications	T1	Quantity/quality criteria
		T2	Time schedule of deliveries

Finally, the sustainable contract management past the project life-cycle shall be prepared and signed before project closes.

09:30 Techniques and Tools

09:31 Content of Invitation to Participate or Call for Tenders

An invitation to participate in the tender, or directly call for tenders, shall provide four blocks of information as shown in Tables 4.4 and 4.5 (reduced information for the qualification for of the bidders in the invitations).

09:32 Evaluation Scales

The following scales may be used in evaluating the offers (Schreiber 2000):
- Nominal scale: applicable particularly in evaluating the eligibility criteria and critical requirements. The decision is binary: either criterion is met (fulfilled) or not (not fulfilled).
- Ordering scale: places the results in an order: first choice, second choice, third and so on or comparison results: greater than, equal, smaller than. Applicable in complex subjective evaluation e.g. in combination with Delphi procedures. Due to the subjectivity seldom applied.
- Cardinal scale: the fulfillment of each criterion is placed on a scale, applied to all offers and normalized between several criterions. The highest score wins the award of a contract. For example three criteria are weighted: 0.5, 0.2, 0.3 each. Each criterion is applied with a fulfillment scale between 0 % and 100 %. First bidder fulfills the criteria in a sequence: first in 35 %, second in 90 %, third one in 80 %. Second bidder correspondingly: 50 %, 75 %, 60 %. The final evaluation is as follows:

> Results first bidder = 0.5*0.35 + 0.2*0.90 + 0.3*0.80 = 0.175 + 0.18 + 0.24 = 0.595
> Results second bidder = 0.5*0.50 + 0.2*0.75 + 0.3*0.60 = 0.25 + 0.15 + 0.18 = 0.58

In this example the first bidder reaches higher score and qualify for the award of the contract. Both the nominal and ordering scales may be converged to the cardinal scale as, as a matter of fact, happens in most cases known to the author.

09:33 Price/Cost Calculation Spectral Schemes

Procuring organization may choose between the unlimited and limited price spectrum of the offers taken into consideration.

Unlimited Price Spectrum

In case of the unlimited price spectrum the evaluation of the tender on the cardinal scale between the lowest (maximal normalized value 1) and the highest priced tender (minimal normalized value 0), is giving by the equation:

$$PE \text{ (given tender)} = (H - GT)/(H - L)$$

where :

PE : Price evaluation of a given tender

H : Highest price of any tender

GT : Price of given tender

L : Lowest price of any tender

Procuring organization may limit the price spectrum of the tenders taking under further considerations to price range between the lowest price and its double value. In this case the following price evaluation equation applies:

$$PE \text{ (given tender)} = (2L - GT)/L$$

where :

PE : Price evaluation of a given tender

GT : Price of given tender

L : Lowest price of any tender

It shall be noted that in this case all the tenders, which prices lay beyond the double lowest price are not taken under further consideration.

09:34 Contract Components

The Uniform Commercial Code UCC Article 2 Part 3 in the USA (American Law Institute 2011), the Obligationenrecht in Switzerland (Schweizerische Eidgenossenschaft 1911; Widmer 1998), Prawo Handlowe I Gospodarcze (Sejm Polski KC 2013), just to name few, regulate the basic components of the commercial contract of sale, as given in Table 4.6.

09:40 Templates

09:41 Project Documents

One of the most demanding challenges in procurement management is the request for clarifications and changes upon publishing the call for tenders. The WTO-conform treatment of all bidders demands answers to be elaborated accordingly to the targets of the purchasing and procuring organizations with full law and rules obedience and distributed equally to all, who asked respectively submitted change requests. The general public has to be informed through the same channels as through which the original call for tenders has been issued. A record of the request

Table 4.6 Contract components

No.	Content	Description
1	Title	Gives basic indication of the transaction object
2	Type of contract	Describes if it is one time delivery, service, maintenance, main or sub-contract
3	Contract parties	Name and describes the contract parties with the names and function of responsible persons
4	Documents list	Defines the sequence in which the documents enclosed in the contract are to be taken under consideration
5	Purpose	Purpose of the contract
6	General obligations	Obligation of the seller to transfer and deliver and that of the buyer to accept and pay in accordance to the contract
7	Goods to be sold	Possibly exact description of the goods to be transferred and delivered by the seller
8	Time, form, place and acceptance of the supplies	Exact definition where, how and when the goods shall be delivered and under which acceptance criteria will be considered as transferred
9	Price to be paid	Description of the payment conditions and forms of payment by the buyer
10	Risks allocation	Allocation or division of risks among the parties, ownership restrictions and confidentiality
11	Expressed Warranties	Warranties expressed by selling party in the offer or during the negotiations
12	Implied Warranties	Warranties resulting from legal obligations and contract purpose
13	Damages	Regulates the responsibility and coverage of damages, which may occur during the contract realisation.
14	Legal responsibilities	Regulate the responsibilities for legal occurrences, copy rights etc. before, during and after delivery
15	Contract changes and extensions	Define under which conditions and how the changes and extensions to the contract may be adopted.
16	Contract validity	Defines the time period of the validity of the contract and rules for its termination
17	Jurisdiction	Place the contract within the subsidiary law and place of jurisdiction.

and the taken actions supports the correct handling. Table 4.7 exemplifies such a document.

09:42 Documentation of the Project Results

The final results of the tender evaluation have to be documented in a formal way, which can withhold a juridical trial. Suggested trace of the procurement process results is given below (Table 4.8).

Table 4.7 Contract components

No.	Date of reception	Source and return address	Request	A. Sent for procurement objectives action by/on?	B. Sent for legal/rules clarification?	Change upon answer from A. and B.?	Ok?
1	….					Text 1	
2	….					Text 2	
3	….					Text 3	
4	….					Text 4	
99	Deadline for inquiries/ change requests						
100	Publication date	List of recipients				Final texts	

Table 4.8 Contract components

No.	Tender	Date of reception	Eligible	Evaluation score	Evaluation documents	Rank
1	………….					
2	…………					
3	…………					
	Choice					
	Published on					
	Challenges			Decision	Documents	Action
1	…………					
2	…………					

09:50 Activities and Primary Outputs

09:51 Initiation Phase

Activity
• None

Primary Outputs
• None

09:52 Planning Phase

Activities
• Elaborate desired Output from the project objectives
• Elaborate deliverables and time schedule of procurement

- Estimate costs of planned procurement
- Decide make or buy
- Select tendering procedure
- Select tendering team
- Elaborate award algorithm
- Elaborate tender time schedule
- Obtain acceptances

Primary Outputs
- Accepted procurement Objectives
- Accepted procurement Plan

09:53 Implementation Phase

Activities
- Prepare and issue invitation to tender or call for tenders
- Select bidders if selective tendering have been chosen
- Execute challenge processing procedure if needed
- Collect in due time offers
- Evaluate offers, choose the awarded ones, obtain the acceptances and publish the choices
- Execute again the challenge processing procedure if needed
- Negotiate and sign the contract with awarded bidder
- Re-enter the evaluation and subsequent new choice if the first choice contract signing unsuccessful
- Choose contract administrator
- Assure common interpretation of contract and supplier cooperation
- Collect the data from EVM and QM to decide and execute the payment plan
- Secure the lawful and conform with the rules contract changes
- Prepare and execute claims
- Prepare and sign suitable contract management agreements

Primary Outputs
- Publication of tender and invitation to tender (where applicable)
- Evaluation of bidders and choice of awarded ones
- Handling of all challenges and publication of the results
- Negotiated and signed contract
- Administered contract during project life-cycle
- Lawful and conform with the rules contract changes
- Contract execution controlling and payments
- Executed claims if applicable

09:54 Closing and Evaluation Phase

Activities
- Secure the lawful and conform with the rules contract changes
- Prepare and execute last project claims
- Prepare all relevant information for contract management after project closing
- Prepare and sign suitable contract management agreements

Primary Outputs
- Lawful and conform with the rules contract changes
- Contract execution controlling and payments
- Executed last project claims if applicable
- Summary of contract relevant information from the project life-cycle
- Signed agreements for sustainable contract management after project closing.

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10:00 Earned Value Management: EVM

<div style="text-align: right">**5**</div>

Quick Look

What Is It?

Earned Value Management EVM firstly elaborates an estimation of the actual project progress and than the corrective measures to ensure that the final end product will be reached within the deadlines and scheduled budget.

Who Does It?

In small projects, the project manager is the one to control the progress, to elaborate the measures and to manage the earned value. In projects staffed with few other employees, it is suggestible to charge the project comptroller or project management office with the responsibility for this process.

Why Is It Important?

Project scopes are set with time constraints and financial goals. Only if we measure the progress we can manage the project. EVM provides an early warning of performance problems and helps teams to focus on project progress. It secures that the project scopes do not creep and usually serves to satisfy the stakeholders.

What Are the Steps?

First we have to estimate where we are in the project: at a given time point we shall evaluate how much money have been spent and what has been really reached. Than we compare that with a plan and consider appropriate measures: preventive actions, changes, problem solutions.

What Is the Work?

Most important is the estimation of the actual project situation and prognosis of further progress – both allow project manager to grasp the suitable actions to secure that the project delivers along it's goals. Moreover, the progress reports serve stakeholders and team members.

How Do I Ensure That I Have Done It Right?

Honesty first. Correct assessment of the results and exact financial report secures right performance estimation. Use the whole spectrum of all corrective actions in

any process of your project management. Be convinced that they are effective. Bear project scope always in mind.

Process

Earned Value Management process (Fig. 5.1) estimates the actual situation in a project and forecasts the progress. Upon deviations corrective actions are to be taken. Gained knowledge shall be processed.

10:10 The Goal of Earned Value Management

Planning & Scheduling process set the project scope to be reached with a given quality within planned costs and time schedule.

Earned Value Management EVM shall provide exact estimation of the actual progress at any given time with regard to the project scope and planned scope and forecast further progress in the project, based on these performance estimations. Any deviation from the schedule, which cannot be absorbed in regular project course, shall lead to appropriate measures: Change Management Process or Problem Management Process.

Reports from EVM allow project manager and his team to detect early performance deviations, keep track on the project scope and provide the stakeholders with the information about the project progress.

10:20 Methods

The ISO standard defines three separates processes: 4.3.24. Control Schedule, 4.3.27. Control Costs, and 4.3.5. Control Project Work. Beside there is a process 4.3.14. Control Scope, which refers rather to the controlled change in the scope of the project (change with a consequence in the Process of Planning and Scheduling) (see Chap. 2, 07:00 Planning & Scheduling: P & S). In the authors view the three elements: project objectives (scope + quality), schedule (time) and costs has to be evaluated jointly, as only joint evaluation se-cures the correct assessment of the project progress. We may expect, that this is the intension of the Process 4.3.5 Control Project Work, reading the description of this process (ISO 21500:2012 2012). Concluding our Earned Value Management Process covers (ISO 21500:2012 2012):

- 4.3.5. Control Project Work
- 4.3.24. Control Schedule
- 4.3.27. Control Costs
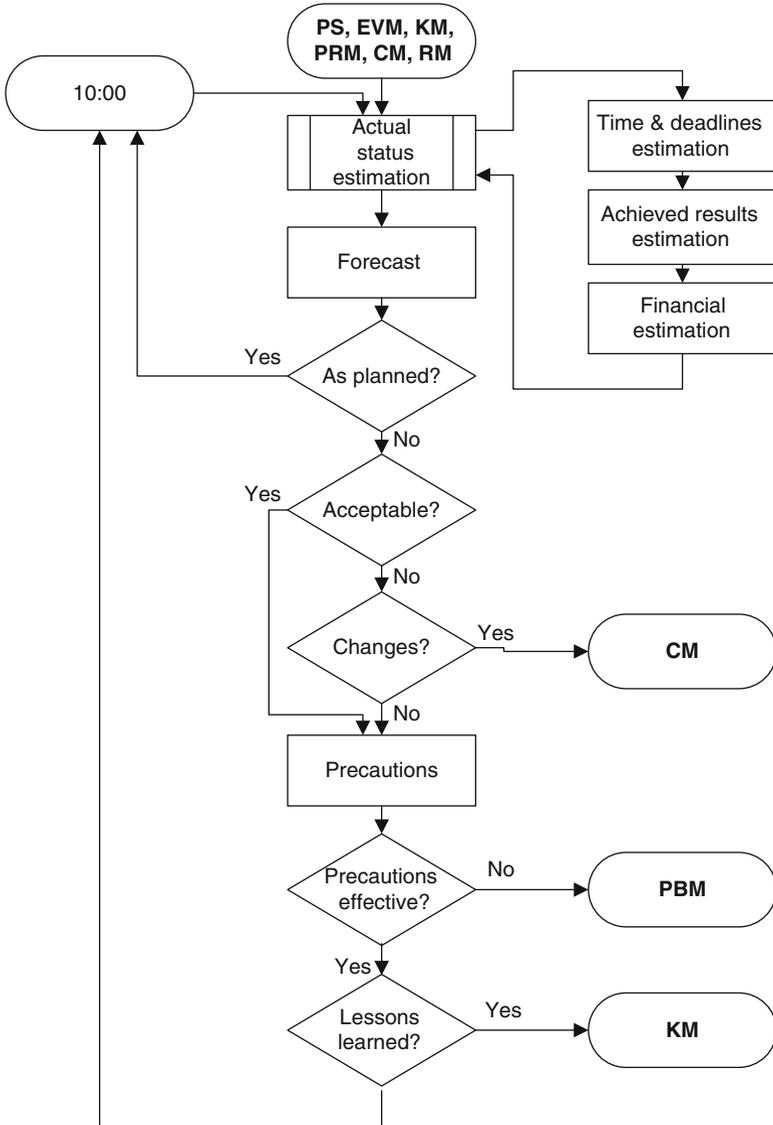
Fig. 5.1 Earned value process EVM

10:21 Interrelationship Between the Project Scope Objectives

The project scope target values are measurable parameters of the output, time and costs and can be presented in the form of the iron triangle (see Chap. 2, 07:00 Planning & Scheduling: P & S, section "07:21 Project Goals and Project Objectives", Fig. 5.2):
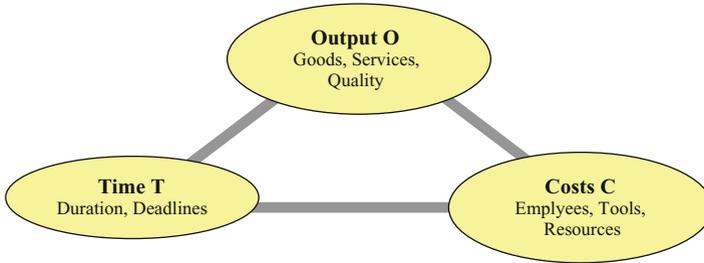
Fig. 5.2 Project scope objectives
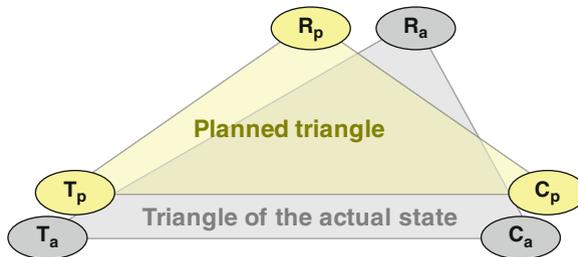
Fig. 5.3 Planned triangle and the triangle of the actual state

All project objectives in this triangle are interdependent. Any change in any of the project objectives causes a change in at least one other objective, too.

Cutting time, e.g. by shorter deadlines, has influence on the results (forcing e.g. reduction of the targeted features or quality) and/or on the costs (e.g. increase due to overtime payments). Cuttings in the project budget (cost) usually lead to reduction of the targeted results, and so on.

In the process of project realization there are certain discrepancies between the plan and the actual state. The discrepancies within the particular project scope objective, cause deviations in other, finally forming another triangle, which differs from the planned triangle as shown in Fig. 5.3. The above discrepancies have to be analyzed and certain countermeasures should be applied in order to minimize an impact on the project scope and to achieve the planned project scope objectives as close as possible (Lewis 2011; Motzel 2003; Felske 2003; Szyjewski 2001).

10:22 Analysis of Actual Project State

Assessment of Results

Assessment of the actual state of the project shall cover all activities of the project team members within the main project processes of the results delivery, their validation and adjustment of the business processes, as well as all supportive

processes, expenditures for quality assurance, risk management, training and so on. The assessment may be carried out through:

- "Helicopter estimation" of the particular project part
- Control of the project status upon reaching a milestone determined in the process of 07:00 Planning & Scheduling P & S,
- Verification of the consistence between the results of the delivery and validation processes
  The necessary data can be elaborated from the following sources:
- Checklists of control activities
- Individual consultation
- Meetings of the project team
- Reports
- Experts' appraisals
- Control processes
- Tests
- Reviews

Testing

Testing is validation of the achieved results against the earlier drawn up specifications. The validation may be performed on different levels: components, partial results, overall project results (compare V-Model, Chap. 2, 7:00 Planning & Scheduling). Testing is the basic method of the validation process in a project (Hansen and Neumann 2001).

Check-up

Check-up consists of measurements, analysis, quantification of project results feature, as well as the comparison of results with reference parameters. The aim of all those activities is statement if the set requirements will be accomplished with reference to each and every project results feature, or if consistence has been achieved (Ottmann 2003).

Check-up Versus Testing

Check-up is mostly an un-continuous action providing an answer, if a particular feature is 'consistent/non-consistent/or has a particular value'. Testing is usually related to a continuous process like e.g. validation and delivers not only the evaluation of the project results, but also allows to assess and improve the involved processes.

Assessment of Time and Deadline Course

Assessment of time and deadline course is basically an analysis of the past in relation to the planned project time schedule. One or more of the following techniques may be used simultaneously:

- Relationship diagram,
- Time schedule (e.g. project MS)
- Milestone trend analysis

Particular attention shall be paid to all interrelations between individual project activities. Any delay in one may not necessary lead to an equal delay in the overall chain of activities. Contrary, even a small change may cause major re-shake in the whole network of interrelated operations. In case of doubts four eyes principle might be helpful.

Assessment of actual project costs shall comprise all components and all activities related to project scope realization, such as:

- Personnel costs
- Financial expenditures for investment and material re-sources
- Service costs for the supporting units
- Decision concerning financial expenditures relevant in the assessment of the earned value in the project
- Present earned value, acquired in the project
- Estimation of own costs (see section "10:35 Cost Driven Management" Cost Oriented Procedures)
- Analysis of project financial sheets
- Control of entries in accounting department
- Analysis of discrepancies

Correct assessment includes both the costs already charged to the project as well as the costs already incurred but not charged yet (e.g. ordered future deliveries from sub-suppliers).

10:23 Forecast of Further Project Progress

A vital project management goal is possible early identification of the deviations from the plan and taking suitable pre-cautionary measures. Past performance elaborated in the analysis of the actual situation and the comparison with the original plan, lead to the identification of the reasons of the discrepancies and allows forecasting further developments of the project. The above refers both to particular scope objectives of the project (time, results, costs), as well as to their mutual influence (the magic triangle).

10:24 Analysis of Discrepancies

At this stage a decision concerning further realization of the project must be taken:

- Which differences can be absorbed (namely, which differences do not obstacle the achievement of project scope objectives),
- Which differences exceed the capabilities of the project to continue further as planned (namely, which lead to the change of the planned magic triangle project scope objectives).

Delimitation of the threshold value between the both classes of differences is relative and depends on the project and overall assessment by a project manager.

It is recommendable to set this value with project team and let it get approved by the project supervisory board.

Significant differences lead to changes. Thus, a regular change request with suitable information should be filed out. Further procedure upon change request is described in Chap. 9, 14:00 Change Management: CM.

10:25 Precautions

Significant deviation from the plan, leading to the process of Change Management, generally results in the change of one or more of project scope objectives:
- Change of the planned results,
- Change of the planned costs,
- Change of the planned time.

The simultaneously introduced precautions aim at the reduction of the probability of the next, following deviation in the project. Earned Value Management Process is the only and right process to estimate the effectiveness of the undertaken counter-measures. In case shall they prove insufficient, a major effort has to be initiated: we have a problem (see Chap. 7, 12:00 Problem Management: PBM).

10:30 Techniques and Tools

This part describes the most effective techniques and tools, which supports the earned value analysis and Earned Value Management Process.

10:31 Workbench

Setting Workbench for EVM
A right alignment of the results, time and costs is critical in project evaluation.

Most financial management systems allow for a periodical report, usually a monthly draw. The accuracy may be optimized up to 1–3 days delay between the most recent registered entry and available report.

On the other hand, milestones are set along the reasonable and most efficient realization plan – seldom matching the financial reports schedule. The remaining period between the milestone date and reporting date is frequently a source of differences in the assessment of the current project scope objectives.

Twofold separation of financial bookings helps to assess correctly the earned value.
1. Exact assignment of fiscal accounts to project phases, an individual milestone related accounting periods

Nr	Product	Start	End Milestone	End Account	Account	Schedules 1 2 3 4 5 6 7 8
1.	Concept	1.01.14	30.04.14	31.05.14	700-01	◄━━━━━━► ▪▪▶
2.	Project	30.04.14	31.05.14	30.06.14	700-02	◄━► ▪▪▶
3.	Realization	1.06.14	1.08.14	31.10.14	700-03	◄━━━► ▪▪▶
4.	Implementation	1.08.14	30.08.14	31.10.14	700-04	◄━━►

Fig. 5.4 Magic triangle traceability technique

Financial Accounts

We follow here exactly the magic triangle relationship. Each fiscal project account is associated with exactly one measurable results objective and time to reach it.

Once the foreseen time period elapsed, the results objectives are measured and the financial results summarized. From that very moment the project team works on the next part with other results objectives (e.g. next milestone) and all the efforts and expenditures are booked on another financial account. Figure 5.4 illustrates this approach.

2. Exact trace of charged expenses in the current report period and future already committed expenditures.

Financial Tracking

Another source of frequent misunderstandings and incorrect assessments is the treatment of financial commitments in a project.

Financial systems are retrospective and can track only registered working hours and billed invoices. Project Management is the only source of correct assessment what is committed: ordered or already received, but not yet invoiced. That means that to evaluate correctly earned value, all registered expenditures but also all already consumed and not yet invoiced services and project contributions have to be jointly considered.

A suitable approach is to register financial forecast in the period, in which the charges are expected, irrespectively and in parallel to the actual financial account balance (Fig. 5.5).

10:32 General Assessment Procedures

Delphi Procedure

Carrying out a survey among experts (see Chap. 2, 07:00 Planning & Scheduling P & S, section "07:34 Project Cost Estimation") can be also applied to evaluate the

Nr	Phase	End	May									%
			own		services		investment		total		
			Account	forecast	Account	forecast	Account	forecast	Account	forecast	
1	Concept	30.04	850	1000	-	-	-	60	850	1060	80
2	Project	30.05	-	400	-	100	-	-	-	500	-
3	Realization	01.08	-	-	-	-	-	-	-	-	-
4	Implementation	30.08	-	-	-	-	-	-	-	-	-

Fig. 5.5 Planned triangle and the triangle of the actual state

actual progress in a project. The method is effective when the complexity of the project's results or their innovative character demand competences beyond the capabilities of the members of the project team. External experts help to estimate the results in a proper way. (Phillips 2010; Cadle and Yeates 2008).

Earned Value Analysis

Analysis of values worked out in the project is carried out independently in three fields: results, cost and time. The analysis, based on the assessment of the project processes from the present (actual) perspective, forms a vital decision basis. It sets a relation between the planned and actual data as well as relation between results and costs in a given point of time. Proper comparison of the planned and actual progress is conditioned by a comprehensive assessment of the present situation, as well as by complete planning processes. The described activities depend on the precision of approximate values. It refers to both the planned data (see Chap. 2, 07:00 Planning & Scheduling P & S), and the data describing the present (actual) state which shall be elaborated using the same estimation procedure. This guarantees correctness of the comparison and further evaluation of the earned value. Other-wise, there is a need of the assessment of influence (Felske 2003).

The analysis of earned value in the project consists of the following activities:

1. Actualization of the project plan (e.g. with the help of procedure creating the network of interrelationship). Taking into consideration the actual state and the remaining planned deliveries, it is possible to estimate the progress index. In order to do this, it is possible to apply different techniques, e.g. the technique of milestones, procedure 50/50 or procedure 0/100 (Motzel 2003).
2. Elaboration of the results, which should have been reached at that stage, based on planned, overall progress estimation. The value of the work, which should have been done with the corresponding financial expenditure, is the Earned Value – EV. The relation of EV to Planned Costs (PC) to reach these results gives the so called Schedule Performance Index

$$SPI = EV/PC$$

Table 5.1 Earned value of project (an example)

The following weeks of project	1	2	3	4	5	6	7	8	9	10
Costs planned in budget cumm.	25	48	75	100	113	122	140	146	149	162
Actual costs cummulated ACC	30	68	103	110	122	129	135	146	147	152
Earned value	20	35	55	96	118	125	130	140	157	170
Indexes of project										
CPI		0.67	0.51	0.53	0.87	0.97	0.97	0.96	0.96	1.07	1.12
SPI		0.80	0.73	0.73	0.96	1.04	1.02	0.93	0.95	1.05	1.05

CPI Cost Performance Index (calculated: earned value/actual costs), *SPI* Schedule Performance Index (calculated: earned value/costs planned in budget)

3. Comparison of the Actual Costs (AC) in the project with the achieved results EV. The difference is the so called Cost Variation CV. The relation of EV to AC determines the so called Cost Performance Index

$$CPI = EV/AC$$

Example

The monthly budget has been prepared at the amount of 25,000 $ (equal to the accepted, actual planned costs PC). The realized planned tasks achieved the level of only 80 % (= assumption). Thus, the Progress Index is 0.80. The Earned Value (EV) achieved this month can be easily calculated: EV = 0.8 × 25,000 PLN = 20,000 $. SPI = 20,000/25,000 = 0.8.

Although the planned tasks has been performed in only 80 %, the actual costs (AC) of work done so far amount to 30,000 $ (= assumption). With the extrapolation of the current results, the 100 % task performance would be connected with the cost at the amount of 37,500 $. In the comparison, it is clear that there are additional costs (cost variation CV) of 10,000 $ (30,000–20,000) and that the project without any precautionary measures will cause the increase of costs by 12,500 $ (= 37,500–25,000) in comparison to the previously prepared budget.

Graphical presentation of data is useful in data analysis. The preparation of such presentation can be made easier by the tabular calculation program as exemplified in Table 5.1.

Figure 5.6 extends the above given example with a simulation of possible several weeks realization of the project and corresponding figures.

Both graphs indicate certain challenge in schedule and cost management in the first stage of project (it is visible through both indexes, CPI (with reference to costs), or SPI (with reference to time schedule)). The value of index "1" denotes 'ac-cording to the plan'; index higher than 1 'better than planned', and index lower than 1 'worse than planned'. In the presented example, the increased costs at the
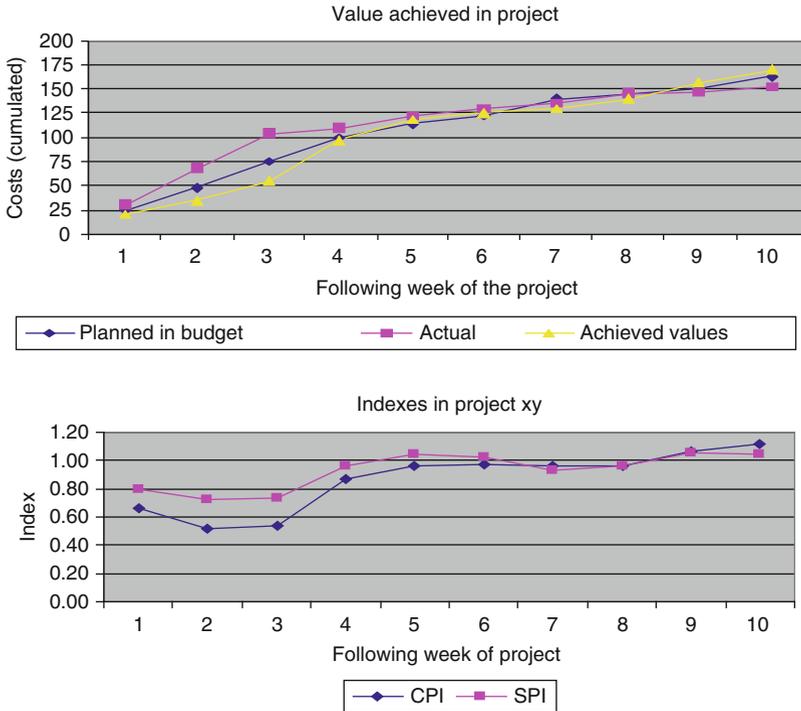
Fig. 5.6 The example of graphical presentation of earned value with the help of tabular calculation program

beginning of the project were at the same time connected with lower than planned Earned Value. In this scenario, the project manager faced the situation, that the project, without any precautionary measures will be more expensive (see actual costs) and a significant delay must be taken into account (see low earned value). The taken preventive measures had a positive influence on the project, allowing finally to achieve the planned progress (see, the middle part of the project). After a short problematic period, the project could be finished with a better result than planned, both in the scope of costs, as well as timing (see also both indexes, which are higher than 1).

Management by Critical Factor

Management by critical factor bases on earned value and both cost and schedule performance indexes. Both indexes of the analysis of the achieved values (CPI and SPI), which track the discrepancies in the plan, are mutually multiplied by themselves for each stage. It results in numerical index called the Critical Factor (CF) for the given stage i (Lewis 2011):

$$\text{Critical Factor}_i = (\text{SPI}_I) \times (\text{CPI}_i)$$
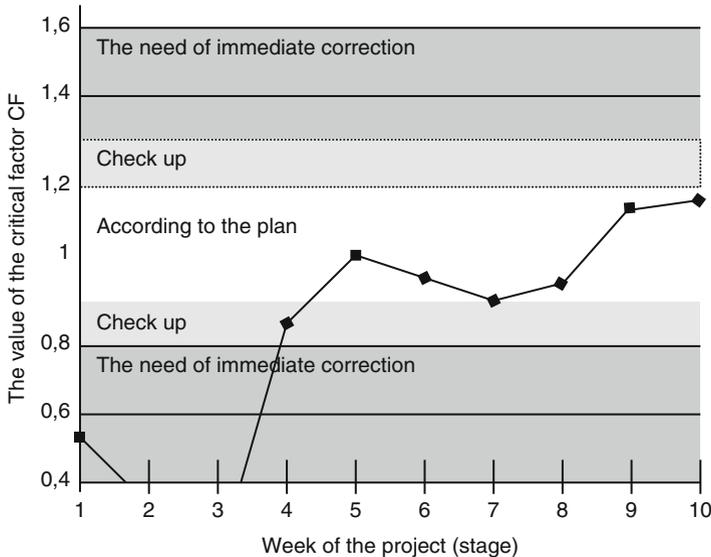
Fig. 5.7 Graphical analysis of the critical factor value

the end of calculation, the numerical critical factors of each stage are compared with the best case empirical values (see Fig. 5.7). CF value between 0.9 and 1.2 is considered as acceptable (no need for any immediate corrective action). The curve drew in Fig. 5.7 corresponds with the values from the example in Fig. 5.6. The graph clearly shows, that the value of the critical factor of week 2 of the project achieved a critical dimension. The project works already corrected after the first week should be stopped (the trend was visible).

Extrapolation of Past Numerical Indexes

Numerical indexes may be taken from the previously conducted and already finished similar undertakings (e.g. the output of a programmer in lines/hours, number of clients served daily by a call center agent etc.). The above numerical indexes should be adjusted to a given project, in which they are treated as points of reference. The adjustment is necessary, since projects differ in subject, results, time and costs, have different managers and their partners, have different organization and different project scopes. The adjustment of numerical indexes is done by approximate calculations, moreover, as a form of help we can apply estimation method. In order to make the whole process easier, it is necessary to conduct the division of project's tasks into possibly small partial tasks, which are assessed individually. If the numerical indexes have been adjusted to a given project, they serve as the indicators of early warning about potential deviations in the project. The indexes are supportive in the analysis of the actual state as well as the analysis of differences as shown in the above example.

Systems of numerical indexes are based on previous data and experience. Thus, using them, we must secure that the experience or information involved is valid for current project and actual conditions under consideration (the basis of extrapolation).

Forecast Based on the Analysis of Situation Development Options

In this procedure, assuming a certain state as the starting point, we present how a situation could look like in the future. The situation is a consequence of an assumed logical course of certain events in a given time space. At the same time, alternative solutions at each stage shall be considered (critical deliberation). During this time, certain decisions or activities should be already implemented, verifying past assumptions and scenarios. On the basis of such information, the possible future development in the context of potential alternative activities is assessed (Mag 1993).

Let us consider an example, where we have to choose between the actualization of a system with additional system components and the complete software migration to an alternative system. The analysis of the first option indicates total costs of 100,000 $ and the time of realization of 1 year. In case of the second option the costs amount to only 60,000 $, the migration can be done within 4 months, but the new system will be less effective in comparison to option 1. Final decision has to be taken with consideration of the overall needs and financial possibilities at a given moment and cannot be anticipated a priori.

Other Techniques

Besides the above simple yet efficient techniques, there are more complex statistical processes available for project progress forecast. Among others an exploration of tendencies, the technique of the smallest squares, exponential approximation, as well as simple and multiple regression schemes. Due to their complexity and limited practical usage in connection with approximate values of the progress estimation in the project they are not further considered here. The readers interested in the topic can find more information in (Mag 1993).

10:33 Estimation of the Level of Project's Goals Realization

The described below procedures are useful in estimation of the actual state with reference to the overall planned project's results, progress of priority project's tasks realization or the analysis of reasons of any discrepancy in a project.

Individual, Group or Team Assessment

The first procedure is set as assessments. They can be held individually, or with several people at the same time. Assessments held with several people at the same time have the advantage of judging a situation from different points of view, and all participants of the assessment can react on particular ideas in the discussion. However, in a group, we observe the effects of group dynamics, with negative effect of damping certain persons' active contribution. Thus, the form of

assessment: individual or team, has a significant meaning. The participants of the assessment can include co-workers from the project team, independent specialists in the field of application or technology, as well as the users of the targeted product. In order to use the time set for assessment in an optimal way, it is necessary to emphasize the role of good preparation of participants and the leader of the assessment in the merits of the discussions. The minutes, notes, and recording of the assessment can serve as a documentation. It should be noticed that, the participants of the assessment, in case of their recording, can behave differently, which can have a negative impact on the final result of the assessment procedure of the project's state as well.

Testing

Usually, testing is conducted in the process of product development, with the aim of the measurement of the level of realization of certain requirements set in the specifications. The tests can be run manually (so the activities are performed by a human) or in an automatic way (with the use of special programs). In both cases, the test should not be done by the author or developer of the tested product, but another per-son, possibly in cooperation with one more person.

Basically, we distinguish two below presented types of tests, however, in order to run the full test we should consider both of the test to be done subsequently (Kahlbrandt 2001):

Test of Black Box

The test of black box is a functional test. Functional specifications' requirements which are expected to be newly fulfilled are used to create test cases. The internal logic and technology remain hidden and irrelevant at this stage.

Test Execution

In order to check the function, we generate test cases out of application specific parts (e.g. through the creativeness technique or in accordance with Use Cases) and deploy them in expectance of specific reaction of the product. The test usually includes particular functions, which are then tested for their completeness. The correctness of internal product operation is not checked out.

Test of White Box

Unlike the test of black box, the test of white box checks the logic of particular product reaction or behavior and the legitimacy of particular program steps, which might have been initiated.

Error Search
Test Execution

In case of the search for possible errors, we prepare a record of potential errors or situations leading to errors, using the creativeness technique, intuition, experience or perceptive-ness, and test scenarios. Characteristic gaps or obvious de-tails in specification and test scenarios, which have not been predicted earlier in the

specification phase, but which might pop up during the design or realization can serve as the starting points. After the test scenarios have been prepared and essential procedures have been realized, the project results are tested. The results will be compared to the specifications and expected error list. The differences in the achieved results point to errors.

Random Data

By analogy, just as in case of the procedure of error searching, the test subject is tested with the use of random data or random situations. The results of these tests are gathered together with random trigger situation/data and build test cases used further in the test.

Cause–Effect Diagram

In cause-effect diagram all effects are linked with the corresponding causes. This way, it is possible to have the overview of feasible relationship between several causes and/or effects, which is helpful e.g. in the process of errors' identification.

Test Checklists

Test checklists allows for the assessment of the progress in the project based on the standards of a given enterprise, with the use of a catalogue of preprepeared questions like e.g. 'Has project organization been prepared?', "Has the load test been done?" etc. (Lent 2003).

10:34 Time Control Procedures: Trend Analysis

All tasks are attributed certain execution time and put into logical sequences in the planning and scheduling process (see Chap. 2, 07:00 Planning & Scheduling: P & S).

Dynamic developments lead to modifications of these values and in consequence – the interrelationship of the individual tasks among themselves. By assessing the results reached at certain stage we search for the tool to extrapolate project development in the time scale.

Milestone Trend Analysis

The Milestone Trend Analysis MTA provides an overview of the project development in time, based on the assessment of time consumed to realize particular task and the interrelation between the tasks. MTA can be performed only if one can possibly exactly determine the result and time needed to execute this task. An analysis of the time dependencies in inter-relation network leads to relatively good picture of the project development over the time. Usually good base constitute milestones set in project with well-defined deliverables and costs. Therefore, the technique under discussion, although general, is widely known as Milestone Trend Analysis MTA. (Felske 2003).
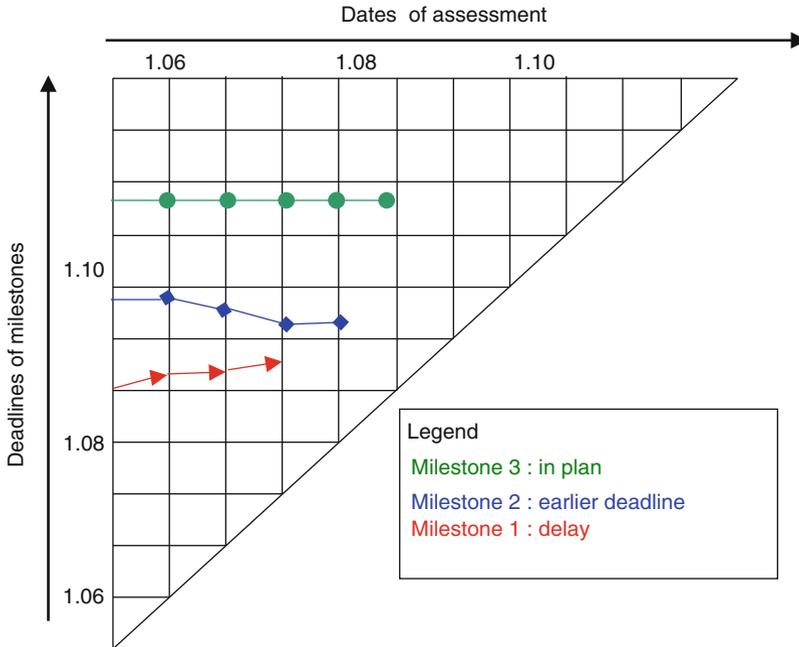
Fig. 5.8　The milestone trend analysis (MTA) example

Milestone Trend Analysis is executed in the following steps:
- Verify interrelationship network between the tasks and set new interconnections where justified
- Identify exact results and the deadlines bound with them for each task.
- Group the tasks around major decision items – milestones
- Verify cyclically (e.g. weekly) the deadlines of all mile-stones
- Assess the changes in each tasks execution time and assess against deadlines and consequences in interdependent tasks
- Draw a graph of the results on the MTA chart
- Review all differences,
- Evaluate the effects and potential corrective measures.

Milestone Trend Analysis Diagram

Based on the above considerations we may attempt to present graphically the MTA results (see Fig. 5.8). In order to reach this we have to perform the following activities:
- The graphical scheme has the form of a right-angled triangle, between two time axes. There are no restrictions on the time scale nor on the amount of time displayed beyond the requirement, that both axes must be equal in this respect.
- The horizontal axis presents the period of time presented in the report, and the vertical axis presents earlier planned milestone deadlines.
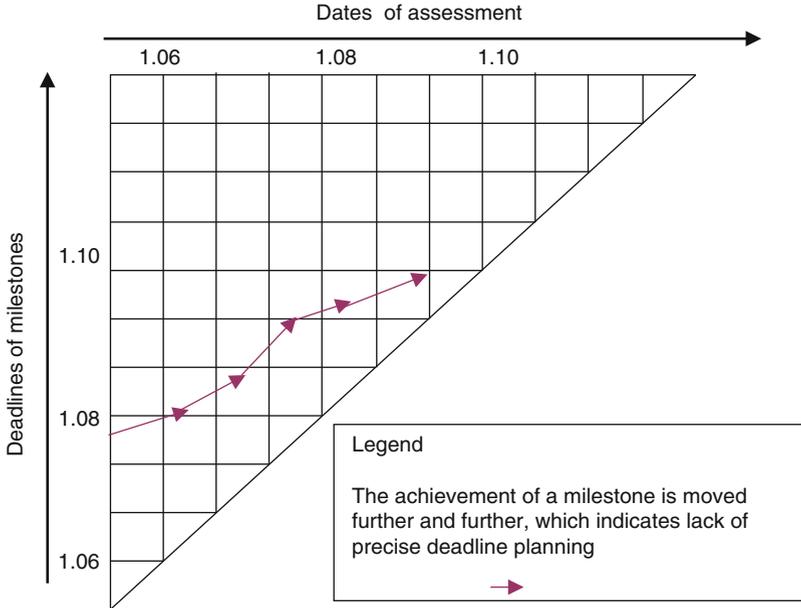
Fig. 5.9 The course of curves in case of lack of precise deadline planning

- The newly estimated deadlines of reaching each individual milestone are assigned each time the assignment is done (progress along horizontal axis), and then it is connected with a line with the previous deadline estimations.
- If the sequence of estimations reaches the diagonal line which binds two ends of the axes, it means that the milestone has been reached. We must notice, however, that the vertical time axis must be read from the bottom.
  The curves in the above graph shall be interpreted as follows:
- The ascending curves mean failure to keep the deadline,
- Horizontal lines mean that given milestones progress as planned,
- Descending lines mean that given milestone will be achieved earlier than planned,
- If milestone curve reaches the diagonal it means that is has been terminated.
  Examples of four typical cases of the milestone deadlines development are illustrated in the following Figs. 5.9, 5.10, 5.11, and 5.12:

Case 1 (Fig. 5.9)

The planned deadline to reach the milestone is moved forward each time, the verification takes place. The course allows to draw a conclusion that deadline planning was not done with a necessary accuracy and poses a serious risk to the whole project planning.

Case 2 (Fig. 5.10)

The planned deadline of reaching the milestone (🔵) remains unchanged, while the deadline of reaching the milestone planned to be reached before moves
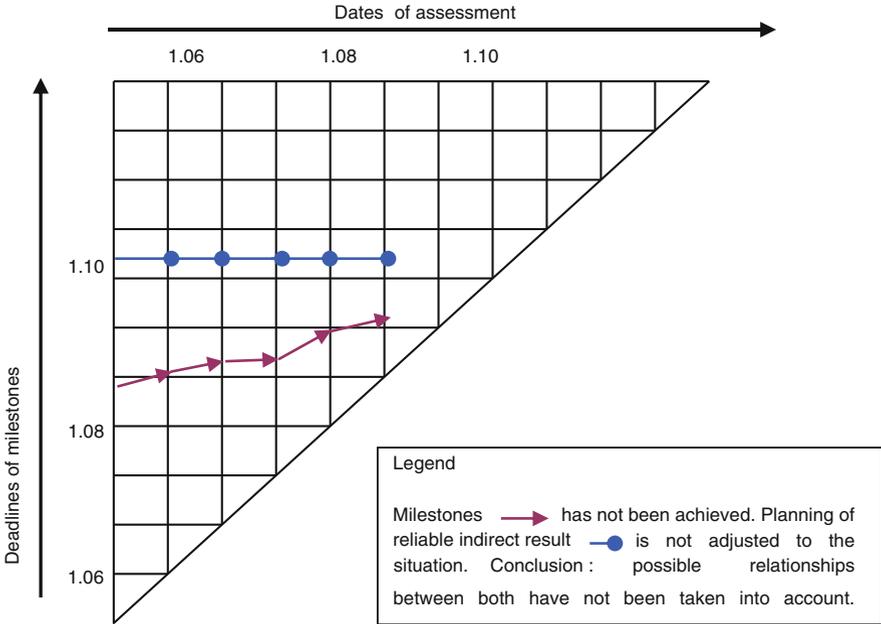
Fig. 5.10 The course of curves in case of failing to take relationships into account
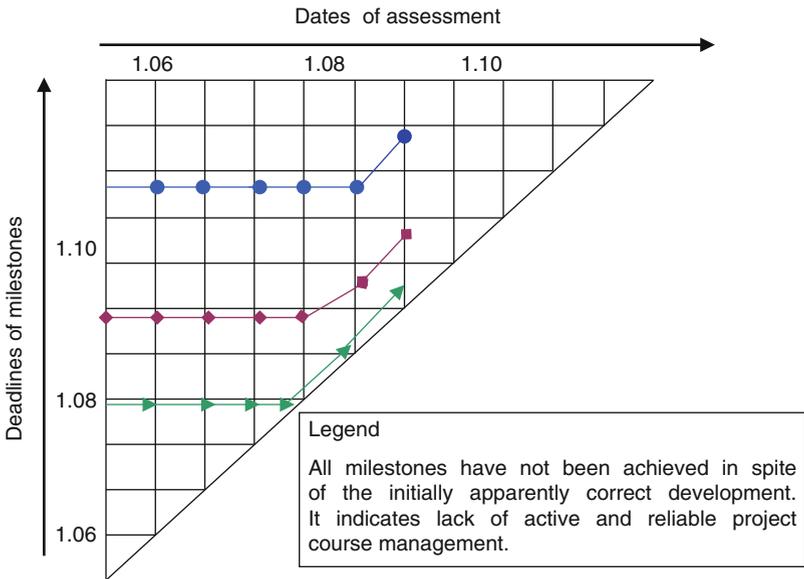
Fig. 5.11 The course of curves in case of lack of active management of the further course of project
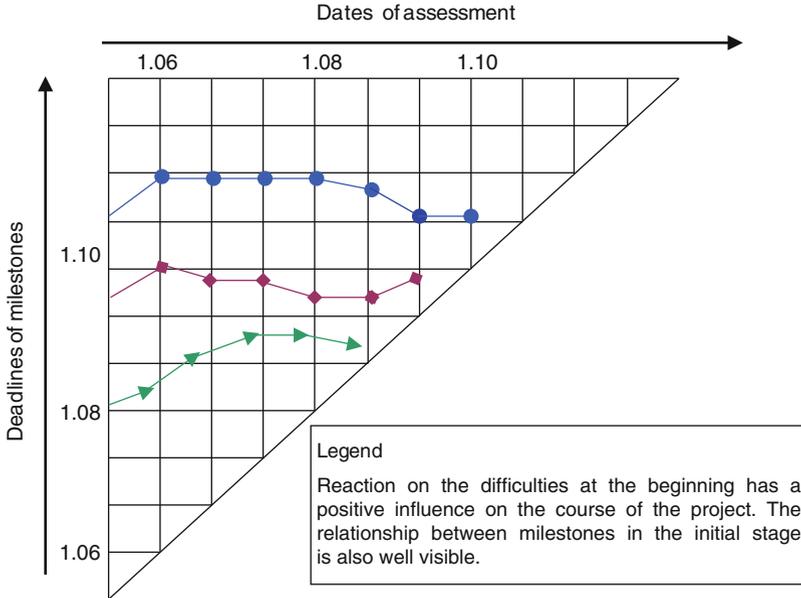
Fig. 5.12 The course of curves in case of positive reaction on the difficulties at the beginning of the project

continuously forward, i.e. the deadline is subsequently delayed (→).In most cases reaching of a milestone is conditioned by reaching of the deadlines one after another; however, in this case, the effects of moving the milestone 1 (→) have not been taken into account. The situation is not very trustworthy and shall draw an attention of the project manager to clarify the issue and eventually to re-plan the deadlines of both milestones.

Case 3 (Fig. 5.11)
All milestone deadlines are verified several times and confirmed as realistic. Shortly before the first milestone is reached, new delayed deadline is set and again moved ahead when also this date is passed. The situation is similar with other two deadlines. The situation is clearly out of control – and poses a risk to the whole project.

Case 4 (Fig. 5.12)
Milestone Trend Analysis shows clearly the negative impact of failure to keep the deadline of milestone 1 (→) on the following deadlines. The steps taken to counteract further negative development are reflected in positive influence on the development of deadlines.
Table 5.2 summarizes shortly advantages and disadvantages of Milestone Trend Analysis.

Table 5.2 Positive and negative sides of the analysis of the MTA

Positive sides	Negetaive sides
Simple, understandable, easy to use	Subjective assessment
Can be done in a short time	The curve of trend cannot be the only indicator of progress
Transparent and explicit	Explanation is necessary
Differences in deadlines are clearly visible	
Perfect means of communication in the project and out of it	
Allows to verify the interdependencies	
Enforces awarness in deadline keeping	
Stimulates the general team awareness	

10:35 Cost Driven Management

Budget Planning and Control

The project scope can be fully reached only if targeted results are reached within the deadlines and within the planned financial budget. It is thus necessary to regularly keep the record of arising costs in relation to the budget set at the initial stage of the project.

Cost driven management sets the financial limits as the regulatory vehicle demanding adjustments in time or in project scope features to match these limits.

Prerequisite to effective cost control is possibly detailed allocation of financial means to individual tasks and deadlines associated with these tasks. (compare 10:31 Workbench).

Project Relevant Financial Accounts

Reasonable is further split of the costs into cost groups, related to the company or purchasing organization accounting scheme. From the project point of view relevant are the following categories of expenditures:

- Own costs of staff on a pay-roll
- Costs of staff on loan and external services
- Project investment costs

The first (own staff) and last (investment) are medium to long term commitments. As such they can be only conditionally modified and in general are unsuitable instruments of cost driven management.

Effective on short notice management is feasible with staff on loan and external services. A project manager has a high flexibility to decrease or increase the expenditures depending on the current situation within one or two financial revenue periods.

Obviously, the company standards may lead to further spilt of these classes due to the further internal rules of e.g. investment write-offs or assets management.

Nr	Phase	Σ past Total	Now May Total		June Total		July Total		Aug Total		Sept Total		Oct Total	
			A	F	A	F	A	F	A	F	A	F	A	F
1	Inception	240	850	850	-	-	-	-	-	-	-	-	-	-
2	Planning	5720	-			100	400	600		600		600		940
3	Implementation	1200	-		-		-		-		-		-	
4	Closing & Eval.	0	-		-		-		-		-		-	

Fig. 5.13 Exemplary project double cost tracing scheme

Project Double Cost Tracing Scheme

Due to the asynchronous and delayed company accounting data and possible accounting errors, mentioned earlier in this chapter, a project-manger is encouraged to proceed with shadow, project internal, accounting tracking. Figure 5.13 summarizes the exemplary project cost double tracing scheme in alignment to the proposed workbench (A – account, F – forecast, see section "10:31 Workbench").

The Analysis of Cost-Consumption Ratio

The Analysis of Cost-Consumption Ratio helps to achieve the estimated values concerning the sum of costs of a given project in relation to the targeted final deadline. Simultaneously, the above analysis may serve, just as the Milestone Trend Analysis, as the indicator of early warning about possible deviations in the project.

Earned Value Analysis is a prerequisite to the correct Analysis of the Cost-Consumption Ratio. Setting the estimated value of global costs is conducted in six steps:

- The starting point are the planned total costs PTC of the project resulting from the planning of project's costs (see Chap. 2, 07:00 Planning & Scheduling P & S).
- Actual up-to-date project costs, meaning cumulated costs ACC, are determined cyclically (e.g. once a week).
- The actual earned value (EV) is determined periodically, while the value of the finished tasks and packages of tasks strictly relates to the planned costs. In case of task packages, which have not been completed, the earned value is determined on the basis of the actual earned value in the project (see section "10:32 General Assessment Procedures", Earned Value Analysis, step 2 hereafter)
- The estimated value of total costs ETC is calculated according to the formula presented below, on the basis to the planned total costs, the actual cumulated costs and the actual earned value:

Table 5.3 Example of the cost trend in a project

Control period (week)	Planned total costs (PTC)	Actual cummulated costs (ACC)	Earned value (EV)	Cost impact factor (ACC/ EV)	Estimated value of total costs (ETC)
1	200	25	20	1.25	250
2	200	50	40	1.25	250
3	200	80	60	1.33	267
4	200	100	80	1.25	250
5	200	140	100	1.40	280
6	200	170	120	1.42	283
7	200	180	140	1.29	257
8	200	200	160	1.25	250
9	200	215	180	1.19	239
10	200	230	200	1.15	230

$$ETC = PTC \bullet \frac{ACC}{EV}$$

where:
ETC: estimated total costs
PTC: planned total costs
ACC: actual cumulated costs
EV: earned value

Cost Impact Factor
The ratio of ACC to EV is determined as the cost impact factor. The value higher than 1 indicates the increase of costs, the value lower than 1 indicates the decrease of costs as compared with the original planning. Table 5.3 illustrates the exemplary estimations.

Figure 5.14 illustrates graphically the above example. Diagram allows to detect any deviations from the cost plan in the early stage and to counteract on time.

Comparison of cost impact factor of two consecutive estimations illustrates the following rule of cost trend evaluation:
- If current cost impact factor is higher than the most recent one, we have an increase of total costs beyond the currently anticipated level (compare period 2 and 3 in the above example).
- If current cost impact factor has lower value when compared to the previous one, the tendency to increased cost efficiency shall be expected (see e.g. periods 6–10).
- If there is no change in the cost impact factor value, we have stable situation, irrespectively of the actual estimated total cost ETC relation to the planned total costs PTC.
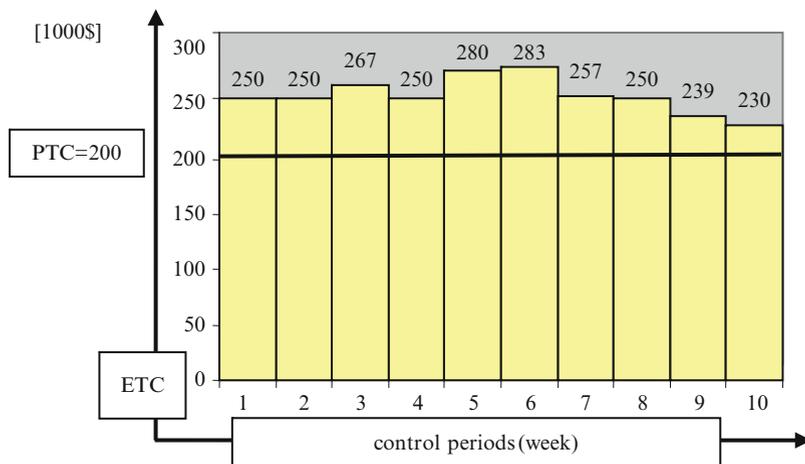
Fig. 5.14 The example of the project cost trend

The Example of the Analysis of the Cost Trend as the Indicator of Early Warning About the Deviations in the Planned Costs.
If the total costs amounted to $22,220,- with the progress index equal to 0.9, we must take into account the increase of total financial expenditures at a level of about 10 %. This value holds true as long as the cost impact factor remains stable constant, i.e. other unitary costs remain unchanged and there are no other effects on the course of project realization.

Advantages and disadvantages of the cost trend analysis are given in Table 5.4.

10:36 Simulation Tools

Simulation Tools
Complex project, judged by size (over $500,00.-), complexity (over 100,000 function points) or project staff number (over 10) make manual elaboration of the interdepencies and mutual impact a Sisyphus work.

Cost Impact Factor
Available tools like TopSim, Simultrain or ProModel (TopSim 2013; Simultrain 2013; ProModel 2013) allow the multidimensional optimization along selected criterion of the shortest time or the lowest cost. Progress index may be modeled directly through the adopted in the simulation earned values or as a quality parameter. The last has a linear impact on the realization time und thus cost.

Table 5.4 Positive and negative sides of the analysis of cost trend

Positive sides	Negative sides
Simple, undersstandable	The method can cause problems with calculating the earned value
Easy to use	The curve of the trend cannot be the decisive factor only
Transparent, explicit	Explanation is necessary
Easily noticeable proved differences	It does not include the anticipated decrease of costs in the future
Clear form of early warning about deviations	
Increases the awareness of cost rationalization	
Stimulates the team awareness	

The simulation tools allow to enter the real project data of each individual task and to summarize the total time and costs along different realization paths. Several strategies of prospective project developments may by exercised.

Convenient are tools which hook on the widely used project planning tools like MS Project, e.g. Project Simulator (Schnitz 2009). By entering the additional information like chosen index criteria or strategy various options of cost/deadlines development may be evaluated (Fig. 5.15).

However, the predictability of the expected results is limited to the correctness of the implemented algorithms (Lent 2009). This indeterminacy may be used to reflect an impact of the human factor (e.g. staff motivation level) but it puts the final simulation results in question. In conclusion, this technique shall not be used solely to support the EVM process, but may be adopted as a validation tool for otherwise elaborated results.

10:37 Decision-Making Process

Once the results of the level of project goal realization, mile-stone and cost analysis (remember the magic triangle?) are available, we can proceed to the decision process about the necessary corrective actions in the project (the author in his vast praxis never met project where it was not necessary!).

The decision process would be an easy go if all the data, used in the analyses were 100 % error-free. In this case, a straight forward follow-up of the obvious conclusions form the performed analyses would be the way to proceed.

However, most data and estimations, like earned value, are approximate with limited degree of reliability.

Among different techniques of decision making, few, like e.g. Bernoulli Rule, provide complicated mathematical apparatus to include the evaluation of risk associated with the used limited reliability figures (Schildbach 1993).

Some useful practices are described below.
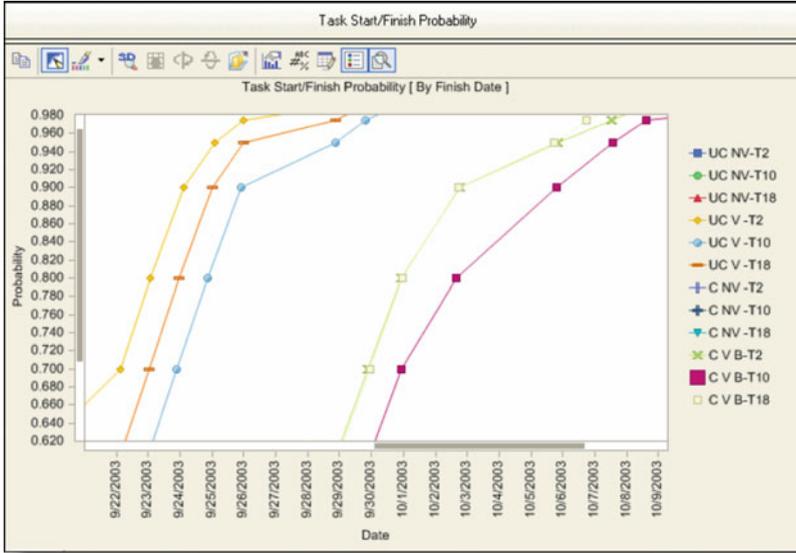
Fig. 5.15 Project simulator screenshot deadlines trend (Simultrain 2013)

Minimum Loss-Maximum Profit, or Maximum Profit Minimum Loss Rule

Minimum Loss – Maximum Profit Rule (or opposite) refers to the case of worst case anticipation. The rule is, to choose the option, which causes the lowest losses. Thus, the person taking decision must choose the alternative of the smallest maximum losses in case of unfavorable course of developments in the project.

Optimization Rule

The Rule of Optimization is applied in case of completely opposite attitude. The priority is given to the profit and not the loss maximization. Thus, the person taking decision chooses the option to minimize the losses in the possibly most favorable course of developments in the project.

Pessimism – Optimism Rule

The pessimism – optimism rule entails both of the above procedures. When assessing the alternative options the best and the worst partial result for each option is summed up, while the two partial results are balanced before summing up in the following way:

- Possibly highest value of each alternative option is multiplied by subjective value λ,
- Possibly lowest value of each alternative option is multiplied by $(1 - \lambda)$.
  Following remarks shall be considered while choosing λ:
- The value of λ reflects the personal assessment of situation by the person taking decision,
- The value of λ can only be within the range between 0 and 1, including both 0 and 1 values,

Table 5.5 Progress control meetings' minutes

Minutes of	Project . . .
Date of the meeting/consultancy.	Subject. . ..
Participants	Distribution list
Reports on management processes	
P&S, OM, PRM, EVM, QM, PBM, RM, CM, IM, KM, DM, BSC	
HRM, TM, CFM, COM, SM, L	
In a given case:	
1. Evaluation of the project progress (since the last report)	
2. Justification of differences	
3. Improvement potential	
4. Other planned activities	
5. Decision concerning the differences and precautionary measures	

- If the decision maker sets the value of lambda λ equal 1, he is very optimistic and applies the Rule of Optimization.
- The value of lambda λ equal 0, indicates the fullest pessimism of the decision maker and thus deployment of Minimum Loss – Maximum Profit Rule.
- The assessment of all the alternative options is performed with the same lambda λ factor,
- The alternative with the highest final result value is to be chosen.

Expected Value Rule

In case of the Rule of Expected Values each partial result of one of the alternatives is multiplied by a weighting factor, before the balanced partial results are summarized. This way, we achieve the final value of the alternative with subjective estimation of individual elements.

The following points must be taken into consideration:

- The assessed partial results which corresponds each to other in different alternatives are multiplied by the same factor,
- Factors are taken regardless of each other (except that, there are relationships between particular partial results),
- The value of factor can only be within the range between 0 and 1, including 1 and never 0 values,
- Unlike in the rule of pessimism – optimism, where in the assessment of the alternative only the best and the worst values are taken into consideration, the rule of expected value compares all values. A balance factor should be taken for each category,
- The alternative with the highest final score is to be chosen.

10:40 Templates

10:41 Project Documents

The indispensable elements of earned value management process and progress control are meetings and consultancies, which should be recorded in the minutes. The minutes should include the items given in Table 5.5:

Table 5.6 Test report
example

Report on the test (HERMES 2003)
0 General information
1 Aim of the document
2 Scope of the test
2.1 Performed activities
2.2 Test goals and focus
3 Test results
3.1 Applied methods and procedures
3.2 Assessment of test results
3.3 Anticipated risk
4 Enclosures
Tests' results/ test minutes
Test specification
Tests' procedures

Tool applied in assessment of the progress in the project scope realization are tests. The type, form and procedures applied concern the process of earned value management (Table 5.6):

10:42 Documents of the Project's Results

Earned Value Management Process shall produce the results, which may be presented in one of the following forms including earned value (Fig. 5.6) and a critical factor (Fig. 5.7) not depicted there (Table 5.7):

10:50 Activities and Deliverables of EVM

Process development and the results of the EVM can vary in different sub-processes of production, validation, and business process reengineering (Fig. 5.7), Therefore, the activities and the deliverables are presented separately for each of the above sub-processes:

10:51 Initiation Phase

Sub-process Production

Tasks. None

Results. None

Table 5.7 Project progress report example

Project progress report (HERMES 2003 (2003), p. 185 ff)
0 General information
1 Aim of the document
2 Project status
2.1 General situation
2.2 Results reached in the reported period
2.3 Discrepancies in the results as compared to the plan
2.4 Discrepancies in the deadlines as compared to the plan
3 Project costs
3.1 Discrepancies in the costs as compared to the plan
3.2 Justification of the actual costs
3.3 Countermeasures against cost increase if applicable
4 Encountered problems and applied solutions
4.1 Encountered problems, unexpected events, appearing risk
4.2 Applied and suggested solutions, countermeasures against risks and cost/deadlines de viations
5 Forecast of further project development
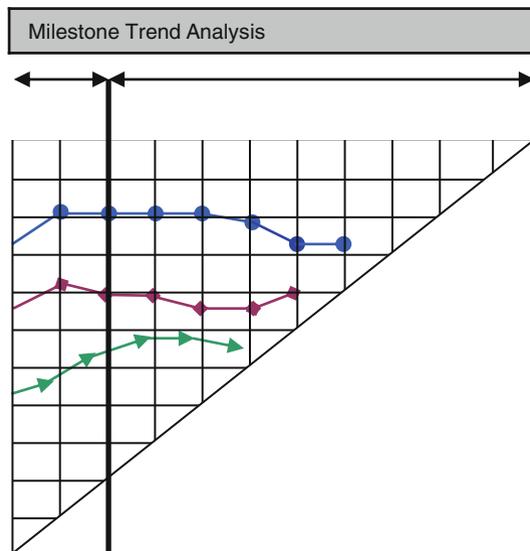
Sub-process Validation

Tasks. None

Results. None

Sub-process Business Process Reengineering

Tasks. None

Results. None

10:52 Planning Phase

Sub-process Production

Tasks
- Choice and elaboration of suitable Earned Value Management tools and techniques
- Preparation of the assessment of progress control in accordance with the realization plan
- Conducting the assessment of the progress control and EVM reports of the stage of planning

Results
- Chosen and agreed methods and techniques of EVM
- Plan of progress control and EVM reports
- Assessment of the progress control and EVM reports of the planning phase

Sub-process Validation

Tasks
- Same as in the Sub-process Production for validation efforts

Results
- Same as in the Sub-process Production, focus customer acceptance

10:53 Implementation Phase

Sub-process Production

Tasks
- Conducting the assessment of the progress control and EVM reports of the realization phase

Results
- Assessment of the progress control and EVM reports of the realization phase

Sub-process Validation

Tasks
• Evaluation of the validation test reports and validation of the results reached in the reported period
• Conducting the assessment of the progress control and EVM reports of the realization phase

Results
• Test rapports with assessment of the validated results
• Assessment of the progress control and EVM rapports of realization phase

Sub-process Business Process Reengineering

Tasks
• Assessment of the viability of business process reengineering
• Conducting the assessment of the progress control and EVM reports of the realization phase
• Obtaining customer acceptance of EFM reports

Results
• Business process reengineering assessment -
• Customer reviewed assessment of the progress control and EVM reports of realization phase

10:54 Closing and Evaluation Phase

Sub-process Production

Tasks
• Conducting the assessment of the corrective efforts and failure improvements progress and EVM reports of the implementation phase
• Preparing the final project EVM reports, production part

Results
• Assessment of the corrective efforts and failure improvements progress control and EVM reports of the implementation phase
• Final project EVM report, production part

Sub-process Validation

Tasks
• Conducting the assessment of the test and validation efforts progress and EVM reports of the implementation phase
• Preparing the final project EVM report, validation part

Results
- Assessment of the test and validation efforts progress control and EVM reports of the implementation phase
- Final validation report of project results
- Final project EVM report, validation part

Sub-process Business Process Reengineering

Tasks
- Conducting the assessment of the migration progress and EVM reports of the implementation phase
- Preparing the final project EVM report, Business Process Reengineering part
- Agreeing with customer on Final evaluation results

Results
- Assessment of the migration progress control and EVM reports of the implementation phase
- Final project EVM report, Business Process Reengineering part
- Assessment of the progress control of implementation phase

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11:00 Quality Management: QM

<div style="text-align:right">**6**</div>

Quick Look

What Is It?

Quality Management ensures that project results meet exactly project scope: the deliverables, goods or services are not better and not worse, but precisely along the specifications, which in turn shall fully reflect all expectations of the ordering party.

Who Does It?

It is advisable to assign the responsibility for the quality management to a different person, not a project manager, within the project and contract an external quality control as well.

Why Is It Important?

Thanks to Quality Management all expectations are transformed into specifications, we can plan and manage because we know the details, delivery matches the expectations, and all impact factors are treated comprehensively and efficiently.

What Are the Steps?

Quality Management starts with setting the rules of own acting: mostly aligned with project's hosting company standards. As soon the project team starts, a comprehensive tracing of any deviation within the agreed path is performed: product, process, team. The discovered discrepancies are reported and traced. And last but not least, question posses itself: are there any possibilities of improvements?

What Is the Work?

QM delivers: exact picture of any deviation in the project scope realization, code of quality management system and improvements suggestions.

How Do I Ensure That I Have Done it Right?

As a project manager choose your quality manager as soon as possible – best in the initialization phase. Follow consciously his advices. As a Quality Manager agree with everyone in team and all stakeholders about your handling rules (- system), trace carefully the agreed relevant features, be creative in improvements suggestions, keep going strong, when your good advices are not been taken into account.
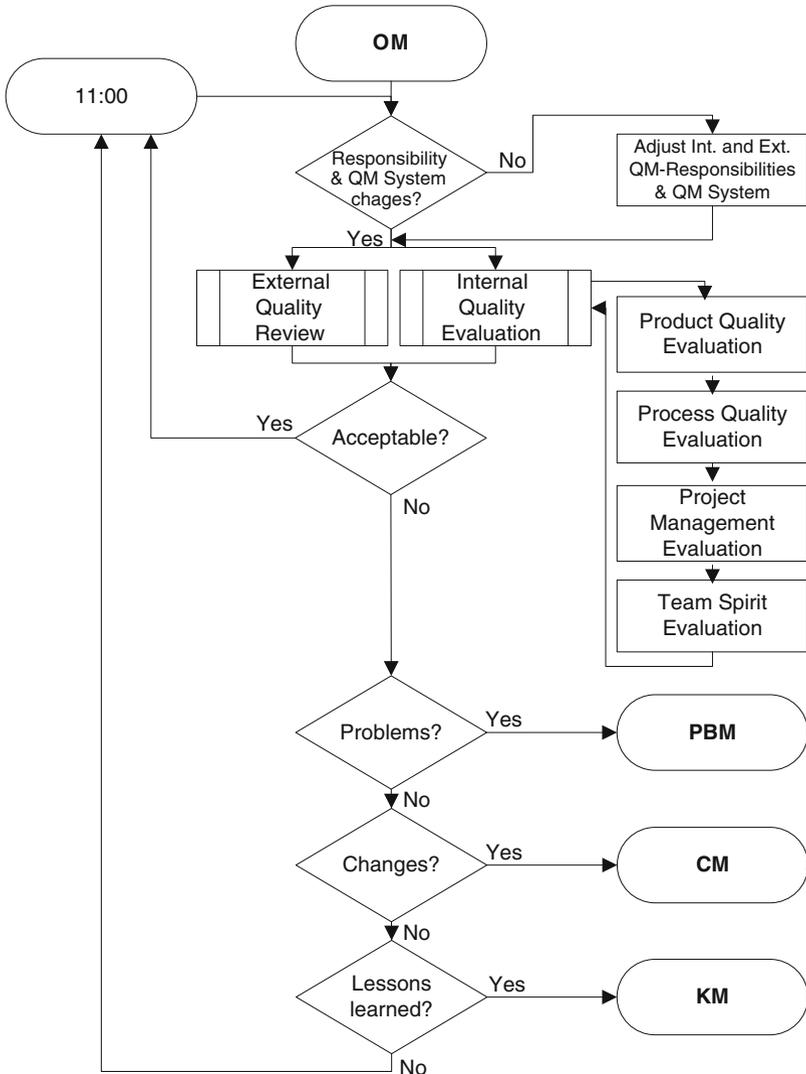
Fig. 6.1 Quality management process

Process

Quality Management process (Fig. 6.1) sets and agrees within project team and stakeholders own code of practice, which subsequently applies to the evaluation of the project products and the way, how they are developed. The detected discrepancies are reported and traced. The gained knowledge shall be processed – to the benefit of own and other processes improvements.

11:10 The Goal of Quality Management

Quality Management shall ensure compliance of results and project's processes as well as other type of characteristics with the project scope specifications and its planned realization. Continuous self-improvement of the Quality Management Process through Knowledge Management Process contributions and Change Capability are exemplary issues for the whole project.

11:20 Methods

In Planning and Scheduling the quality requirements are agreed with the project sponsor and other stakeholders implementing part of the ISO 21500:2012 process: "4.3.32. Plan Quality". The other parts of this process like establishing tools, determining methodologies, techniques to be used and developing the quality plan are part of the Quality Management process discussed hereafter. In this process the following ISO 21500:2012 processes are covered (ISO 21500:2012 2012):

- 4.3.32. Plan Quality
- 4.3.33. Perform Quality Assurance
- 4.3.34. Perform Quality Control

11:21 Quality in a Company

Quality Management System

Quality management consists of all activities related to quality assurance in the company and in project. This starts with a preparation and conduct of planning, preparation of the quality management system, integration of this system in the company's processes and this way into project processes and finally products (see Fig. 6.2). (Ottmann 2003).

11:22 Project's Quality

Quality = degree of requirements' accomplishment
(Ottmann 2003)

Quality management consists of periodical or constant check up and assurance that the set requirements are fulfilled in relation to product's quality (results) and the quality of project's processes.

CMMI

Certain trend towards quantification of the degree of quality may be observed. CMMI® Model (Capability Maturity Model Integration, Fig. 6.3), originally stemming from the automotive industry, distinguishes five levels of maturity with
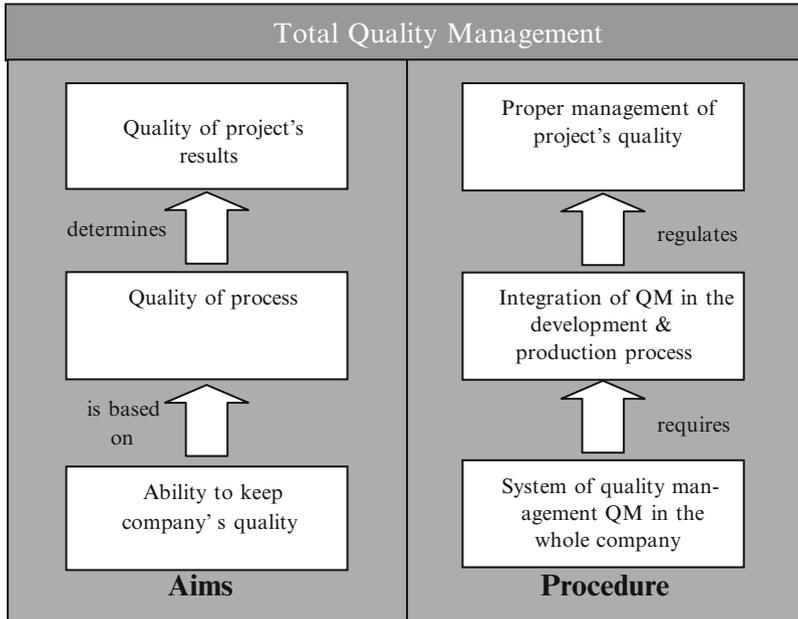
Fig. 6.2 Quality management in a company

appropriate measured process and product areas and predetermined evaluation criteria (SEI 2010). By selecting and applying specific level we do improve our chances to reach the demanded project quality.

Other standards like e.g. Lean Six Sigma (Stamatis 2004; McManus 2013) or ITIL (OGC 2011) combine predefined tools with the improvement processes, to align operations with business strategy.

11:23 Responsibilities for Quality Management in Project

Quality Manager
The task of the person responsible for quality – Quality Manager (QM) in the project is to assure, that the activities planned within the project will be conducted with the demanded quality and that the results of processes and activities correspond with their documented requirements (ISO 21500:2012 Process 4.3.33 Perform Quality Assurance).

Quality Model
Detailed requirements are measured according to criteria of Results Assessment set in Balanced Score Card (Chap. 13, 18:00 Balanced Scorecard). Quality Manager acts proactively: he develops the Quality Management System, agrees with the team on a Quality Model (e.g. CMMI above), quality assurance procedures,
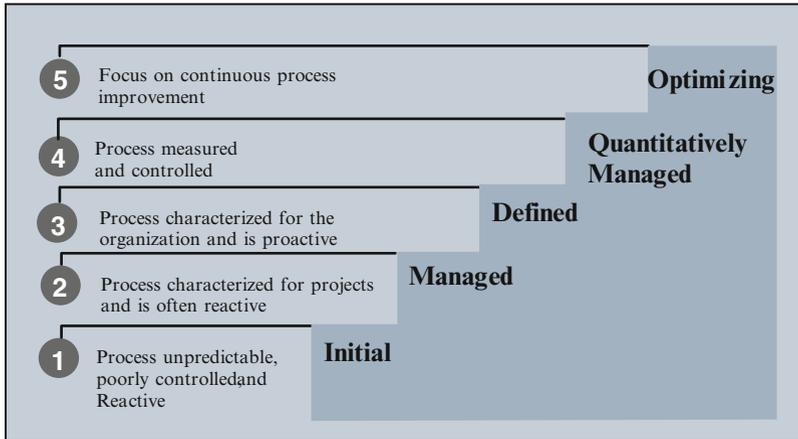
Fig. 6.3 CMMI® model

identifies possible problems and risks a forehead and initiates the necessary actions before the quality deteriorates below the demanded criteria.

Quality Control

Quite opposite is the suggested external Quality Control (ISO 21500:2012 Process 4.3.34 Perform Quality Control). This is a reactive instrument of posterior determination of the deficiencies. The team reacts then by introducing counter-measures, after the deficiency occurred.

Quality Control is an instrument available to Project Manager (see Fig. 6.4), yet, it is recommendable that the Quality Manager takes the lead to plan, schedule and initiate the activities of the Quality Control. This secures optimal coordination of both: internal and external measures and guaranties, that Project Manager does not become an arbiter be-tween two: an internal and an external party with a conflict potential.

Internal Quality Management has an advantage of acting as a team member – so there is higher degree of acceptance by team members and he is more likely to act reasonably as being directly dependent on the project success.

Quite contrary external Quality Control enjoys full independence from project course and it's team. So there is a chance of neutral benchmark, helping the team to assess their efforts in relation to the industry standards.

Quality Assurance and Validation Process

The quality assurance should not be mistaken with validation process, set in the Planning and Control Process (see Chap. 2, 7:00 Planning & Scheduling: P & S). Whereas quality assurance focuses on the evaluation of the degree to which the requirements have been met, the validation process defines how the individual deliverables are verified and validated against the specifications. Validation Process
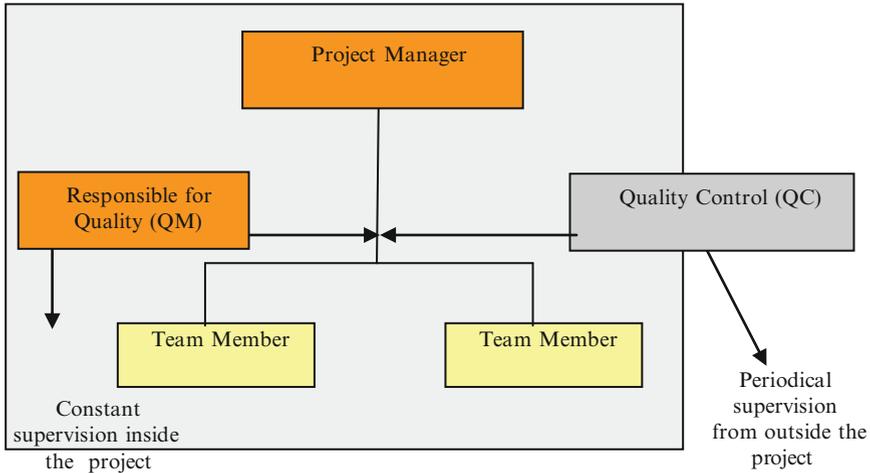
Fig. 6.4 Person responsible for quality and control of the project's quality

focuses exclusively on the product specifications, their verification, and their validation, whereas Quality Management concerns also processes and humans involved in the project.

11:24 Quality and Results' Assessment

William Edwards Deming, pioneer of quality management in the USA in 1940s formulated 14 areas of quality aspects in a company, which are impressively actual and worthy of pursuing in project management of the 2010th (Deming 2000):

1. Create constancy of purpose for improvement of product and service.
2. Adopt the new philosophy.
3. Cease dependence on mass inspection.
4. End the practice of awarding business on the basis of price tag alone.
5. Improve constantly and forever the system of production and service.
6. Institute Training.
7. Adopt and institute leadership.
8. Drive out fear.
9. Break down barriers between departments. People should work as a team.
10. Eliminate slogans, exhortations as contra productive.
11. Eliminate quotas and objectives. Substitute leadership.
12. Remove barriers that rob people of their right to pride of workmanship.
13. Institute a vigorous programme of education and self-improvement.
14. Put everybody in the company (project) to work to accomplish the transformation.

The today's Total Quality Management TQM, emerged from the Deming's premises. It is a philosophy resulting in a management style in delivering quality
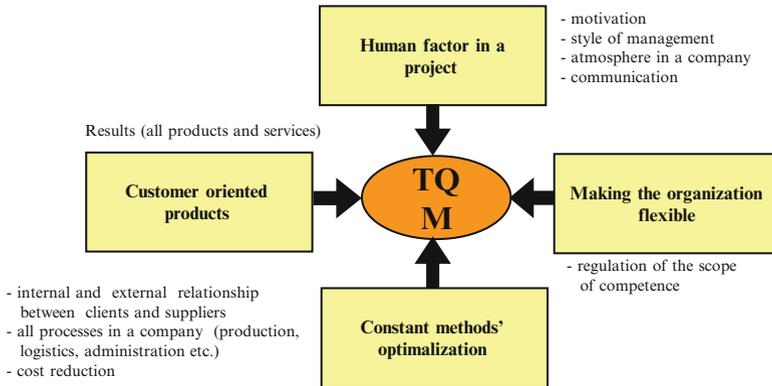
Fig. 6.5 Total quality management (Ottmann 2003)

to the customer by viewing each task in the organization as a process that is in a customer/supplier relationship with the next process (Naidu and Rajendra 2006; Hummel and Malorny 2010). TQM groups the Deming's premises into four perspectives (see Fig. 6.5).

Perspective of Providing Services to a Client
Consistent orientation on the provision of services to a client in quality management (presale – sale – after sale) requires the following elements to be taken into account:
- Explicit requirements between clients and supplier,
- Contract control,
- Management of processes in a project,
- Management of the process of products' (results) planning,
- Process of results' validation,
- Process of after sale support
- Periodical assessment of the project by a client.

Perspective of the Process Evaluation
Project's orientation on quality in processes is applied through:
- Processes' description,
- Records of data concerning suppliers,
- Regular controls,
- Records concerning the quality of a finished process.

Orientation on Team and Organization
Project organization must be oriented towards clients' needs, integration of team members and being able to act according to the set processes.

11:25 Quality Assurance Plan

With various targets, complex project scope, multiple active contributors and several models to choose, well organized systematic approach to quality assurance seems to be the only way to reach reasonable solutions at reasonable cost. The magic keyword is: "Quality Assurance Plan".

Quality Assurance Plan (QA-Plan) regulates the scope and approach to secure the quality in the project. It is neither resource nor time planning tool. These are handled in the planning and scheduling and organization management processes (see Chap. 2, 07:00 Planning & Scheduling: P & S and Chap. 3, 08:00 Organization Management: OM).

In QA-Plan firstly, a selection of a quality model determines further identification of specific quality relevant project scope features.

Identification of all quality features may be done with the help of techniques introduced in Chap. 2, 07:00 Planning & Scheduling: P & S: brainstorming, morphological matrix, etc.

Subsequent structuring allows for quality goals identification and finally criteria of their accomplishment forming a sound basis for further activities listed below.

11:26 Method of Quality Control

Quality control may be performed in a similar manner as results assessment in Earned Value Management:

- Compare planned and actually reached results,
- Run analysis and trends research (statistical methods),
- Control the present level of quality,
- Control and elaborate improvement's proposals,
- Periodically control the project's progress with regard to quality.
  The main support means of quality control in a project are the following:
- Quality management and quality control plans, which de-fine means of quality assurance for a given project (de-termination of the project's results, which are subject to control, selection and provision of adequate control methods etc.),
- Schedule of control, which includes the dates of planning particular controls with important details concerning their running and criteria,
- Controls' minutes, which are used as a form of documentation of the carried out control and its results.

11:27 Accepted Norms/Standards and Their Directives

In most companies quality standards are aligned with internationally recognized, already quoted above (see Chap. 2, 07:00 Planning & Scheduling: P & S), quality management standards such as:

- ISO 09001 (quality norms),
- ISO 15504 (programming),
- DIN 69901 (project management)

- CMMI (process quality)
- ITIL (service support)
- Lean Six Sigma (service delivery)
- TQM (quality management)

11:30 Techniques and Tools

The techniques and tools presented below used in quality management have been divided into two groups:

Quality of the Project Management System

1. Techniques and tools which serve the provision and development of quality of project management itself. In the centre of attention there are the project management processes as listed in this book. Motions for improvement and implementation of changes, achieved with the use of techniques and tools of the group, refer to the processes of projects' execution. The rules and the system are comprised in a project management handbook.

Quality Management in a Project

2. Techniques and tools of quality management in a project help to achieve the project's goal. They refer to all operational tasks of the project, and in particular to the planned goals. Current situation in a project is compared with the target goals specifications. The comparisons provide conclusions about the improvements and changes, which aim at the correction of any deficiency in a project. However, unlike in case of Earned Value Management, here the comparison is carried out irregularly in alignment with major decision points (milestones, problem solving, changes etc.).

11:31 Quality of Project Management System

Certification

Certification is carried out by independent units. They prove the compliance of the system of project management with legal regulations or independently set standards, exemplary named in section "11:27 Accepted Norms/Standards and Their Directives".

Most companies and projects honestly admit that main motivation of certificate acquisition is first of all, a marketing aim. The improvement of the quality of product and process, and the increase of clients' satisfaction diverge unfortunately to a secondary goal. Nevertheless, the final result is a contribution to project quality and that is what really counts.

Since besides the processes first of all team and the project manager have significant influence on the project's success, also the team members and their qualifications can become the subject of certification. Certification of team members along the same standard leads to a common understanding and eventually the standard of theoretical and practical knowledge, which is particularly useful in comprehensive and multicultural projects. There are different standards and different requirements; most valuable for quality contribution are those, where qualification and practical experience are necessary to acquire a certificate (see also Chap. 14, 20:00 Human Resource Management: HRM, Section 20:33 Candidates Evaluation Techniques).

Audit

During audit independent auditors (i.e. people, who are not directly responsible for the execution of the audited activities) conduct systematic review, if the way how processes are executed and results are consistent with the planned course of process realisation and its assumptions and if the planned stages of the project lead to the achievement of goal. The main points covered by the audit are as follows (Ottmann 2003):

- Purposefulness, adequacy and sufficient effectiveness of the project management system
- Sufficient documentation of the taken measures in order to carry out the project,
- Fulfilment of requirements of the adopted project management handbook
- Organization of the process of reaction on deviations in the project management system.

The aim of audit is to formulate conclusions leading to improvements in the project management system. Therefore, a systematic, comprehensive and repeatable audit proved to be most effective.

The auditor is responsible for the following activities (the list reflects the sequence of audit activities):

- Selection and build-up of auditors' team,
- Preparation of audit plan and schedule,
- Conducting preliminary talk with the project manager and the project team. Its aim is to explain the goal and way, how the audit will be done;
- Audit performance in cooperation with the audited project team (comparison of project documentation with the contents of a project management handbook, direct questioning of team members, practical control, short time surveillance, etc.),
- Taking minutes of the findings, (the results must remain confidential at that stage of audit)
- Presentation of preliminary conclusions to the project manager and team members agreed with him. The presentation must contain the summary of audit findings as well as recommendations of precautionary measures.
- Verification of the conclusions and elaboration of final audit results, comprised of audit findings and improvement recommendations
- Control report to the interested parties and bodies supervising the project. The report must include the following data:

- Confidentiality clause,
- Scope and aims of the performed project audit
- Names and references of the auditors,
- Name and affiliation of the audited project,
- Time and place of audit,
- Data concerning the reviewed documents,
- Statement about the differences and flaws (if there are differences in opinion between the auditors and the project manager, the statement must include both opinions properly marked),
- Steps taken by the project manager and team members in order to exert positive effect on the project management system prior to audit, including the responsibilities and deadlines,
- Assessment of the actual state of project's management issued by auditors,
- Name of place, date and signature of auditors,
- Distribution list,
- Enclosures.

Project Management Handbook

Mandatory tool in effective project management is project management handbook. It comprises all the rules, along which project is to be conducted, best case building up a project management system, i.e. rules integrated in some comprehensive, integrated, logically constructed structure (see Chap. 11, 16:00 Knowledge Management: KM, section "16:36 Project Management Handbook").

11:32 Quality Management in Project

Periodical Control of Project Realization

Periodical control of project realization is carried out regularly, however, first of all, after certain events, as for example when a milestone has been achieved or there have been a change of the project manager. Except establishing the present (actual) situation in comparison to the planned results, the periodical control of the project realization supports also earned value evaluation in the area of progress estimation (see also Chap. 5, 10:00 Earned Value Management: EVM). Periodical control of the project's state is at the same time a de-tailed, more or less formally planned and divided into stages analytical and decision process. During the control external or internal experts evaluate and comment project's results achieved so far. Thus, periodical, quality management induced control of project, unlike the control of project's management above, focuses on the quality of the deliverables of the project. An important trait of the control is that the members of the project team are included in periodical control and the control directly concerns the manner and results of their work.

To avoid arbitrary exchange of opinion between the experts and the project team during a periodical control, we must, possibly early, e.g. during the initialization of planning of the periodical control, set the expectations concerning project's results

in a written form and agree upon it's contents with the project manager and with team members. Beside that, there must be a plan of control, readiness to implement modifications in the project based on the control results, as well as the information that periodical control of the project realization serves the purpose of achieving the project scope and not divert objectives.

The control of the project realization resembles the project management audit and is carried out in the following five steps:

1. **Planning**
   Periodical control is planned in cooperation with all the members of the project team. It also involves control objectives with relation to the goals, time of control, place of control and the aspects subject to control. In particular, the time of periodical control, is known to all involved, thus the control is never a surprise.

2. **Preparation**
   Both the project manager as well as the controlling team gets prepared to the periodical control of the project's state by collecting the necessary data and reviewing the control objectives and control criteria.

3. **Carrying out the periodical control of the project realization**
   The basic forms of control are interviews with the project manager and project team members. The answers are subsequently scrutinized by experts and, if appropriate, verified by direct inspection by a control team member.
   Effective interview demands critical questions well pinpointing the target quality objectives agreed with the team during the planning phase.

4. **The analysis of the present (actual) situation**
   After the proper control, the findings must be analyzed and the control report must be prepared.

5. **Adjustment of the existing project plan**
   In order to include or eliminate the detected differences in the further project realization, the existing project plan shall be adjusted along the results and suggested precautionary measures formulated during the periodical control of the project realization. For this purpose a change request is formulated and Change Management process initiated.

Diagram of Relationship of Network Elements ('Project Excellence' Assessment Method)

Diagram of relationship of network elements can be used, on the one hand, to assess the present (actual) state of a project, and, on the other hand, to assess project's realization process. The assessment is based on graphical presentation of the relations between the goals achieved in that period. Starting from the center, each criterion is placed on the diagram of relationship of network elements as a separate radius, which terminates according to the relative level of significance (target objective). We draw concentric circles based on each radius (Fig. 6.6.).
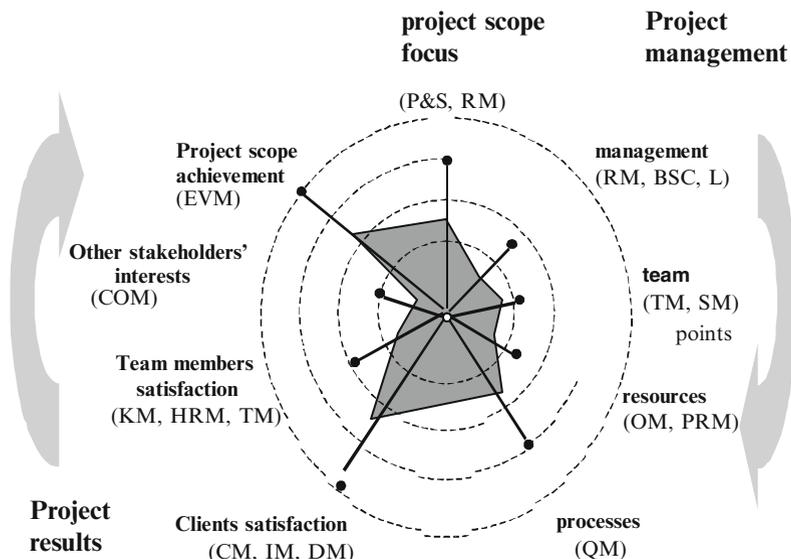
Fig. 6.6 Example of diagram of relationship of network elements

Team Assessment

The assessment of each criterion, depicted in Fig. 6.6, should be, on the one hand, carried out on the basis of own assessment of the team running the project (e.g. method of brainstorming (see Chap. 2, 07:00 Planning & Scheduling: P & S)), and, on the other hand, on the basis of the assessment of experienced experts. In case of the team assessment, we must assure project scope oriented, objective, open and honest atmosphere, which allows for a critical attitude to the assessment (otherwise the results will not be reliable). It is a challenge to the team and in particular to the project manager.

Benchmarking

Specific technique of assessing quality in a project is benchmarking. Benchmarking is a reference of project under investigation to another project or universally applied model. Usually best case results are used for benchmarking. However, consciously median results or even worse case scenarios may be used as reference, too.

With the use of this comparison assessment, we make an attempt to find out the reason of other teams' success in realization of comparable project. Due to that, it is necessary to take two steps: firstly, we must point to the differences in realization to other projects and project teams; secondly, we must examine the reasons of the differences. On the base of this analysis the improvement potential is identified and – if feasible – a suitable change request initiated. In case of reference to best case model optimization of project management processes is feasible, leading to the efficiency increase in team.

On the one hand, benchmarking should be referred to another model project as close to our project as possible, on the other hand, a positive cross-boundary benchmarking may bring substantial improvements, stimulated by adverse procedures or product criteria, which are applied in different disciplines.

Benchmarking Risks

Benchmarking shall be carried out by a team of experts who deal with each other on equal terms. This is particularly critical in case of benchmarking between two projects by two different teams within the same organization or market. Honest and thus only valuable benchmarking demands an exchange of sometimes confidential information between both the referenced and benchmarked project. Rivalry, competitiveness, personal attitudes are decisive to success in this otherwise excellent technique.

The following procedure is recommended for successful benchmarking:

1. Examination of own project with the focus on weak points and improvement potential.
2. Organization of the team caring out the benchmarking (3–5 members).
3. Analysis and elaboration of indicators of discovered weak points and improvement potential.
4. Choice of the model of reference and team representing this model, to be treated openly and on equal terms in further benchmarking steps.
5. Initiation of contact with a chosen team representing benchmarking model and establishment of common goals and benefits.
6. Joint comparison of indicators and analysis of differences, weak points and improvement potentials by both teams together.
7. Documentation of results and if needed, further analysis by our project benchmarking team.
8. Choice of improvement measures, scope of responsibility, deadlines and participation in the realization.

Models of comparison which are used in benchmarking can be divided into two groups (Schelle 2003):

- Models independent from the branch
  - Are usually based on indexes,
  - Are usually oriented both on the processes and results,
  - Serve the comparison, less an improvement identification
  - Example models: methods of project assessment Project Excellence (see Chap. 13, 18:00 Balanced Scorecard: BSC, section "18:22 BSC Evaluation"), PM Delta.
- Models specific for a particular business activity field:
  - Are mainly oriented on a process,
  - Define exact terms of reference
  - Provide good source of improvements potential
  - Example models: CMMI, BOOTSTRAP, SPICE for ICT, Minergy for Construction, Vehicle Certification for traffic allowance etc.

Models which focus on processes tend to provide human independent indicators and terms of reference, misleading the benchmarking team to a final project evaluation, which apparently does not rely on human momentary attitude.

In reality, performance and quality of work of each individual may vary up to tenfold depending on e.g. motivation that is not considered in such a benchmarking. Therefore, a reasonable dose of criticism is recommended while applying this technique.

11:40 Templates

11:41 Project Documents

Quality Assurance is an integral part of any project's realization. Thus, it is important to elaborate a plan of quality assurance, which entails the items listed in Table 6.1 below:

11:42 Documentation of Project's Results

In parallel to the Quality Assurance Plan, it is also vital to describe a model of quality management, which reflects the quality goals with reference to products. A possible model of quality management is given in Table 6.2 below:

11:50 Activities and Deliverables of QM

11:51 Initiation Phase

Tasks
• Draft with the team possible rough quality goals or project scope features

Results
• Rough quality goals agreed with project team

11:52 Planning Phase

Tasks
• Develop the system of quality management taking into account possessed relevant certificates
• Define quality goals on the basis of project's goal and the existing standard of quality (goal of the company, branch standards, directives, standards). Quality goal must be oriented both on the clients' service as well as processes, and team members

Table 6.1 Quality assurance plan example

Quality assurance plan (QA-plan) (HERMES 2003 2003)
0 General information
1 Aim of the document
2 Goals
General, specific for a project quality assurance goals
3 QA organization
QA in the project structure, tasks, scope of responsibility as well as interfaces to other teams outside the project
3.1 Organization structure
Quality Management Organisation and Quality Control units; both responsible for quality; their mutual relation. The level of independence of people or units playing their role in QA process must be unambiguous
3.2 Tasks and scope of responsibilities
Responsibilities within the Quality management. First of all, we take account of the differences in relation to the model of roles assignment established by a standard
3.3 Cooperation outside the project
It is important to decide which institutions, organization units or people are responsible for giving information and contacts both inside and outside of the organization. The enclosure to the project's plan must also regulate matters connected with reporting on quality management
4 Strategy
It includes the main terms concerning quality applied in the project. The strategy defines the course of project's quality assurance, and in particular quality planning, quality management and quality control
5 Qualification
It lists directives and standards of a project, which are the basis of system and its function units qualification; they are set depending on certain level of precautionary measures taken by the person responsible for quality QA
5.1 Applied directives and standards
Here is the enumeration of all important for the project directives and standards, which refer to hazard and safety, necessary to qualify the system. We must assume general definitions of the system security. As a rule, they refer to a catalogue of criteria, what is more, the included regulation rules are applied in accordance with the project specificity
5.2 Security induced requirements
Here is the enumeration of QA precautionary measures based on the level of required data security, and demanded precaution measures
6 Quality assurance accompanying the development
Activities and list of project's results, which are subject to quality control, must be clearly defined. Moreover, there is a list of necessary decisions concerning their realization
Results subject to control
It is important to create a list of all results, which are to be controlled
6.2 Activities subject to control
It is important to create a list of activities, which compliance with the set rules (standards, directives, and methods) must be controlled in the project
6.3 Tests
Here is a rough list of all anticipated tests. The details are presented in the concept of tests and their specification

(continued)

Table 6.1 (continued)

Quality assurance plan (QA-plan) (HERMES 2003 2003)

6.4 Decisions concerning realization

It is important to decide about the organization of the process of decision taking which concerns the realization (decision points, objects of control, participants, invitation, course, taking minutes, and so on)

6.5 Baselines and results assigned to them

Results, which are defined as starting points for further steps in the project development, are gathered together to form a baseline. We must decide here, which baselines are required and which values should be assigned to the baselines

7 Specific means of control

Here we enumerate and describe specific means of the control of quality assurance with reference to ready products, dispatch, but also problem presentation, management activities as well as controls referring to Knowledge Management Process

7.1 Initial controls of ready products

There must be identification of the producer and product

We must check if there is a documentation compliant with the project scope specifications

We must explain if proper steps of the quality assurance have been taken or in which cases the control must be enhanced

7.2 Contractor's controls

It is important to establish which directives concerning realization are relevant for the contractor. With the use of such directives concerning realization we must set:

Scope of documentation and

Standards of contract fulfilment (e.g. programming), etc

Next, we must establish means of control for the contractor:

Control accompanying the development

Acceptance controls of the made products

Assumptions of internal controls at the contractor's

7.3 Initial control of the components of the system

Different types of products and services require detailed information about documents, control and acceptance testing (as a supplement of works accompanying the project)

7.4 Encountered problems and activities taken to solve the problems

Here is a description of methods to be applied in case of reporting, tracing and solving the problems

7.5 Control of modifications and changes

Here is the list of requirements concerning the quality assurance QA with reference to procedures applied to change management and induced changes from the view of QA

7.6 Regulation of supervisory competences

Here is the description of the manner of QA supervision. It especially refers to the access to the documentation of the QA-results

7.7 Control of configuration management, data security and archives

Here is the description of the procedures in case of control of the configuration management, data security and archiving

Table 6.2   Quality model example

Q-model (HERMES 2003 2003)
0 General information
1 Aim of the document
2 Basis of quality model
Presents briefly the basics of the quality model (e.g. SPARDAT or ISO9126).
3 Specification (distinguishing features) of a product
Describes the specific character of a product/application/of the system, which is to be created.
4 Structure of significant quality features
Here is the enumeration of specific features alongside with the description of their significance, taken from the basic model of quality management
5 Quality goals
Here is the enumeration of the most important parameters of quality and the description of their influence on the goal of the project and product
6 Quality indicators and criteria of their accomplishment
Here is the description of quality indicators together with characteristics, criteria of their accomplishment and their measurement, taking into consideration the assessment and method of their performance
The particular quality features and criteria of their accomplishment can be enumerated with reference to particular stages

- Start the search of a benchmark partner
- Prepare plans for Quality Assurance, Quality Management and Quality Control taking into account the quality goals
- Develop the quality indicators and quality criteria
- Evaluate the initial status of all quality indicators

Results
- Model of quality management
- Quality Management System
- Preliminary Assessment of Project Results in Planning Phase
- Quality Assurance Plan
- Quality Management Plan
- Quality Control Plan
- Certifications

11:53 Implementation Phase

Tasks
- Control the product realization
- Conduct periodical control of the project
- Carry out benchmarks
- Carry out a quality control
- Carry out a control of project realisation
- Actualise QA-, QM- and QC-Plans

Results
- Control minutes
- Periodical control report of project status
- Benchmarks evaluation report
- Report on the control of the present (actual) state of the project
- Diagram of relationship of network elements
- Actualised QA-, QM- and QC-Plans

11:54 Closing and Evaluation Phase

Tasks
- Manage the process of quality assurance of the project realization and results
- Perform and document final quality acceptance tests
- Collect the acquired knowledge and enter data to knowledge management

Results
- Collected knowledge regarding quality management
- Documentation of final acceptance tests

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12:00 Problem Management: PBM

<div style="text-align:right">**7**</div>

Quick Look

What Is It?

Sooner or later each project faces a serious technical or organizational problem: something that exceeds the possibilities of daily routine decision making and the frames of scheduled budget. Problem management helps to bring the project back on track in a systematic, professional way.

Who Does It?

Problem solving is a chief's matter. However, there may be someone in a team or an available external expert who can efficiently lead the team towards problem solution and save some time of the chief. In any case it is advisable to involve the team members, who are closest to the source of the problem or subject to it's effects.

Why Is It Important?

Problems draw project out of it's scopes, let budgets explode or introduce unacceptable delays. This may have a negative impact on project team members, lead to the project stop or even have serious legal or financial consequences for all the involved. All reasons to counter it.

What Are the Steps?

Good identification of the problem and its reasons is a starting point; knowledge about the desired situation the other end. Systematic evaluation of the possible solutions and associated risks leads to the selection of the right countermeasures. The implementation of the selected solution closes this process.

What Is the Work?

Critical is the profound evaluation of the reasons, why problem occurred and the identification of the main causes. An exact recall of the project scopes and formulation of the desired situation at this very stage in the project help to assess the gap. There are always more than one way to close the gap – be conscious of the risks and choose carefully the most efficient solution.

How Do I Ensure That I Have Done It Right?
Problems mostly do not disappear – they rather amplify with time. So tangle them
as soon as you detect first symptoms. Use experts, any knowledge available to
identify the right sources and best sustainable solutions. Make them truly work –
half hearty steps will hit back with double impact.

Process

Problem Management process (Fig. 7.1) tackle the unplanned major issues in the
project and counter them consciously. The gained knowledge shall prevent problem
recurrence.

12:10 The Goal of Problem Management

The goal of Problem Management PBM is to solve in sustainable way technical and
organizational problems which emerged in the project within the planned project's
costs and planned time schedule. The process takes place during the whole project
duration. PBM comprises both problems' detection as well as supervision of the
selected solution's realization.

12:20 Methods

12:21 Problem Management Focus

In the process of project's realization, we encounter different unexpected
challenges. Their common denominator is the project time and budget, which
enforce the search of a solution within that frame.

To deal with them effectively, we shall select the way best suited with their
nature.

Problem Management process, and subsequently this chapter, focuses on the
technical or organizational issues.

The interpersonal occurrences demand a different approach. Depending on their
nature, they are deliberately treated in different human factor dedicated processes
(see Chapters beginning Chap. 14, 20:00 Human Resource Management: HRM and
the following).

Problems usually have vast impact on project and project team members.
Solutions demand creative and often unorthodox approach. It is purposeful to
involve a wider group of team members: all those, who might have something in
common with the reasons, why problem emerged as well as all those, who can
contribute to fast choice of the best sustainable solution. External experts may boost
the right diagnosis and right solution significantly.
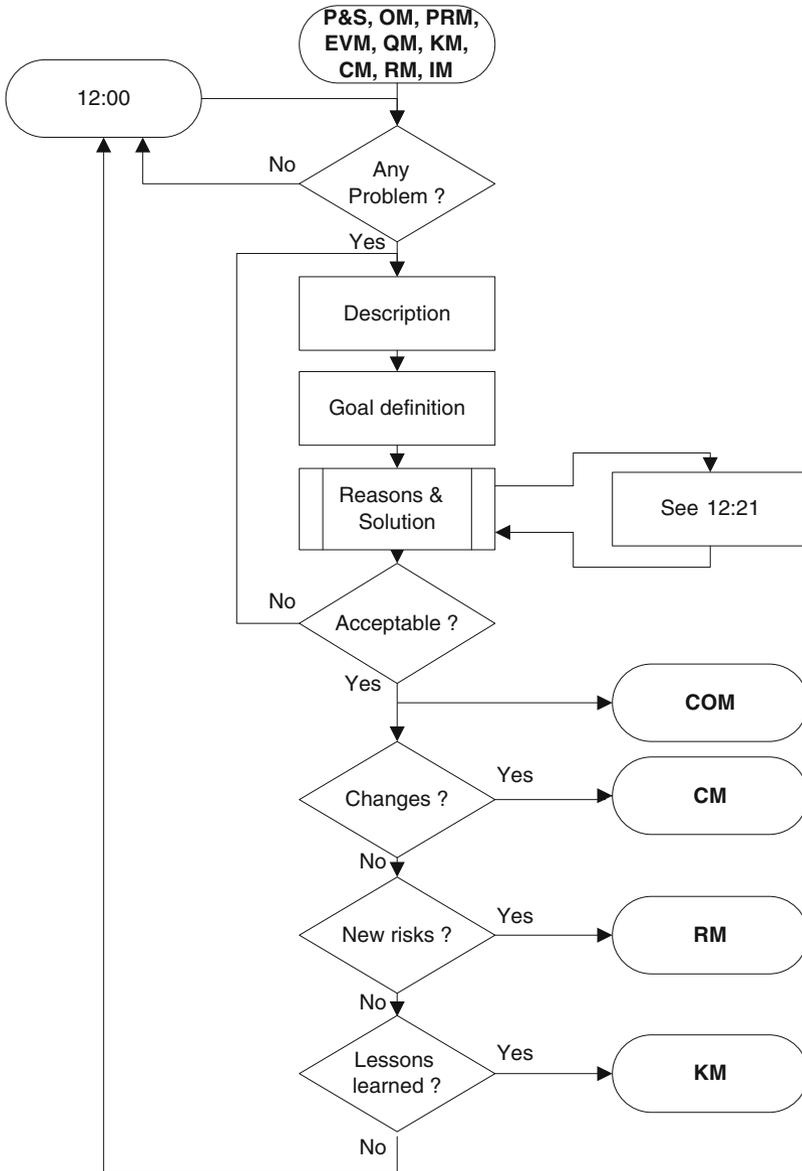
Fig. 7.1 Problem management process PBM

12:22 Problem Solving Procedure

Problem solving procedure is a substantial part of Problem Management. It begins with the proper description of the problem and ends with the implementation of the selected solution (Pannenbäcker 2003). (see Fig. 7.2).
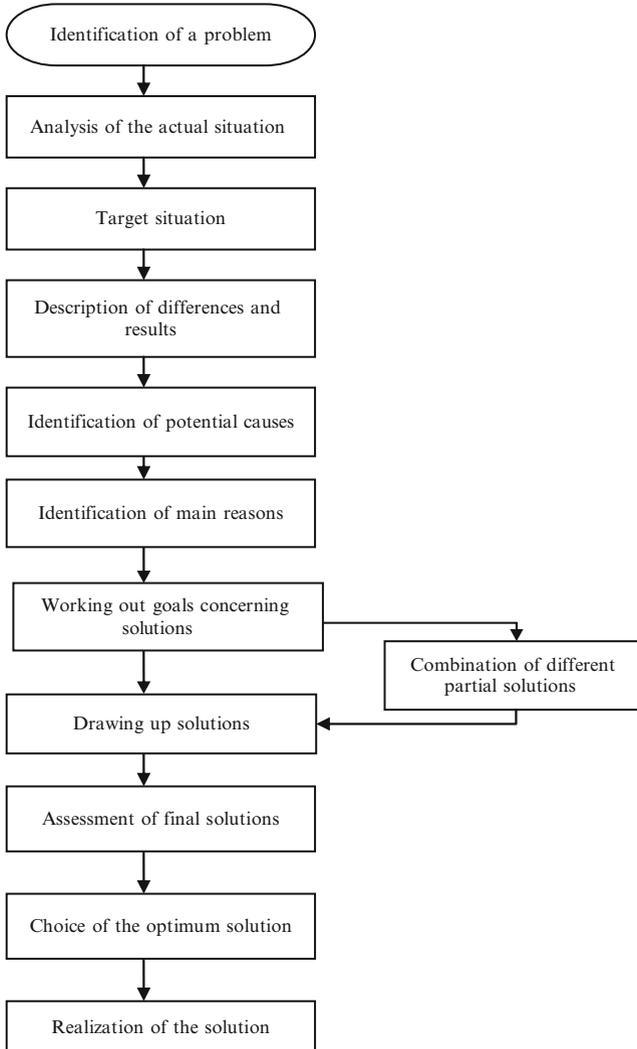
Fig. 7.2 Problem solving (Pannenbäcker 2003)

1. **Identification of a problem**
   Good identification of a problem is already half-a-way towards the right solu-
   tion. Problem shall be unambiguously distinguished and described in such a way
   that the description indicates the starting point of counteraction.
2. **Description of actual and target situation**
   The description of actual situation places the problem in a context: it appears
   together with all observations and information, which are or seem to be
   connected with the problem. Best way is when the project team together

describes the actual situation and proceeds to describe target state with the most important aspects the same way. Team work is essential: any additional question and description of the tar-get situation as viewed by different persons may deliver relevant hints on problem causes and potential solutions.

3. **Description of differences and results**

   By exposing significant discrepancies between the actual situation and the expected one, we accentuate possible directions of problem solving. We observe here mainly the con-sequences of the arising problem which exerts influence on the project and/or surroundings.

4. **Identification of potential causes of the differences**

   An effective problem solution can be achieved only through the removal of its causes. To identify the right one, all possible causes are gathered here. Problems may be induced by:
   - Man,
   - Organization,
   - Deadline,
   - Budget, costs,
   - Surroundings,
   - Methods
   - Technology.

5. **Identification of the main cause**

   Right solution begins with the identification of the main cause. Several techniques may be deployed in this step. It can be done for example through the ABC analysis.

1. **Drawing up solutions and their assessment**

   First, the goals of potential solutions are carefully and thoroughly formulated.

   Then, all possible steps in order to achieve the goal are drawn up. Different partial solutions can make a complete solution. The elaborated solutions can be later improved and supplemented.

   The optimum solution may be drawn up on the basis of different assessment methods (ABC analysis, analysis of functional value etc.).

   The stage of problem solving is finished when the involved persons who defined the problem are convinced that the worked out solution is a target one and it really eliminates the problem and/or its results on the way to project's scope achievement.

1. **Solution's realization**

   In order to secure the realization of the selected solution it is purposeful to define an action plan:
   - What should be done?
   - Who should do it?
   - Which auxiliary measures should be taken?
   - When the action can be considered as finished?
   - Who controls the results?
   - What will happen, if the taken steps do not bring the expected success?

Example

During the project management it is impossible to keep an important deadline.

1. **Identification of a problem**

   It is impossible to avoid the delay in spite of the taken precautionary measures. The goal of the solution is re-synchronization of the magic triangle: cost, deadline and result with the planned values/amounts of cost-deadline-result triangle.

2. **Description of the actual and target situation**

   The gap between the actual and target situation increases (extrapolation of the currently achieved results).

3. **Description of differences and results**

   It is impossible to keep the deadline, because of insufficient production capability. In case when the situation remains as currently unchanged for a longer period of time, the costs of the project are going to get doubled.

4. **Identification of potential cause**

   - Incorrect appraisal of costs in the process of project planning
   - Holiday leaves have not been worked into the schedule while planning
   - No planning of regulations concerning replacement
   - Wrong priorities during the project planning
   - Sudden absence of project's team members
   - Insufficient abilities of the project's participants

5. **Identification of main reasons**

   The main factor with most negative impact on goal achievement is the planned absence of two engineers (holiday leave)

6. **Drawing up solutions and their assessment**

   (a) Getting additional team members – impossible for financial reasons

   (b) Suspension of the holiday leave for both engineers – at cost of their cancelled holiday travel commitments.

   In this case, the second (b) solution is chosen and realized.

7. **Realization of chosen solution**

What should be done?	Cancel all Travel Arrangements, refurbish the costs
Who will do it?	Cancellation: Project's assistant Ms X
When?	Refurbishing the costs: Accountant Mr Y 10.05.10

12:30 Techniques and Tools

Figure 7.3 illustrates the recommended techniques in the process of problem solving.

Problems by nature appear unexpectedly and as such call for the fastest possible solution. Therefore, for the sake of time, in most cases only selected crucial elements of methodical approach are performed. The particular, most frequently used techniques are presented below.
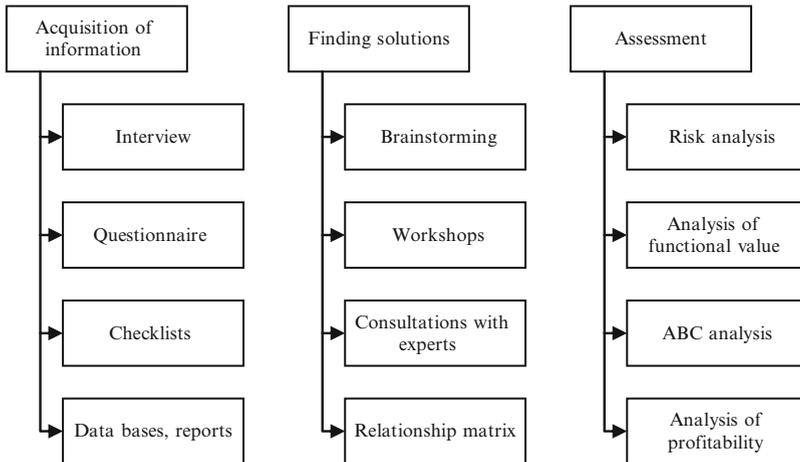
Fig. 7.3 Techniques and tools in PBM

12:31 Techniques of Information Acquisition

Interview

Interviews, as well as coincidental chats – in the hall, in a canteen etc., are one of the most appreciated and efficient means of acquisition of information while tracing possible problems. They provide the project manager and the project team with a unique possibility of getting information concerning both the issue and the sphere of impressions, directly from the involved person.

Crucial for proper problem analysis is best possible gathering of all information concerning possible causes of the problem. The interviews and chats offer good possibility to question our counterpart, attentively perceive the answers and – what is even more valuable in case of problem identification – read the body language during the answers. The last may be the main source of real information in case sensible performance issues are involved.

Interview is a formal way of information exchange, planned in advance and agreed between the participants with regard to time, place and agenda. Both parties have a chance to prepare and even elaborate the questionnaire. This results usually in smoothed version of answers and, in fact, consciously or unconsciously falsified description of the reality.

Not surprisingly the apparently spontaneous and coincidental chats are in some cases not so coincidental as they seem to be to the interviewed person. In search of real information the whole set-up of such a chat is well prepared in advance, the seemingly irrelevant remarks are well placed questions, and the whole even shortest encounter is meticulously masterminded.

Time Allocated for an Interview or Chat

Special attention shall be given to the time allocated to the interview or chat. In the later case it might be more challenging as we can only anticipate our counterpart schedule and cannot predict his engagement in the chat, nor his willingness to spend the time with us.

In most cases we are confronted with a fix time allocated to an interview or uncontrollable duration of a chat. The subject and purpose of the interview or chat are crabbed as the time elapses. Significant details might get by unnoticed.

Yet, we should strive to adjust the time planned for an inter-view or chat to the complexity of an issue. In most cases after 1–2 h, the attention of participants falls down and either a consecutive follow-up meeting or a brake is necessary.

Documentation

The result of an interview, the interview or a chat itself should be documented. Useful are meeting minutes made after the interview, notes during and after each answer, filling in of the prepared survey, as well as recording the whole interview. The last three can not be done visibly to our counterpart while chatting. (Pannenbäcker 2003).

Questionnaire in a Written Form

Unlike an interview, during which both parties have the possibility to comment or precise the statement upon additional question, questionnaires in a written form are mostly carried out in an asynchronous way between the questions and given answers. This allows the interviewed per-son to reconsider the answers, take any time intended for this task and, in case of anonymous questionnaires, to provide openly honest reply, otherwise unobtainable.

Preparation of a useful questionnaire is a comprehensive and complex task. All questions have to be perfectly unambiguous and leave practically no room for any interpretation other than intention of the author (Kühn and Fankhauser 1996, p. 173 and further). In practice, the technique is often viewed as too demanding and requiring too much time. In case of problems, which demand a thoughtful analysis and concern many persons, in spite of all the above, it can be still the only and proper technique.

The following issues are to be considered in case of questionnaires (Pannenbäcker 2003):

- The asked questions can be consciously or unconsciously understood in a wrong way. That is why it is suggested to ask the so called control questions.
- Respondent can also be given only a limited possibility of various statements (so called closed questions)
- If a questionnaire is filled out in the presence of a pollster, it may have an influence on the given answers.
- Form, way of conducting and the analysis of questions asked in a written form, as well as the danger of reluctant conduct of questioned person, can require even bigger effort than anticipated.

Survey

Survey is a more comprehensive form of asking questions useful in case of asking unprepared and, to only limited degree, involved persons. It may be conducted in a written printed out form distributed over conventional distribution channels or electronically in an interactive manner. The survey thus must enclose:

Preliminary Letter

In a preliminary letter we include the goal, relation between the respondent and the subject of the survey (why exactly this person is asked questions), deadline to respond, contact persons in case of further questions as well as advanced expression of gratitude to the respondent for taking care and time for providing the answers. If an analysis of anonymous answers is sufficient for problem identification, then we should also assure the respondent about the anonymity here.

Title Page

The title page identifies the initiator of the survey and way how he can be contacted. The goal of a survey has to be stated and an average time for answers, (in any case not longer than 30 min!) shall be given. Deadline to return the survey and exact address are mandatory.

Initial Set of Questions

The first set of questions of the survey is used as the 'Ice breaker'. It is achieved through simple questions, which can be easily answered and which at the same time present the respondent with the topic.

Main Set of Questions

Main set of questions of a survey includes questions for which the pollster seeks answers. This is the core of a survey and should be properly prepared.

Additional Remarks

In the part additional remarks a respondent is given a possibility of providing further information, additional questions or comments. It is usually realized through open questions.

Demo-Graphical Data and Thanks

If it is necessary, we also ask questions concerning demo-graphical data concerning the respondent or his/her position. They can be useful in the answers' analysis. At the end, we should thank the respondent and place again the address, where the survey should be returned.

The analysis may start with the first received replies. It is important that all results are documented and stored together with other completed surveys.

Checklists

Checklist is built up of questions, which aim is to identify and describe the problem together with its reasons. Checklist for the purpose of Problem Management shall include:

- What exactly is wrong, and how should it be?
- When exactly did the problem arise?
- What was the reason of the problem's escalation?
- Is it a problem in the area of technology or organization or a problem connected with a human factor?
- Is it possible that the technology or organization problem stems from personal reasons?
- When does the problem may be registered and when does not?
- Where was the problem observed?
- What do we know about the problem?
- What should we know about the problem?
- Is it certain that the problem is not a symptom of a different problem?
- What is the starting point for the problem's solution?

Data Bases and Reports

Another source of information can be the existing data bases or reports. They must be searched purposefully in order to find useful information. However the data recourses in the present companies have too big volume for a comprehensive research without a set goal. Due to that, a project manager must know exactly what to examine or search. The process of searching can be systematical or with the use of free questions. The goal is to compare and find relationship between the information from the data bases and the data gathered otherwise.

12:32 Techniques of Searching Solutions

Brain-Storming

Solution of a problem often requires a new or unconventional type of idea. Brainstorming described in Chap. 2, 07:00 Planning & Scheduling: P & S, serves well for identification of such ideas.

Workshops

If a choice between several good ideas concerning solution has to be made, workshop is a good and efficient way to go. The discussion which takes place during the workshop may lead to new ideas extending the number of available alternatives.

Two solutions are practicable: either all participants of work-shops work on the same alternatives, or different subgroups are created, each working on their own alternative of solution. As next, all elaborated ideas are presented on a forum and discussed again.

At the end of a workshop or a cycle of them, the number of alternatives must be reduced to a possibly small number of well founded working solutions. All notes taken on flipcharts, wall boards, transparency etc. must be kept for the purpose of documentation.

Delphi Procedure

Ideas and alternatives of solutions can be found with the support of experts along the Delphi procedure (see also Chap. 2, 07:00 Planning & Scheduling: P & S, Chap. 5 10:00 Earned Value Management: EVM).

Mind-Mapping

Mind Mapping is a cognitive technique stimulating the associations with similar or related entities. (Buzan et al. 1996) The interrelationship between the components is depicted in a form of a graphical presentation. Alternative solutions are divided into the components (entities) which are linked and hierarchically structured. The entity which describes a problem or seeks a solution is placed in the middle of the page. The individual solutions are drafted starting from that central entity building a tree of identified components (Bergfeld 2003) Visualization helps to identify contradictions, interdependencies and assess the complexity of each solution.

12:33 Solution Assessment and Selection Techniques

Functional Value Analysis

While the analysis of risk level makes an attempt to quantify the potential damage in a project, the Functional Value Analysis (FVA) concentrates on the benefits which are provided by the alternative. In fact, certain benefits are difficult to express in numbers, e.g. delivery deadlines, product's quality, working conditions or motivation of partners (Garcia and Hirakata 2008). In order to achieve a basis for the overall assessment of a solution, Functional Value Analysis balances all important aspects of alternatives and assesses them with the use of points allocated to a specific functional value. The metrics is well suited for evaluation of the initial project scope definition and earned value analysis. (Pannenbäcker 2003).

The Functional Value Analysis consist of the following steps:

FVA Criteria Definition

Firstly, project team involved in elaboration of the FVA has to formulate the FVA criteria, along which the analyzed problem solution will be evaluated.

Balance of FVA Criteria

In this step criteria are mutually balanced through the evaluation of their relevance to the sought problem solution.

Table 7.1 Exemplary FVA metrics

The level of the fulfillment of the criterion	100	≥98	≥95	≥90	<90
Points of functional value	10	8	6	4	0

Table 7.2 Exemplary FVA evaluation

Criterion	Maximum amount of points	Solution a	Solution b	Solution c
Level of the fulfillment of goals significant for the user	20	20	18	12
Fulfillment of the producer requirements	10	7	10	0
Operational results	10	10	9	10
Associated risk evaluation	10	9	5	10
Probability of keeping the deadlines	20	18	12	18
Costs	30	24	26	28
Total (the best option is the one with a maximum number of points)	100	88	80	78

FVA Metrics

In parallel to the balance of all criteria, metrics for each single criterion is to be defined. The metrics can be functional or in form of a matrix as presented below in Table 7.1.

Assessment of the Alternatives

Once the criteria are mutually balanced and metrics being developed, the fulfillment of each criterion of all alternatives can be assessed by a project team.

Calculation of the Functional Values

For each assessment the functional value is assigned along the agreed metrics. The final assessment of each alternative is achieved by summarizing the assigned point values for each alternative. In practice, a simplified example could look in the following way (see Table 7.2)

In the above example the highest score of the acquired FVA values is the winning option. It is also possible to reverse the evaluation and to follow the minimal values. However, the reader is discouraged to mix the individual criteria to be either best minimum or best maximum, as this usually leads to some errors and miscalculation in the final evaluation.

Sensibility Analysis

If we are not certain about the correctness and precision of the results or when the assessments of alternatives are very similar to each other, it is purposeful to adjust the metrics for better differentiation or check their stability with the calculation of a deviation of component values.

Results

The results including minutes of meetings and consecutive iterations shall be properly documented.

ABC Analysis

ABC analysis (Pannenbäcker 2003) is often used as a heuristic procedure based on the otherwise proven rule, that in the whole set of possible reasons of problems there is a small subgroup (the so called A reasons and solutions), which has a decisive influence (rule 80:20) on the final solution. Examples: the single occurrence which determines the fate of the project, like e.g. wrong composite or change to a completely new technology which solves once and forever the critical composite risk. Thus, it is purposeful to focus ones attention and to concentrate the efforts on this subgroup (class). In the second B class there may be up to 50 % of all possible solutions, but they contribute only 20 % to the total solution. The remaining third group sometimes as large as B class contributes only 10 % to the total success. The following ABC analysis procedure is suggested:

- Determine the assessment criteria to qualify the alternatives into the classes A, B or C (e.g. risk potential and/or probability of its occurrence),
- Assess the outcome of the alternatives,
- Put the alternatives into a sequence as they contribute to the total solution,
- Add and verify the result of the assessment of all alternatives (=100 %),
- Compare the assessment results of each alternative in relation to the total of 100 % (data in percentage),
- Display the evaluation results graphically in a system of coordinates (the axes present cumulated values)
- Delimt and choose the class A, B and C solutions.

Profitability Analysis

The elaborated alternatives must be checked also for their profitability. The same ratio criteria of various mechanisms as presented in Chap. 2, 07:00 Planning & Scheduling: P & S and in Chap. 5, 10:00 Earned Value Management: EVM may be applied (Berman et al. 2005).

12:40 Templates

12:41 Project Documents

The document identification of exceptional situation is used to describe problems taking place during project realization (Table 7.3). The document helps later to compare the reasons of the problems and their solutions.

Exceptional situations must also be monitored in order to ensure the realization of accepted problems solutions and possible avoidance of reappearance of the same problems in the future.

Table 7.3 Problem evaluation form

Identification of exceptional situations (HERMES 2005)
0. General information
1. Identification
Number of exceptional situation
Short description
Date
Author
2. Priority
Level of urgency
Where and how does the exceptional situation exert influence (system, available measures, resources, achievement of decisive points)
Category (error, problem, sickness, accident, etc.)
3. Impact of exceptional situation and precautionary measures
Estimation of the impact of exceptional situation
Definition of conduct in order to take control over the exceptional situation

List of exceptional situations/problems (HERMES 2005)
0. General information
1. Identification
Project identification
Date
2. For each problem/exceptional situation:
Identification of a given problem
Progress in the process of problem solution (identifies in a text – critical state, solution)
Person responsible for solution
Deadline, up to when the solution should be realized

12:42 Documents of the Project Results

The documentation of the process of problems solving make the solutions management easier and increases the effectiveness of the process (Table 7.4).

12:50 Activities and Deliverables of Problem Management

12:51 Initiation Phase

Tasks
• Draft with the team possible rough problem solving approach

Results
• Rough problem solving approach agreed with project team

Table 7.4 Solution documentation

Solution to a problem x
0. General information
1. Problem
General description of a problem, also in connection with its context
2. Traits characterizing a problem
Detailed description of a problem with its properties. We must take account of all the aspects of a problem (technical, organizational, professional and personal dimension)
3. Procedure applied to solve a problem
It includes a description of the ways how the problem solution have been sought. Each alternative comprises their utterances concerning the usefulness of a given conduct in relation to a specific problem, possibility of adjustment to the conduct, as well as possible alternatives of execution
4. Results of problem solving
The results of problem solution are described in detail. They also include the most important elements of the analysis of the process of problems' solution
5. Results verification
The functionality of problem solution must be checked after a given period of time. At this point we must present results of the control; it is possible that it may lead to further correction, which analogically to problem solution in PBM, are formulated and treated as a motion for changes implementation
6. Change Request
On the one hand, we must formulate all change requests necessary to find a solution, as well as describe these change requests. This way it is possible to trace again the route leading to the solution as well as partial results of the process. On the other hand, we must also enumerate all changes currently in the implementation, including their present state, which can appear during further verification of problem solution (see point 5 of the document)

12:52 Planning Phase

Tasks
- Define the exact problem solving procedure
- Establish the problem management team
- Define and put through the team acceptance the problem description documents
- Make the problem management operational

Upon Problem Appearance:
- Conduct the acceptance of problem description
- Evaluate the actual and target situation
- Describe the differences and their results
- Identify possible causes
- Identify the main cause
- Prepare solutions and their assessment
- Supervise the realization of solution
- Secure the documentation of the process
- Initiate appropriate processes COM, RM, CM, KM

Results
- Problem Management procedures and templates
- Problem Management organization
- Documentation of the results of problem solutions

12:53 Implementation Phase

Tasks
- Analogically to 'Planning Phase'

Results
- Analogically to 'Planning Phase'

12:54 Closing & Evaluation Phase

Tasks
- Analogically to 'Planning Phase'

Results
- Analogically to 'Planning Phase'

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Quick Look

What Is It?
In each project unexpected occurrences demand handling. By preparing possible reaction to those occurrences and later acting correspondingly in systematic way we can significantly reduce negative impact on our project. We call it risk management.

Who Does It?
Each team member shall be made sensitive to possible risks. Someone in team shall take charge to lead the preparation and – during the project course – handling of the potential and already occurred risks.

Why Is It Important?
Risks have always negative impact on project. Their unpredictable occurrence can magnify this negative influence. By analyzing potential risks and preparing the suitable measures we can reduce this impact to the level acceptable to the project customer/sponsor.

What Are the Steps?
At the very first planning, initial risk assessment and detection system shall be done. An evaluation shall lead to the preparation of countermeasures. Upon risk occurrence the prepared action shall be initiated and lessons learned shall be forwarded to Knowledge Management.

What Is the Work?
First the analysis of possible occurrences with negative impact on the project shall be done. Probability of occurrence and impact level shall lead to some classification. Measures shall be elaborated with regards to the risk as well as it's impact and procedures of their application shall be defined. Upon occurrence proper handling is to be adopted, including unforeseen events.

How Do I Ensure That I Have Done It Right?
It is advisable to entrust creative analyst in a team with the responsibility for this process. Whole team and, wherever applicable, external persons with suitable expertise shall be involved in risk analysis and evaluation. Elaborated measures shall have

sound economical justification. Make sure that customer/sponsor of the project fully support your risk assessment and expenditures for mitigating measures.

Process

Risk Management process (Fig. 8.1) prepares possible measures to mitigate potential risk or reduce impact upon their occurrence by systematic risk analysis and assessment of the prepared measures. Upon risk occurrence suitable actions are undertaken. The gained knowledge shall prevent problem recurrence.

13:10 The Goal of Risk Management

The goal of risk management is an economical minimization of negative impact of unexpected occurrences in project through constant identification and analysis of potential hazardous situations, elaboration and conscious implementation of the chosen precautionary countermeasures.

ISO 21500:2012, in the description of the process 4.3.28 Identify risks, includes also the events with positive impact into the risks under consideration (ISO 21500:2012 2012). However, in the view of the author, positively impacting events are mandatory in planning of the project and upon occurrence in any case to be implemented. As such there are different methods of dealing with both types of events. Therefore in the considerations of this Chapter only events with negative impact are further considered here.

13:20 Methods

ISO 21500:2012 distinguishes four risk-treatment related processes (ISO 21500:2012 2012):
4.3.28. Identify Risks
4.3.29. Assess Risks
4.3.30. Treat Risks
4.3.31. Control Risks

The Assessment of the identified risks comes in a sequence after the identification and is in praxis a part of risk analysis. The more profound risk assessment includes the countermeasures elaboration.

The risk treatment is covered by the risk handling procedure hereafter.

Risk control according to ISO initiates changes and corrective actions. Methodologically corrective actions have to be treated in a coordinated way with other risk treatment procedures. Therefore, they are included in the Risk handling Procedure, too. As the norm does not consider any problem beyond the agreed risk management handling or knowledge management contributions, is risk management in this chapter differently treated. Yet, all the deliverables and actions of the ISO 21500:2012 risk management processes are thoroughly covered here.
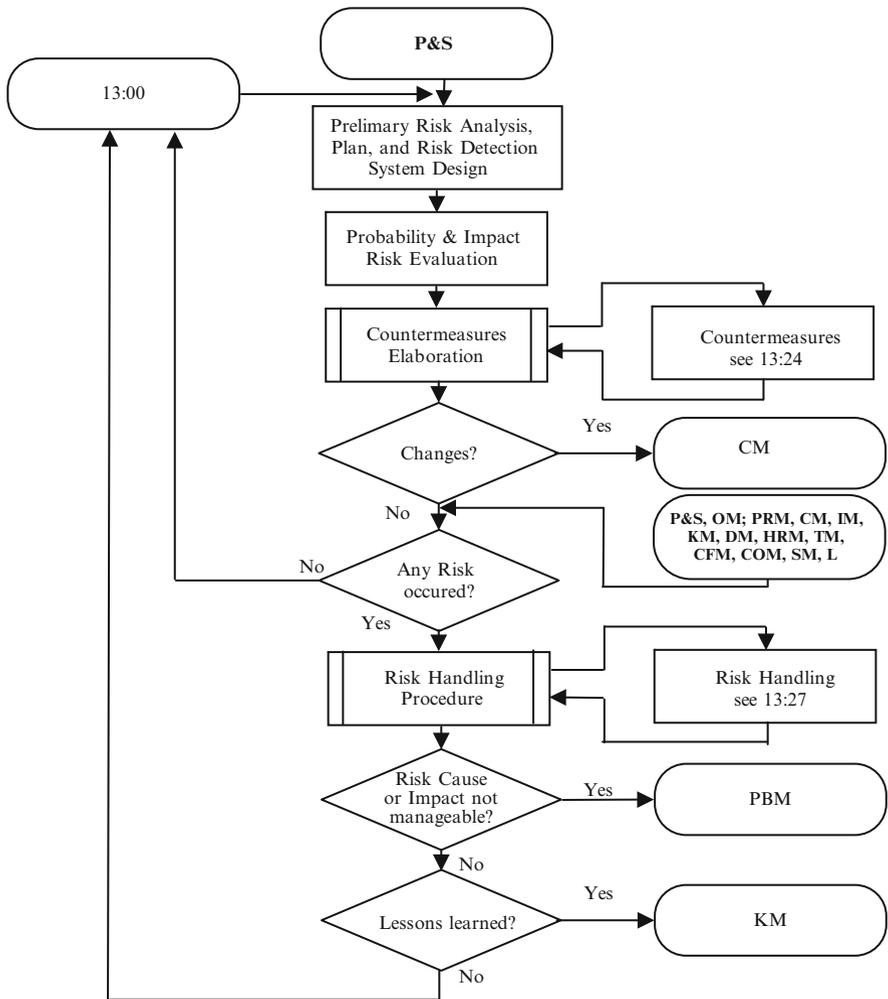
Fig. 8.1 Risk management process RM

13:21 Terms

- **Risks for a project:**
  Probable events or situations (with a probability of occurrence P) with negative impact (D-damages) on the deadline, costs and/or results of a project. The multi-plication of P*D defines project Composite Risk Index CRI (Rohrschneider 2003).
- **Risk management:**
  Identification, assessment and priorisation of risks, followed by coordinated and economical application of resources to minimize, monitor and control the probability and/or impact of unfortunate events (ISO/DIS 31000 2009).
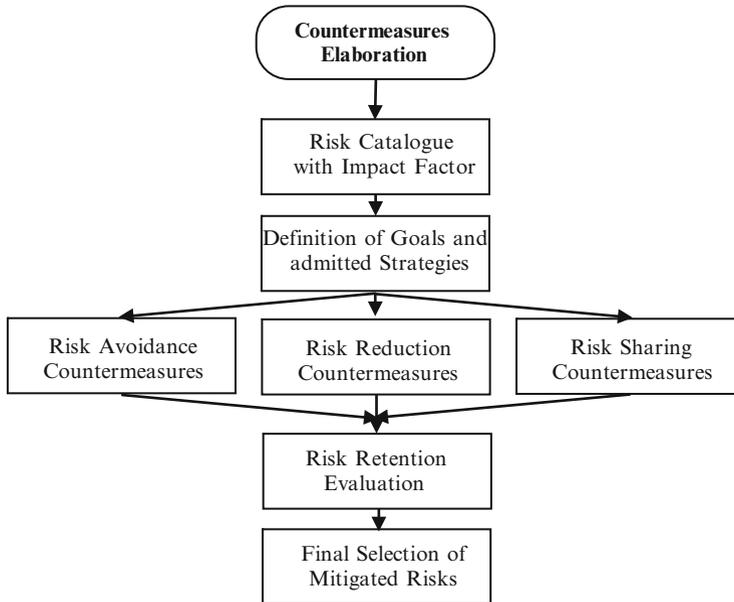
Fig. 8.2 Countermeasures elaboration

13:22 Preliminary Risk Analysis, Plan and Risk Detection System Design

From the very first days of a project we encounter some hazards (risks) for a planned course. Therefore, simultaneously the analysis of possible risks has to be conducted, counter-measures have to be elaborated and the risks have to be accordingly handled. The process must be periodically repeated in order to register changes both in the hazardous situations as well as in the undertaken precautionary measures. Frequently we are able to assess the probability of risk even before the project begins, yet their results and damages appear later (Rohrschneider 2003).

In Planning and Scheduling (see Fig. 8.2) the preliminary risk analysis accompanies the elaboration of the project structure plan.

Subsequently the planning, goals setting and framework for the risk management are set. ISO 31000 names this phase "establishing the context" (ISO/DIS 31000 2009).

Risk Detection System

Crucial to further effectiveness of Risk Management is the detection system adopted in the project. Basically only symptoms of occurrences which pose a risk to the project may be identified. The creativity may be supported here by the selection of the proper reasoning system, like e.g.:

- Taxonomy based identification (sources are classified along best cases)
- Project goal deduced risk analysis (the occurrences preventing the goals achievements)

- Project scenario deduced risk analysis (possible threats during project course are considered)
- Company check-list based on best case experience

Suitable indicators with threshold level shall be defined in this stage of Risk Management.

With preliminary risk assessment and selected detection system reasonable planning of the next actions may be planned.

13:23 Probability and Impact Risk Evaluation

Priorisation Along CRI

Probability and impact risk evaluation aims at the priorisation of the possible risks. The priorities are set along the Composite Risk Index CRI (Rohrschneider 2003; Cadle and Yeates 2008), resulting from the multiplication of:

- **Probability of risk occurrence**
  Probability P assessment of the real danger (the risk turns into a fact), which specific situation poses in a project. It is usually expressed in percentage (see also section "13:32 Assessment of Risk Rate").

- **Impact on the project course**
  Assessment of the potential damages D, caused by risk occurrence, usually estimated in certain financial values or relative impact scale (e.g. 1–5).
  $CRI = P * D$ leads to clear priorisation: the higher the value of CRI, the higher is the priority of the risk on the list of occurrences, which endanger the project.

Project Scenario Deduced Risk

We encounter two types of risks in projects:

Considerable amount of risks with high CRI originates from project course. According to CHAOS Group research (Gaulke 2004), the following main risks can be named:

- Insufficiently defined requirements
- Lack of contact with a user
- Lack of resources/funds
- Unrealistic expectations
- Lack of support from the board of management
- Change of requirements and of specifications
- Lack of planning

Project Goal Deduced Risk

The second main group form the project goal related risks, These are technological, safety, performance, acceptance risks, just to name few.

Risk Identification

Risk analysis shall be performed periodically, triggered if not by tickets from other processes, than at least by the L-Timer® recurrence. In the course of a project risks are constantly supervised and if proves necessary, a comprehensive analysis shall be prepared from the scratch. Ideally, risk identification is the result of team work, or at least it is agreed with the team (Cadle and Yeates 2008). Identified risks and the evaluation of possible damages form together risk catalogue with impact factors.

The following examples of risks groups might be taken under considerations:

- **Human factor:**
  - Have the people who play an important part in a project their replacements?
  - Who belongs to the group of people playing an important part in a project/ decision taking entities?
  - Do the project managers possess professional and social competence?
- **Technique**
  - Have the applied technologies been already checked?
  - Will the technologies be supported for at least next 10 years?
  - Where in the course of a project can we identify activities with particularly high rate of innovations?
  - Do the technologies and work directions correspond with the strategy?
- **Budget**
  - Is the budged realistic?
- **Organization**
  - In what way does the project influence the existing economic processes?
  - Are there any objectors to the project?
  - Are there any sponsors for the project?
- **Goals**
  - Which results and project works are subject to special quality requirements?
  - Are the requirements concerning the principal and the user detailed enough?
- **Frame terms/restrictions**
  - Are there any legal restrictions?
- **Deadlines**
  - Is the planning realistic?
  - Is there a critical path?
  - Is there any time interrelation with other projects?
- **Practical and theoretical knowledge**
  - Where especially is the practical and theoretical knowledge needed?
  - Do the partners in a project have the necessary professional knowledge?
  - Is it necessary to involve external advisers?
- **Project surroundings**
  - The existing surroundings
  - Influence of line organization
  - Management
  - Change of strategy

13:24 Countermeasures Elaboration

Countermeasures

The goal of countermeasures is the reduction of the Composite Risk Index. In order to achieve that, it is necessary to identify and assess the costs of countermeasures implementation (Rohrschneider 2003). Basis is risk catalogue with impact factor, elaborated in the precedent risk analysis.

Risk Counter-Measures Goals

Countermeasures elaboration may follow various goals and strategies. Goals may be:
- Better description of a risk,
- Better identification of the risk source,
- Faster identification of risk occurrence,
- Suppression of the risk occurrence effects,
- Elaboration of countermeasures and their costs estimation.

Risk Priorities

The risk countermeasures shall be weighted against the benefits of their application and the total costs of the project. Most commonly the costs of countermeasures are limited and priorities has to be set as which of them shall be applied. In setting the priorities various aspects can be taken under considerations: Risk assessment, Costs of Countermeasures vs. benefits, realizability of countermeasures, social impact, team motivation and so on.

The strategies fall into the following classes:
- Avoidance (eliminate, withdraw from or not become involved),
- Reduction (optimize – mitigate)
- Sharing (transfer – outsource or insure)
- Retention (accept and budget)

These strategies are called sometime ACAT (for Avoid, Control, Accept or Transfer) in resemblance of similar term describing the US Defense industrial procurements, where risk assessment plays a considerable role. Figure 8.2 illustrates the countermeasures elaboration, following these strategies.

Risk Avoidance

The risk avoidance countermeasures basically aim in not performing the desired action, thus not giving a particular risk an opportunity to occur. However, this means that the originally planned action is not done, too. This may not be an intention of the project – so avoidance may be only selectively applied (e.g. withdrawing from off-shore activities).

Risk reduction countermeasures aim in:
1. Minimation of the damages or
2. Minimation of the probability of damages.

Good example is the deployment of inflammable materials in fire-prone environments.
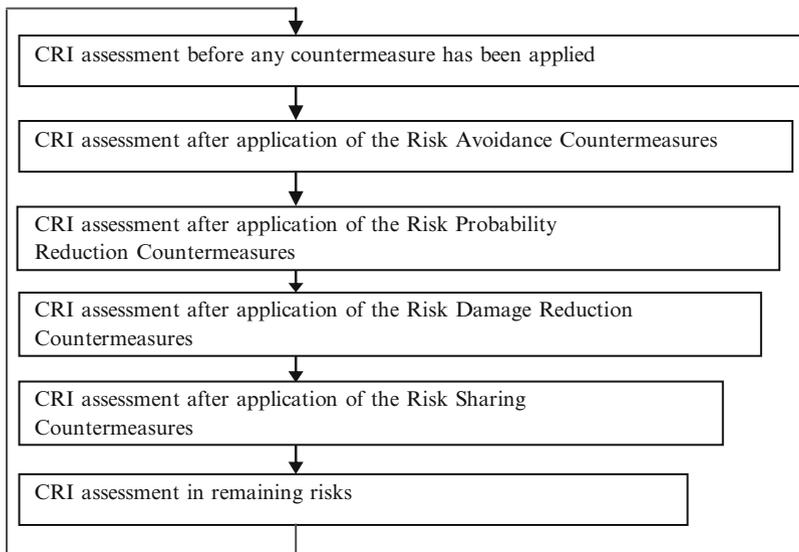
Fig. 8.3 Countermeasures efficiency assessment procedur

Risk Sharing

Risk sharing countermeasures actually transfer part of the losses caused by damages to other party. It may be financial participation of venture capital in project or agreement with customer to accept lower performance of the project results in case time of delivery has a priority.

Risk Retention

The retention unfortunately does not foresee countermeasures. These are all risks, which are consciously left untreated for whatever reason. Design of commercial aircrafts usually excludes the provision of all passengers with parachutes.

Once the catalog of countermeasures is elaborated, an evaluation along the goals, priorities and selected criteria can follow. Finally a list of risks, planned to be mitigated and suitable countermeasures is available for planning and deployment.

13:25 Countermeasures Efficiency Assessment Procedure

Reasonable deployment of countermeasures calls for certain gradation of their application and an assessment of the Composite Risk Index CRI at each stage. This way a selection of suitable measures from the catalogue can be done and matched with the project course. An evaluation follows the steps depicted in Figure 8.3.

13:26 Risk Detection System

Risk Detection System

The risk analysis produced risk catalogue with risks anticipated and treated with countermeasures as well as risks, which for whatever reason are not traced further.

Correspondingly the risk detection system shall be conceived.

Firstly, the mitigated risks are to be evaluated upon criterion of their best detection. Cost/benefit function for possible detection actuators shall be applied. The actuators shall be distinctive in a sense, that each risk shall be anticipated with possibly lowest number of cost effective actuators.

Secondly possibly comprehensive detection actuators shall be set for early detection of all other risks.

The system may be mixed: technical sensor (fire), human rapport (daily), suspect process evolution.

13:27 Risk Handling Procedure

Risk Handling Upon Occurrence

Risk precaution measures are elaborated on early stage of the project and continuously actualized through all the phases. Shall any anticipated risks occur, handling shall follow trace the reasons and improve the countermeasures either preventing the risk reappearance or limiting the damages caused by that type of risk. In case of completely new situation corresponding exception handling shall be initiated. Figure 8.4 depicts the procedure.

13:30 Technique and Tools

The techniques and tools presented in Chap. 5, 10:00 Earned Value Management EVM and Chap. 7, 12:00 Problem Management PBM can be also applied in the process of RM. The techniques unique for RM are presented below.

13:31 Risk Identification

Besides creativeness techniques, which have already been presented (e.g. Chap. 2, 07:00 Planning & Scheduling: P & S), for risk identification w can successfully apply own and company's experiences. Few techniques effective in risk management are presented hereafter (Gaulke 2004):

Analysis of Project Documents

Regular analysis of the existing documents of a project constitutes a good basis for the detection of potential risks.
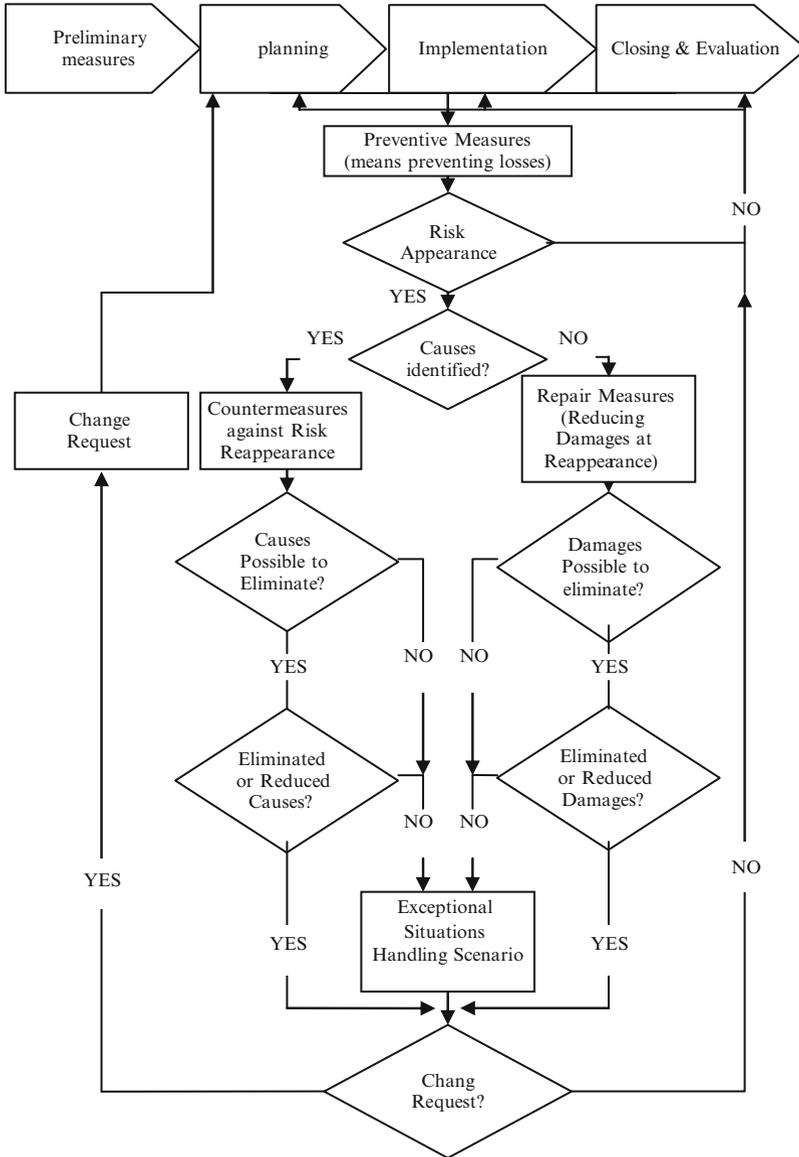
Fig. 8.4 Risk handling upon occurrence

Workshops Concerning Risk

The analysis of possible risks is carried out on meetings with internal and external specialists. With the use of creativeness techniques such as e.g. brainstorming, Delphi conduct or morphological table (see Chap. 2, 07:00 Planning & Scheduling: P&S) we attempt to identify, describe, assess (costs calculated on the basis of

earned value) the potential and probability of the earlier de-fined risk occurrence, as well as to differentiate them. It results in a check list of activities taking account of the probable risks for a project, their description, probability of occurrence, probable losses etc. We must take into consideration the fact that the probability assessment in this case is subjective and thus should be checked by independent experts (Rohrschneider 2003).

Experience of Partners

The chosen partners of a project from different spheres and levels in a hierarchy are asked during personal interviews about their assessment of project risks. In exceptional situation we can also use surveys.

In practice, however, such clues are very often ignored, since the project managers are focused too much on the achievement of project goals or have too optimistic attitude.

Own Experience

One's own experience but also the existing risk analysis can – optionally after being adopted to a given project – contribute to the risk identification. However, in case of clues gathered this way about the probable risks, it is necessary to evaluate their relevance to the current project.

Check List of Activities

Check list of activities, often including a list of potential risks is an effective way of an overall risk evaluation in a project. Since specific risks cannot be identified through such a check list, it is nevertheless purposeful to carry out the analysis of risks in a project. The questions already enumerated in section "13:23 Probability and Impact Risk Evaluation" with the purpose of risk identification are a good example of such check list (Gaulke 2004; Bundschuh 2003).

Systems of Risk Early Detection

Systems of early risk detection enable the analysis of the pre-sent situation in a project from the point of view of the elaborated risk indicators in a system. This ostensibly more detailed procedure in comparison to the previous one, is as effective as accurate are the indicators of risk and their threshold value. For the preparation of risk early detection system the following can be applied: numerical indicators (see Chap. 5, 10:00 Earned Value Management: EVM, section "10:31 Workbench"), analysis of the milestone trend (same chapter, section "10:34 Time Control Procedures: Trend Analysis"), analysis of costs trend (same chapter, section "10:35 Cost Driven Management").

13:32 Assessment of Risk Rate

It is helpful in risk assessment to quantify the probability of risk occurrence as well as the value of possible damages.

Assessment in Non-dimensional Scale

It is known that the approach to express the probability of risk occurrence in exact percentage values leads to endless discussions. So, instead of that, we create so called non-dimensional scale with categories of risk probability and damages assessment, which are not in exact relation to each other: for example 'low' or 'minor', or 'medium', or 'high'. (Rohrschneider 2003) (two-dimensional assessment in non-dimensional scale).

Secondly, we mark alternatives in a proper portfolio (in the example on nine fields) (see Fig. 8.5) (Cadle and Yeates 2008). Risks with high rate of probability and with potentially big damages must be treated with high priority. They play a decisive role in a project. Risks with low rate of probability and with minor damages can have lower priority.

13:33 Assessment of Precautionary Measures

Cost-benefit Analysis (CBA) follows the concept of classical evaluation of consumer product development (Mishan and Quah 2007). It applies to the countermeasures in terms of costs and estimation of benefits of their potential application.

First a general situation is estimated in terms of probability of occurrence P and possible damages D. The Composite Risk Index CRI describes this situation.

Next, the situations (P and D) are evaluated upon applying countermeasures one by one. The countermeasure with a higher risk potential than before their implementation are not further studied. This way all countermeasures are evaluated upon criterion of CRI improvement ("Benefits") (see Example Table 8.1).

Now in the next step the costs of those countermeasures which are taken into further considerations are evaluated ("Costs"). The relation of Cost/Benefit indicate the priority of countermeasures application: the lowest value shall be granted the highest priority (see Example Table 8.2).

Example

We assess here a loss (L) and the probability of risk occurrence (P).

The risk potential is calculated in the following way:

RP (risk potential) = P x L

Situations have been assessed in the following way (see Table 8.1):

As the table shows, the three alternatives are further studied, since all of them exert a positive impact on risk potential, in comparison to the present situation. For further assessment, the three precautionary measures are additionally expressed with the outlay necessary for their realization. Table 8.2, referring and stemming from Table 8.1, provides the calculated values.

Assessment in the example Table 8.2 showed that the countermeasure number 3 receives the highest priority, although it does not give the greatest reduction of risk potential. Of course, also special requirements can contribute to the choice of e.g.

Fig. 8.5 Portfolio as the basis of the priority risk assessment

Table 8.1 The example of the assessment of three precautionary measures

Criterion	Present situation	Measure 1	Measure 2	Measure 3
L	10	9	4	5
P	3	3	1	2
RP	30	27	4	10
CRI improvement	–	−3	−26	−20

Table 8.2 The example of appointing priorities to precautionary measures

Measure	Difference in case of risk potential	Cost in thousand Euro	Thousand Euro for each point of difference	Priorising the measures
1	3	45	15	3
2	26	120	4,62	2
3	20	75	3,75	1

countermeasure number 2, in spite of the above assessment (e.g. with the set goal, possibly greatest reduction of risk potential) or a countermeasure number 1 (e.g. in case of budget restrictions). Needless to say, such type of special requirements or restrictions must be well documented.

ABC Analysis

ABC analysis (see also Chap. 7, 12:00 Problem Management: PBM section "12:33 Solution Assessment and Selection Techniques") can also be used for the assessment of countermeasures. The subject of analysis, just as in case of the previous method, is the relation of costs and profits, in order to choose the most effective measure. The measures are properly prioritized on the basis of the effectiveness of their impact on risk potential (see Table 8.3). At the next stage, the result is presented graphically. Graphics is a useful tool in case when the risk is to be minimalized and our budget is limited. So, e.g. according to Fig. 8.6, with 37 % of total costs, we can achieve 55 % of benefits, and thus we should apply measures 1, 5 and 3 (Rohrschneider 2003).

Table 8.3 Assessment of countermeasures according to ABC analysis

| Position | Measure | Risk potential (look above) | | | Outlay/costs | | | Thousand PLN for each point of difference |
		Difference	Cumulated	%	In thousand PLN	Cumulated	%	
1	1	65	65	27	39	30	14	1.38
2	5	27	92	38	45	45	21	1.65
3	3	42	134	55	105	80	37	2,.49
4	2	48	182	75	150	130	60	3.15
5	6	15	197	81	51	147	68	3.39
6	7	8	205	85	30	157	72	3.75
7	4	30	235	97	135	202	93	4.50
8	8	7	242	100	45	217	100	6.42
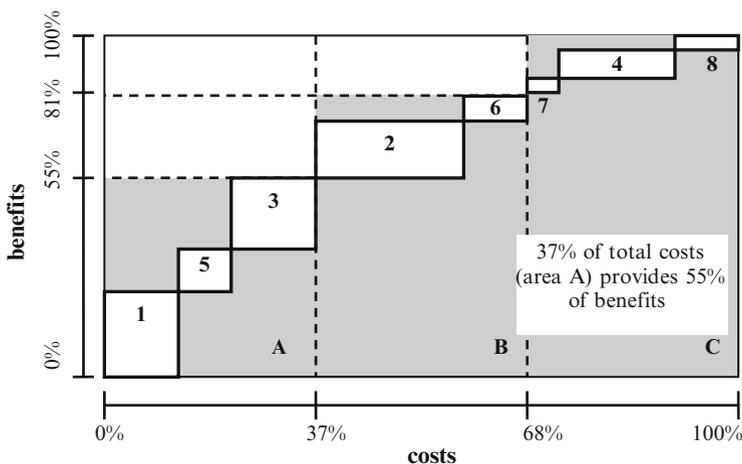
Fig. 8.6 Classification of measures with the use of ABC analysis

ABC analysis is effective, when multiple risks and several countermeasures related even to the same risk, with a minor difference in CRI improvement ("Benefits") are simultaneously traced. In this case the various criteria may be applied. Maximization of the benefits (CRI improvements) against the countermeasures costs leads to the classification of most effective set of countermeasures (Class A), than subsequently B and C.

13:40 Templates

13:41 Project Documents

Table 8.4. illustrates the Risk Management Plan.

Table 8.4 Example risk management plan

RM plan (HERMES 2003 2003)
0. General information
1. Aim of document
2. Goals
Goal of risk management specific for a project
3. RM organization
Organizational arrangements concerning risk management: organizational structure, tasks, responsibility, reporting
3.1. Organization structure
People managing risk and their relations
3.2. Structure
Tasks and scope of responsibility is assigned to particular people participating in the process of risk management. Especially the difference in comparison to a standard model of role distribution is recorded here
3.3. Reporting
It must be decided which organizational units or people are responsible for giving information and contact inside and outsider organization. The supplement of a project plan must also regulate issues concerning the reporting of risk solution management
4. Risk handling procedures
Basic elements of effective risk management
4.1. Sources of information
Sources of information which may indicate the project risks (Risk Detection System)
4.2. Auxiliary measures
In order to assure effective risk identification, we must prepare and designate auxiliary measures. The possible auxiliary measures may include voluntary and anonymous channels, defined methods of notification about changes, and interview. It is purposeful to include the description of cooperation with the process of quality management (QM)
4.3. Instruments and criteria of measurement
Reliability and comparability of measurement is assured through clearly appointed methods, instruments and criteria of measurement. Moreover, we can assign assumption and framework terms of measurement
The so called interim indicators (or threshold values) should be made for each important risk, in order to enable early warning against a loss
Diagram of risks together with interrelations can be used to assess the addend risk influence on the achievement of Project goals
5. Planning
Planning must be done in great detail (resources, deadlines, outlays, action, auxiliary measures, instruments and criteria of measurement, results)

13:42 Documentation of Project's Results

Catalogue of project risks is exemplified in Table 8.5. below.

In order to control the applied countermeasures it is advices to record the history of their analysis and results of their application in a project as exemplified in Table 8.6.

Table 8.5   Example risk catalogue

Risk catalogue (HERMES 2005 2005)
0. General information
1. Aim of document
2. Risk catalogue
List of project risks with the indicators of risk and their updated assessment
3. Countermeasures
3.1. Application of countermeasures
It includes the applied countermeasures with the following data:
Description of countermeasure
Targeted benefits
Date of application
Present evaluation
Date of risk assessment
3.2. Measures which have not been selected for application
Record of all possible measures excluding the measures listed above under P. 3.1

Table 8.6 Example of risk countermeasures record
History of countermeasure's application
0. General information
1. Aim of document
2. History of countermeasure's application
Record and detailed description of all the already used measures, which realization has already been completed, together with the effects.

13:50 Activities and Deliverables of RM

13:51 Initiation Phase

Tasks
- Create a system of risk management taking into account internal and external standards, guidelines and norms.

Results
- RM plan (HERMES 2003, Initial analysis)

13:52 Planning Phase

Tasks
- Identify and assess risks resulting from both the process of project realization as well as from the characteristics of the planned results
- Analyse relationship between risks
- Describe, assess countermeasures, grant them proper priority, and implement in case of need

- Observe the effectiveness of countermeasures
- Optionally, implement further countermeasures
- Include the consequence of risk solution management to project planning
- Create a risk detection system

Results
- Risk catalogue
- RM reporting
- Verified project plan (plans concerning deadlines, results and costs).

13:53 Implementation Phase

Tasks
- Identification and assessment of new risks
- Observation and updating known risks
- Implementation of countermeasures according to RM decision
- Observation of the effectiveness of countermeasures

Results
- Implemented countermeasures
- Updated risk catalogue
- RM report

13:54 Closing and Evaluation Phase

Tasks
- Identification and assessment of new risks
- Observation and updating know risks according to RM decision
- Implementation of countermeasures
- Observation of the effectiveness of countermeasures
- Gained knowledge recording in Knowledge Management (KM) System
- Continuation in risk management from the user's point of view

Results
- Updated risk catalogue
- RM report

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14:00 Change Management: CM

<div style="text-align: right">**9**</div>

Quick Look

What Is It?
Changes are sure in each project. By channelling them into predesigned process we secure their economical and controlled implementation.
Who Does It?
In is advisable to set the Change Management Board consisting of Project Sponsors, Management and respective field competent persons.
Why Is It Important?
Uncontrolled changes may lead to chaos in project course and in implementation. They may cause unjustified expenses and make operations in view on invalid configuration impossible.
What Are the Steps?
Set the organization and the process, how the changes shall be managed in your project. Than evaluate each change request for it's cost/benefit ratio. If justified – verify if there are already similar requests pending - combine them together and decide about economical realization and controlled release. Adjust the configuration and lessons learned.
What Is the Work?
Organize the change management and change management process. Collect the change request and let them evaluate if justifiable (cost/benefit). In positive case let them to be realized and carefully check if grouping of similar cases into problem management is justifiable. Decide about the time of implementation into operations and let the configuration to be duly modified. Lessons learned close the process.
How Do I Ensure That I Have Done It Right?
Critical is the right selection of the members of the change management board (CMB) and broad spread of the change request management policy. By securing that all change requests are handled by your CMB you assure the cost and operations' efficient change implementation. Let the competent processes and people evaluate the change request and do the job if justifiable. Control the process
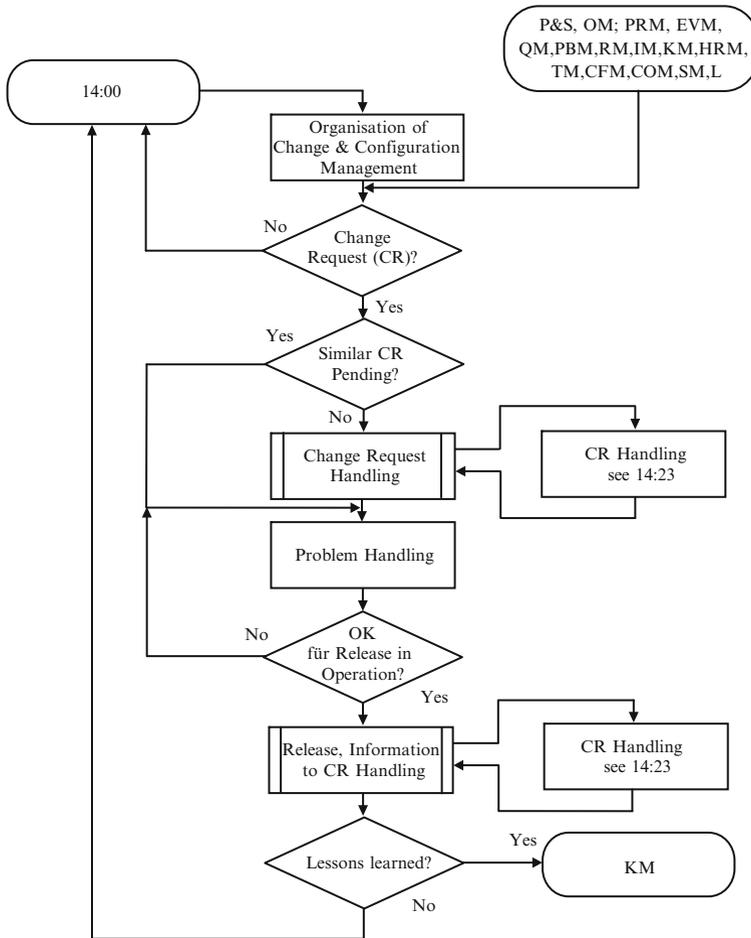
Fig. 9.1 Change management process

of further release into operations. Make sure that the appropriate configuration is correctly updated.

Process

Change Management process (see Fig. 9.1) deals with all sort change requests in a project. The organization and process set in the preparation phase evaluate each change request if it is justifiable in terms of cost/benefits. If positive it is synchronized with other pending requests and controlled release with configuration update close the process. Lessons learned shall be passed to KM process.

14:10 The Goal of Change Management

"The only constant thing is change", a phrase attributed to François de la Rochefoucauld by Phillips and Gully (Phillips and Gully 2011) drives this chapter. Change Management Process shall secure the coordinated efficient evaluation and, if justifiable, the cost efficient implementation of the changes necessary for the final project results delivery up to order with configuration update which secure the future correct operations.

14:20 Methods

The ISO 21500:2012 process 4.3.6 Control Changes is fully implemented by the process presented in this chapter (ISO 21500:2012 2012). Even if the description "Control Changes" and the placing of this process in a Control Group processes suggests reduced to the control handling, the description points rather at management, which includes tracing and configuration management, both of the project and the deliverables. Therefore, this chapter and the process treated here are named change management.

14:21 Change Management Organisation

In setting the change management organization and change management process several standards may be helpful. Selectively the configuration is managed by DIN EN ISO 10007, which handle the responsibilities of management in the areas of the identification, control, status accounting and verification (ISO 10007:2003 2003). In the ICT area most comprehensive is the ITIL standard, meanwhile accepted also by ISO as Standard ISO 20000. (ISO/IEC 20000-1:2011 2011).

14:22 Change Request Handling

Once the change management organization is set and first change requests are formulated and as new admitted, the change request handling process (see Fig. 9.2) is initiated (Philips 2010). Change request is evaluated if justified and whether cost/benefits are favorable. If positive, the change realization by an appropriate process is initiated.

In the next step the realized change is prepared for release. This has to be coordinated to ensure optimal integration with the rest of project and project results.

Released change leads automatically to configuration update. It is indispensable to adjust the configuration suitably. Here the involved other project management processes shall take an active part.

Finally, impact control shall secure stable operation.
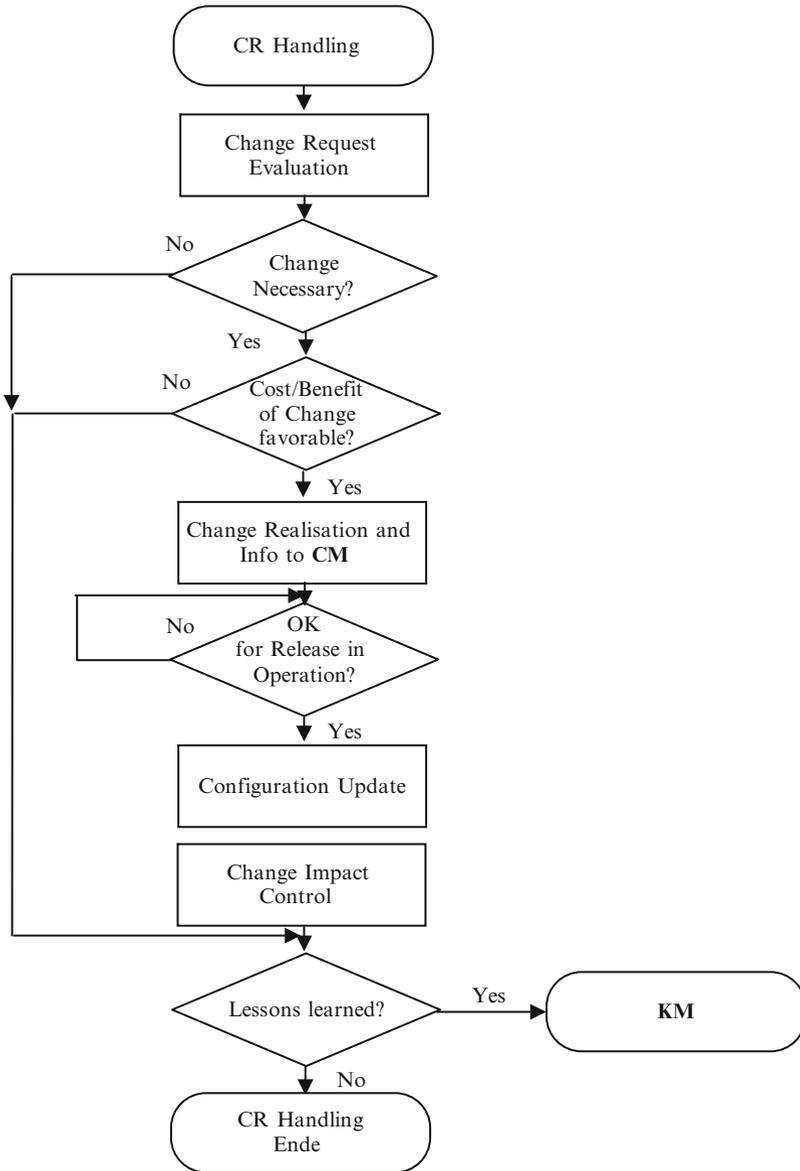
Fig. 9.2 Course of change process management

14:23 Change Request Handling Phases

The stages of change request handling are analogical to the ones in the process of project results implementation, presented in Chap. 2, 07:00 Planning & Scheduling: P & S (Fig. 9.3).
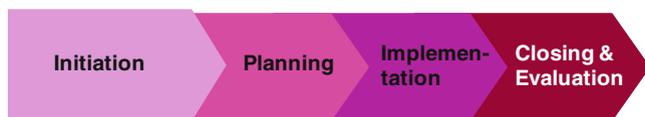
Fig. 9.3 Stages of the process of change management

Each change request shall lead to the initiation phase, where the change realization is set up. In the following planning phase the change implementation shall be planned in close interrelation with the otherwise undergoing project activities in order to secure the cost efficient realization.

Yet, the last critical moment comes when the implementation is ready to commence. In many cases the change developers poses the authorization to implement the changes and tends to put their results immediately into operation. This may lead to unpredictable operation and destabilization of either project or it's products. Therefore, the implementation shall be consciously released: Grouped together with other realized changes, optimized as to the time of the release and fully controlled (Fig. 9.2).

At this stage the configuration adjustment, critical to further operation and maintenance, is taking place. Any change, even the smallest means new configuration and therefore has to be registered as such. Only then we have permanent actual valid description, allowing for further efficient operation.

At least the initial observation of change impact is relevant to validate the purposesness of the just implemented change. Lessons learned shall be recorded.

Finally whether the process goes this way or the change request is discarded at any earlier stage for whatever reason, the change request source shall be informed and change request ticket closed.

14:30 Techniques and Tools

The presented below (see Table 9.1) techniques are allocated to the change request handling phases presented in section "14:23 Change Request Handling Phases" and other PM processes.

14:40 Templates

14:41 Project Documents

The efficient change management process depends to large extend on a comprehensive and complete change request. An example of change request and a list of changes are given in Tables 9.2 and 9.3 respectively.

Table 9.1 Techniques and tools for particular stages of change management

Stage in CM	Tasks to perform	Proper techniques and tools
Initiation stage with reference to the change process management	Setting critical values up to which a change request implementation must be filed. Information about the change management organization and process	Systems of numerical indexes (10:00 EVM)
		Comparison assessment (11:00 QM)
		see Chap. 17, (02:00 COM)
with reference to the CR handling process	Assessment and choice of CR implementation, decision concerning realization	Absolute criteria (09:00 PRM)
		Quantity criteria (09:00 PRM)
		Quality criteria (09:00 PRM)
		Risk analysis (13:00 RM)
		Earned Value Analysis (12:00 PSM)
		ABC analysis (12:00 PSM)
Planning	Detailed planning of changes (project structure, changes, results, time, cost) and passing tasks to the executing competence centres (e.g. project leader, developers, problem managers, etc.)	Project structure plan (07:00 P&S)
		Beta process (07:00 P&S)
		Analogical process (07:00 P&S)
		Schedule (07:00 P&S)
		Interrelationship network (07:00 P&S)
		Milestone analysis (10:00 EVM)
		Cost Analysis (10:00 EVM)
Implementation	Implementation control with reference to the results, costs, time	Milestone analysis (10:00 EVM)
	If necessary: exerting influence on change implementation	Individual talks and talks in groups (10:00 EVM)
		Budget control (10:00 EVM)
		Shadow costs calculation (10:00 EVM)
		Analysis of cost consumption (10:00 EVM)
		Diagram of the relationship between the elements of network (11:00 QM)
		Data bases and reports (16:00 KM)
		see partial process of CM 'Planning'
Closing and Evaluation	Integration of changes in the whole system together with system reception	Structure of data set (16:00 KM)
	Documentation of results	Data bases with news resources (16:00 KM)
	Passing information about changes to the people interested	System of documents management (17:00 DM)
		see Chap. 17, 02:00 (COM)

Table 9.2 Techniques and tools for particular stages of change management

Change request (HERMES 2003 2003)
0. General information
1. Identification
Number of this change request
Short description
Project identification and the corresponding configuration
Date
Author
2. Classification
Level of urgency
Desired time of completion
Category (error, problem, modification, extension, correction etc.)
3. Subject of the change request
Identification of results, which will be influenced by modification
Presentation of the actual state
State of the system
Conditions of surroundings/environment
User's reaction
System's reaction
Effects etc.
Presentation of the target state
Explanations and justification of the anticipated reaction
States, terms etc.
Remarks (e.g. concerning the relation to the motions which have already been filed)

Table 9.3 Example list of changes

List of changes (HERMES 2003 2003)
0. General information
1. Identification
Project identification
Date
2. For each change request:
Identification of a proper change request
Status of modification (put forward, intended, rejected, commissioned, done)
Number of a proper change request
Identification of the configuration containing the change
Person responsible for change implementation
Beginning / end of change

Trace of change requests: their status, phase of eventual implementation and congruence with eventual other change requests may be efficiently handled with a list of changes.

Table 9.4 Change rapport

Change implementation
0. General information
1. Change request
Change request identification
Change request title
Change request date
Change request author
2. Change request justification
Description of reasons, leading to the change request
3. Expected change request implementation results
Description of the effects of implementing change request
4. Draft concept of possible solution
It presents an outline of the possible solution together with costs connected with its realization
5. Decision
Detailed descriptions of the decision together with the justification. Providing the names of the participating change management board members taking decision and the date of decision
6. Implementation control
The realization of decision is under control, and the results are registered. It also includes the control of change implementation acceptance protocols
7. Documents' archieves/supplement

14:42 Documents of Project's Results

Complete information about each change must be gathered in one document, enabling the overview of the history and results of a change (Table 9.4.).

14:50 Activities and Deliverables of CM

14:51 Initiation Phase

Tasks
- Initiate change management
- Initiate configuration management
- Create a plan of configuration management

Results
- Configuration and change management organization and draft of the change management processes
- Configuration management plan

14:52 Planning Phase

Tasks
- Analyze project goals from the point of view of important determinants and external requirements
- Set Change Management Board operational
- Select the roles owner in Change Management Board
- Set criteria for change implementation
- Specify the change request handling process
- Decide about the configuration adjustment control
- Chose and get tools necessary for change realization and change management
- Control the change process from the moment of change request until its implementation

Results
- Implemented change process and plan of configuration management
- Determined basic configuration
- Tools ready to be used for change implementation, configuration and their management
- Tested change management processes
- Tested change request handling process
- Change management and configuration management integrated in a project
- Documented and communicated change management process

14:53 Implementation Phase

Tasks
- Assure proper change request registration
- Direct approved change requests for implementation to proper processes
- Trace and safeguard results/decisions
- Adjust configuration

Results
- Updated configuration
- Registered and controlled change requests and appropriate decisions

14:54 Closing and Evaluation Phase

Tasks
- Pass configuration to the project results accepting organization with further target of operations support
- Assure change registration by the project team and users

- Advice and implement the efficient change request process within project team and users
- Trace and safeguard results/decisions
- Adjust configuration
- Prepare a final report

Results
- Implemented project results with a proper updated configuration
- Registered change requests and proper decisions
- Final report

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Quick Look

What Is It?
Whatever project produces – it has to be integrated somewhere. Successful integration needs some actions.

Who Does It?
Integration Manager, assisted by Acceptance Test Manger and integration team cooperates closely with Project Manager, Communication Manger and Documentation Manager.

Why Is It Important?
Only successful integration in all three dimensions: product, business process and people leads to the successful project closing. Any of those missing may depreciate significantly the whole enterprise.

What Are the Steps?
Plan and prepare carefully all three dimensions. Secure that the Communication and Documentation are actualized and all Tests are passed. Then initialize the implementation. Proceed if migration is feasible. Final Acceptance and les-sons learned close the process.

What Is the Work?
Considerable effort is the good planning and preparation of all three integration dimensions. Dependence on test results (quite a work itself!) cause unpredictability and leads to reworking of plans, preparation, communication and documentation updates. Careful implementation shall be assisted by timely matching gradual controlled migration. Put significant manpower in people integration. Care about lessons learned from each single step.

How Do I Ensure That I Have Done It Right?
Product is in the scope of the project so it's integration is casually well done. Less attention is paid to business process integration – so take care about it. It may be complicated and time-consuming. The people perception is the key to successful project closing – so put it in focus of your efforts. It takes long and depends strongly

on successful communication. You have to overcome all negative change impacts: anxiety, uncertainty, anger, uncontrolled external information influence. Work on people positive attitude – than even minor deficiencies will be tolerated, and your project perceived as a success.

Process

Integration Management process (see Fig. 10.1) plans, prepares, tests and secures successful implementation of the project products and migration from the current to the new state. Lessons learned shall be passed to KM process.

15:10 The Goal of Integration Management

The goal of the Integration Management process is to assure successful implementation of the project results into the existing environment (organization, people, technology, processes), and successful migration from the current to the new state reaching final acceptance of project sponsors and positive perception of the users.

15:20 Methods

The ISO 21500:2012 does not foresees any particular process dedicated to the integration (ISO 21500:2012 2012). The corresponding tasks are included in Work Breakdown Structure WBS and controlled through the processes of the Control Group. This is viewed as inconsistent: WBS contains the product (output) related components and thus focuses on technical integration (First "P" explained hereafter). The Communication process, which should take at least part of the people integration tasks (the second "P" also explained hereafter) is included in the Control Group of ISO 21500:2012 and as such is not concerned with the people integration. Very general process: 4.3.10 Manage stakeholders, does not really mean the users explicitly. The process integration (the third "P", see below) is not treated by the standard at all – it is left to the project set-up to define to which extend it is included in the WBS.

In the author's opinion the conscious and managed integration of all components is a project success factor and therefore worth of a dedicated Integration Management process.

Integration management is carried out in three "P" dimensions:
- First P: Product for technical integration,
- Second P: for Process integration,
- Third P: for People integration.

Technical product integration commences already at the initial phase together with the first concept of results implementation into the target environment. In the planning phase we specify this environment and define in detail the functional and
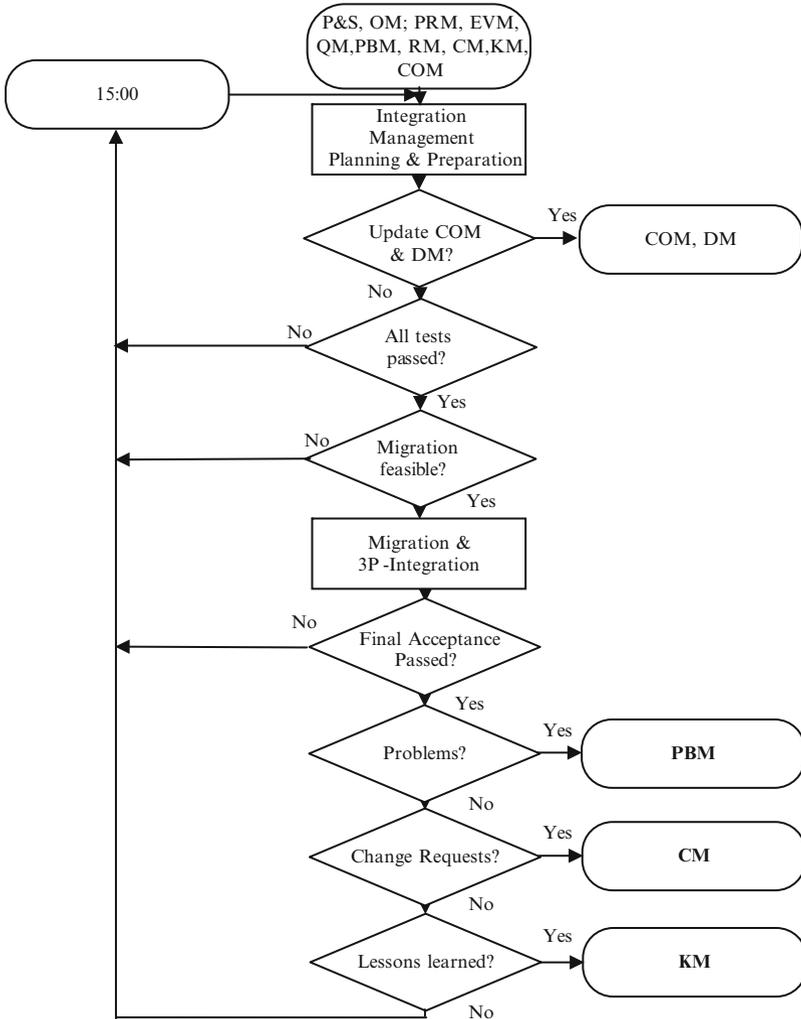
Fig. 10.1 Integration management process

non-functional requirements. In the realization phase, the systems are analyzed and tested on the operational level. The implementation stage begins with the integration test and ends when the full availability of the new system has been achieved.

While most projects focus sufficiently on the technical integration, there is not enough attention paid to the integration of users and business processes. Not surprisingly, exactly in these areas we observe the most problems. We often do underestimate the impact of a new product: even smallest changes in user's interface (see e.g. Generation change in personal computers) result in at least

change of workflow (new functions), and in many cases they may lead to even a deeper organizational change.

People involved in business process reengineering firstly feel anxiety, than uncertainty followed by anger. An uncontrolled external information influence may amplify these feeling extending the duration of their impact. Only after this period is over, curiosity may lead to some emotional engagement and necessary motivation to act along new business processes. Only then the training and learning begin to be effective.

Implementations example dispatch and customer centre
Implementation of a central dispatch and customer service system in a logistics company improved the economic profitability by closing down of about 900 decentralized dispatcher points. Over a thousand of employees were affected by this step. In the new dispatcher centre 300 new employees have been employed, out of whom ten have been employed to deal with exploitation and maintenance of ICT infrastructure. Changes in the business processes, beginning from the initial phase up to the successful ending lasted 4 years. Learning, training, support delivered by knowledgeable and experienced coaches lasted 14 months until the employees were fully productive. The assimilation of new organization and work results of the new dispatcher centre employees, leading to truly effective cooperation in a company, lasted 3 years. Direct costs of business processes adjustments and integration of employees amounted to about 3.5 million Euros. The cost of the production and validation of technical systems reached about 20 millions Euros.

In case of project organization, based on a task oriented model, parallel to the processes of technical development we initiate, plan, realize and implement business process reengineering (see Chap. 2, 07:00 Planning & Scheduling: P & S). This can cost up to 20 % of the total project budget. Moreover, the integration must take into account the aspects of changes within the business processes as well as mutual influence between new product, new business processes and environment. Therefore, proper management attention is due to this activity.

Acceptance of the project results by the user and maintenance staff is most frequently underestimated factor of project management (see also Chap. 14, 20:00 Human Resource Management: HRM). It is in a human nature that a person first tries to assess the changes according to one's own value system before the changes get absorbed. The better this process is prepared, the better the training has been organized and the integration has been assured, the faster and more effective will be the implementation. If it concerns a larger number of employees, the integration process poses high requirements for the logistics and training units. The implementation, migration, including the right solutions to the above issues have to be impaired with an economic profitability of the endeavour to obtain the final overall project positive evaluation.

> **The example of implementation of a bar code in logistics company:**
> Technical adjustment of ICT system to process data from the scanner of bar codes and its technical integration in the company cost totally about 2 million Euro. It affected about 4,000 employees in the whole country. The integration must have been carried out without interruption of services to the clients.
> Training, support with knowledge and experience going hand in hand with properly synchronized availability of the ICT infrastructure took about 3 years. Company has reached break-even in the fifth year since the beginning of implementation of the bar code readers.

15:21 Implementation of Project Results

The implementation of project results concerns simultaneously the creation, validation as well as the business processes adaptation. The goal of implementation process is the deployment of the project products along the original requirements in a planned manner, leading to the target usability and full performance. It usually provides new or improved functionality.

Implementation includes the following tasks:
- Prepare and execute the implementation plan,
- Carry out trainings for users ambiguously in product deployment as well as business process modifications,
- Carry out the implementation
- Secure the target availability of project products,
- Secure the maintenance (technical infrastructure and organization).

The scope of particular tasks decides about the assignment of functions between project team members. It is advisable to define the roles of an implementation manager, who coordinates all implementation activities, and trainings manager, who cares about the optimal education of the users and maintenance manager who organizes the smooth transition to regular operation.

Good practice standards are given by ITIL ((ISO 20000) (OGC, 2011; ISO/IEC 20000-1:2011 2011) and CMMI v3.0 (SEI, 2010).

15:22 Migration from the Present State to the Target State

The successful change implementation means very often to plan every minute of the integration process and diligently carry out migration from the present state to the target state. The key success factor is the proper management of the business process changes. Therefore, by assigning the migration to the person in charge we win at least someone's focused attention. Migration covers the following tasks:
- Analysis of a present situation in the area of technology
- Definition of the state of processes/organization,
- Definition of the target state: definition of the necessary changes, measures,
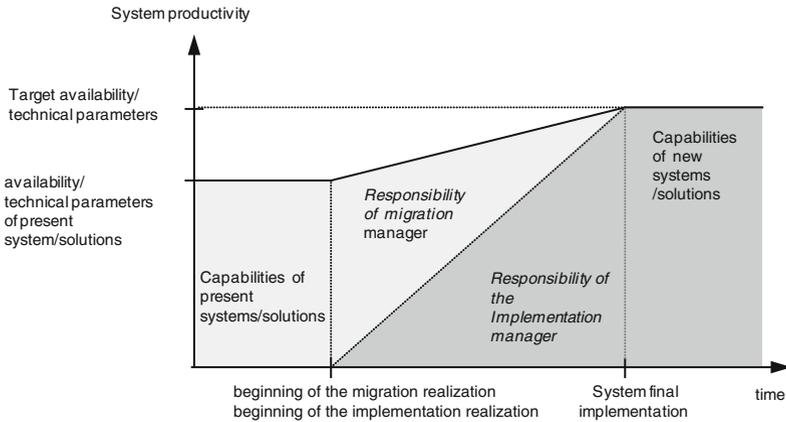
Fig. 10.2 Competences and responsibility during integration

- Elaboration of the fallback scenarios
- Migration planning,
- Realization of the migration stages (initialization phase, planning, realization, implementation),
- De-installation of the replaced systems/products.

Figure 10.2 illustrate the split of the responsibility between the implementation manager and migration manager. Typical for most migrations is certain difficulty in passing the project results into regular operations and maintenance. Therefore, project manager has to take care about this initial operational phase.

15:23 Fall-Back Scenarios

The biggest risk in the process of integration poses a change from the present solution to the newly developed one. Examples are:
- The current solution was removed too early,
- The new solution has not achieved yet the availability and technical parameters necessary for correct operation.

In order to counteract those risks, we must prepare the fallback scenarios as a substantial part of integration management.

Fall-back scenarios elaborate specific constellations of three Ps (products/process/people) supported by implementation and migration teams, users and system operators, which in case of failure in achieving the target parameters, are able to assure work according to the agreed emergency plans.

The following tasks must be taken into consideration:
- Fallback scenarios for the migration phase,
- Fallback scenarios for regular operation,
- Scenarios' assessment and choice of suitable one,
- Cost/benefit ratio of the resources deployment,
- Trial tests of fallback scenarios.
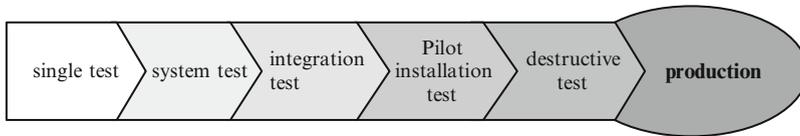
Fig. 10.3 Synopsis of tests' options

15:24 Synopsis of Tests' Options

In the process of requirements definition, we must determine the measurement criteria for the completion of those requirements.

In the process of validation (see task model in Chap. 2, 07:00 Planning & Scheduling: P & S) tests are lined up in a logical sequence presented in Fig. 10.3.

Single tests and system tests are part of the P&S process. The integration process begins with the integration tests followed by the pilot installation tests. It is advisable to conduct some destructive tests (conscious, controlled downgrading of the technical parameters of a system and functions).

As in other cases, by assigning the responsibility for the tests to test manager we secure the optimal know-how transition between the phases. Best case test manager is owner of the validation process (see Chap. 2, 07:00 Planning & Scheduling: P & S).

15:25 Operations and Maintenance

The success of implemented new products depends strongly on the effective operation and maintenance. Already in the project initialization phase, in the specification of the requirements, the basic assumptions and provisions for future operations and maintenance shall be determined.

The criteria which should be agreed with the users include among other the so called Service Level Agreements – SLA, which determine the availability and technical parameters of the exploited project products. Availability, regulated in such an SLA, includes the time slot required for the system maintenance service, during which new components are implemented, updates are deployed, minor corrections are done and system is tuned to better performance. In case of weekly system services lasting 2 h, the maximum availability equals 98.81 % for a week. In case of six system services, each lasting 6 h during 1 year, the availability reaches 99.59 %. If we need greater availability or longer service works, we must create redundant or distributed systems.

The planning of those regular maintenance services shall be initialized during the project and exercised as far as possible during the integration process. This secures optimal transition from the project stage to productive exploitation.

Table 10.1 Differences between tests

Test goal	Test goal	Test subject	Technique and tools
	Single test	A test of particular functions or routine activities of the new system	Rather the so called white box test
	System test	A test of a complete, new system, and the system has not been connected yet to any already existing productive system environment. Mutual interoperability of all functions and system stability are tested	
Tests important for IM	Integration test	Test of a new system integration with the existing system environment (first of all test of tangent point). It shall be carried out in integration test environment, which reflects closely the production environment. Performance and load are tested	
	Pilot installation test	Test of system operation upon integration into productive environment. The last test before final acceptance. Focus on interfaces, productive performance, and usability. It resembles closely the full production, however, in limited application area, e.g. 3 pilot test users of 500 target users	
	Destructive tests	Tests concerning emergency scenarios or way of conduct in exceptional situations. The products undergo controlled stress tests (e.g. lack of current supply to a computer) to check the limits and functional downgrading	Rather the so called black box test

15:30 Technique and Tools

15:31 Product Integration

Tests

For the purpose of technical integration we use tests, in accordance with the V-model presented in Chap. 2, 07:00 Planning & Scheduling: P & S. Each test has different purpose (see Fig. 10.1), and uses different tools (see Table 10.1).

System Diagnosis

Pilot installation tests offers first possibility to check the interoperability with the production environment. The real (production) behavior shall be thoroughly examined. For this purpose system diagnosis concept shall be planned, developed and implemented. Such diagnosis consists of a number of different tests. Their results are compared with the reference values or numerical indicators according to certain standards or previously reached results of comparable tests. The tests can be performed by technological support and accumulated in an automatic diagnosis program. Final goal is the fullest stability and functionality of the delivered product.

System Monitoring

Unlike the system diagnosis, system monitoring is periodical supervision of the continuous system operation. It may be performed by a human. However, technology plays here a substantial role, and today there is no area of our life, where ICT would not be deployed in the monitoring. The results are presented in an easy understandable form usually assisted by the recommended actions. Exceptions and emergency situations case alerts, which often automatically initiate the proper action (e.g. alarms on a mobile phone or emergency centre). In some operations only exceptions are reason of any action (Management by Exceptions). In such situations the automatic procedures usually underperforms and a human interaction is needed.

Protocol Analysis

Besides the system diagnosis and system monitoring, another tool suitable in integration and operation are product behavioral protocols, collected automatically or manually. Critical is here an impact, which generating of a protocol may have on overall system behavior. If it is intrusive, changed system behavior may not deliver the information, which is sought after. Therefore, it makes sense to include the protocol dumps already into the original production system. It's behavior remains unchanged, while we benefit from the gathered information, subdued to the protocol analysis in the later stage. Sophisticated systems provide automatic or manual data base update and comparison generating suitable recommendation of eventually necessary actions (see Chap. 11, 16:00 Knowledge Management: KM).

System Operation Tools and Product Management Systems

Numerous available product specific tools (e.g. HP Open View, Tivoli, Big Brother etc. for ICT products) support the diagnostics, monitoring and protocol analysis. The so called product management systems handle today not only the technological side of the product, but support effectively the business processes (e.g. customer support) or human handling (user management). We have building management systems, highway management systems, home entertainment management system and so on. . . The choice shall be made upon deciding which operational criteria are relevant to the operator. The manufacturer of the product is usually able to suggest or even is interested to provide a suitable management system.

15:32 People Integration

Trainings and Work-Shops

Trainings and workshops are the main tools to introduce the new product among users. They address directly the capability to handle the new product, but also reduce the psychological barriers against the changes. Possibly vast repertoire of communication means shall be deployed, visual, audio, sensual, self-elaboration. The later, leading to the workshops, is considered as the most effective one. Trainer

and group mutual impact provide an intermediate feedback. This way the new interrelationships and new processes can be mastered in the most efficient way.

E-Learning

In former times text books and exercise sheets supported the individual home learning. These has been placed on electronic carriers and are available off-line (e.g. compact disk) or online. The simplest are wisdom compendiums for knowledge retrieval. Google is the most widely known and applied online tool. More sophisticated tools are product specific and provide instant interactive and often highly amusing form of self-learning. The latest unjustly usurps the sole e-learning license, as all electronic forms deserved this description.

Coaching

To whatever extend trainings, workshops and e-learning's be provided, users will always have questions, which arise once the put hands-on on a productive system. By providing them with a possibility to verify their views with someone knowledgeable we contribute the their better acceptance of the product and farther improve their performance. Suitable coaching delivers this.

Floor-Walking

A particular way of coaching is the first day support. The so called floor-walkers are available to users at the area of the product application – they may resolve their issues instantly on the spot.

Superuser

As the deployment of the new product progresses, usually either by denomination or by sher personal knowledge acquisition, one of the users gains an authority in the matters related to our product. Others, new staff, turn to this knowledgable person for local support. We call them superusers. The others call them "Mr Product"...

Stakeholder Communication

Beside those, who are directly involved in the deployment of our product, there are several other stakeholders interested or even involved in the changes and innovations introduced by our project. Suitable communication along the procedures described in the process of communication Chap. 17, 02:00 Communication Management helps to integrate also these people.

15:33 Process Integration

System Diagnosis Referring to the Process Surroundings

The techniques described above (see above section "15:31 Product Integration"): System diagnosis, Monitoring and Protocol Analysis can be also efficiently deployed to support the process integration. In process system diagnosis we evaluate the interaction of newly introduced or changed processes within their remaining

environment. We may stipulate intentionally certain actions to test the process landscape.

Monitoring and Protocol Analysis can be used during the integration process, they are, however, rather means of continuous operation improvement and as such subject of the Quality Management Process (see Chap. 5, 11:00 Quality Management: QM).

Emergency and Exception Scenario Tests

Together with new systems we also implement new emergency and exception handling scenarios. The V-model approach is recommendable here as well. In the first step the isolated particular process chains are initiated and tested for their emergency and exception handling performance. Once acceptable, there are integrated within the process environment and tested along their impact in emergency and exceptional situation on other interconnected processes (see Table 10.1 above). Sending down the system erroneous packages (like e.g. bomb simulation luggage in air cargo logistics) we can trace the weak point. Scheduled (protocol analysis) or upon demand initiated human interviews provide the necessary data about how prone is the whole process landscape upon emergency and exception situations caused by our new product.

15:40 Templates

15:41 Project Documents

Well planned and organized Integration process is reflected in the integration and migration concept. We must regulate the items listed in Table 10.2.

15.42 Documents of Project Results

Example of the project results is a.o. the description of the new or modified processes. The document includes the items listed in Table 10.4:

15:50 Activities and Deliverables of IM

15:51 Initiation Phase

Tasks
• Create a system of integration management, taking into account internal and external standards, guidelines and norms

Results
• System of integration management

Table 10.2 Integration process document example

Integration and migration concept (Hermes 2005 2005)
0. General information
1. Aim of document
2. Requirements
Description of 3P-requirements with reference to the integration and migration
3. Integration concept
Describes the process of integration, and in particular:
Functional and non-functional integration
Initial data feed in and system set-up
Operational concept of the new product
4. Migration concept
Describes the migration process, and in particular:
Functional and data migration
Parallel exploitation of the existing product and the new one being the result of a project
Emergency, exception and fall-back scenarios
5. Planning and organization
Integration and migration organization
Time schedule
Resources (personnel, material measures, services)
Communication concept
6. Taking account of the possibility of risk appearance
Integration and migration organization
7. Deinstallation of the replaced components
Describes the type of measures which are necessary to remove the replaced components, and in particular:
Removing the superfluous material
Documentation of the last Products/Process/People constellation prior to changes
Communication concept to the organizational units affected by migration

The optimal tests are developed and documented in the test concept which includes the items listed in Table 10.3:

15:52 Planning Phase

Tasks
- Preparation of test concept
- Creation of the integration and migration plan with the following aspects:
- Product
- People
- Processes
- Plan of trainings, workshops, e-learning and coaching
- Preparation of emergency scenarios

Table 10.3 Test concept example

Test concept (Hermes 2005 2005)
0. General information
1. Aim of a document
2. Test goals
The description o tests' goal, taking account of the output situation, known problems and assumptions from the model of quality management
3. Test scope
It includes the detailed (organisational and technical) external requirements, test assumptions, terms concerning the type of a test and its discontinuation, test surroundings, test infrastructure, configuration management, data concerning the test and test organization
4. Test procedures
4.1. Test methods and cases of test application
It includes testing methods and the overview of test application possibilities
4.2. Classification table
A classification table documents a proper relationship between the tested objects and the applied tests

Table 10.4 Integration process description example

Business processes description (Hermes 2003 2003)
0. General information
1. Aim of a document
2. Overview of the processes' landscape (level 0)
Description, presentation of the "bird's view" of the whole landscape
Identification of the changed parts
3. Structure of the processes (level 1)
Process and sub-processes diagram
Process and sub-processes description
Planned or deployed process scenarios
Process performance measurement systems
Roles
4. Activities (level 2)
Down level of the process description
Plan of time and delaines outlay
5. Documents and Instruments
Instructions how to execute the process
Users Manual
Sheets
Service and operations manuals
6. Appendices
Test protocols
Relevant process changes
Additional documentation

Results
- Test concept
- Integration and Migration plan
- Test plan
- Emergency scenarios

15:53 Implementation Phase

Tasks
- Carrying out integration tests, trial work tests and destructive tests
- Trainings, workshops and coaching
- Verification of emergency scenarios
- Process adjustment
- Preparing final documentation

Results
- Protocol/minutes of test results/report on test results
- Integration and Migration concept
- Documentation

15:54 Closing and Evaluation Phase

Tasks
- Carrying out integration tests, trial work tests and destructive tests
- Trainings, workshops, and couching
- Carrying out integration
- Carrying out migration
- Communications about the new system
- Preparation and making the documentation available
- Documentation of the results in accordance with the requirements of the process of knowledge resources management (see Chap. 11, Knowledge Management: KM)

Results
- Protocol/minutes of test results/report on test results
- Integration protocol
- Migration protocol
- Business Process Description
- Completed data base KM

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16:00 Knowledge Management: KM

11

Quick Look

What Is It?

Knowledge means understanding of patterns. Successful project management relies on knowledge of the project team. There is certain knowledge everyone brings with, and there is knowledge collected during the project course. This process secures the efficient management and exchange of both.

Who Does It?

The Role of Knowledge Manager demands communicative handling and easy to use yet efficient knowledge management (KM) tools mastering. In most cases a person in charge of Project Management Office (PMO) is the best choice.

Why Is It Important?

There is no project where everything to be done is available and known to persons in charge. The willingness to share the intrinsic tacit as well as the newly acquired knowledge, paired with a will to assimilate by others is the decisive success factor.

What Are the Steps?

Define the KM strategy, processes, technology, people and organizational culture. Build an efficient easy to use knowledge management system and draft project management handbook. Motivate team to engage willingly in knowledge exchange. Moderate and stipulate consciously the knowledge flow. Secure appropriate storage and retrieval. Encourage team to aggravate the knowledge to-wards wisdom: understanding rules behind patterns.

What Is the Product?

Technology is a mean, not the solution. First the knowledge of the team has to be evaluated and than the reasonable goal oriented KM strategy shall be chosen. Next choose the most welcome PMO officer and set the truly working knowledge exchange procedures.

How Do I Ensure That I Have Done It Right?

Do not rely on technology and procedures. Knowledge is in the heads and the willingness to share is the gate keeper. Do your utmost to motivate all in team to
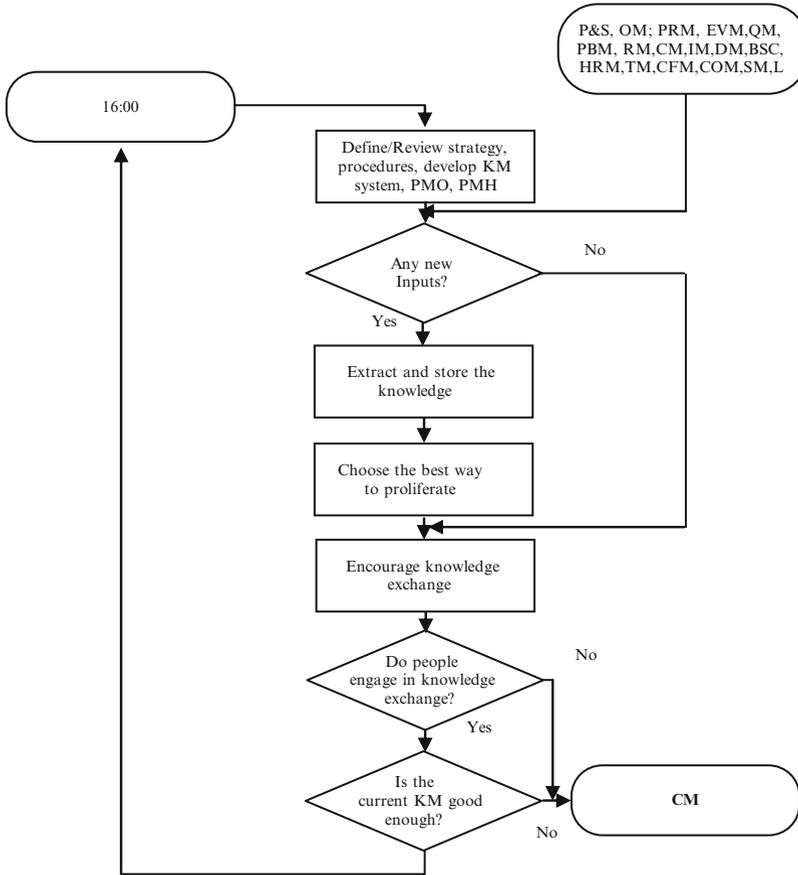
Fig. 11.1 Support of knowledge circulation through work in a team and other tools

freely exchange their knowledge. Support them with means they wish to use, do not impose your preferences and overburden with reports. Learn from drawbacks.

Process

Basic are clear strategy, procedures and the KM system. Project Management Office and Handbook shall be built up. Than the cycle of knowledge retrieval, proliferation and exchange shall take place. Verify if knowledge exchange works or other reasons to optimize KM occur – start CM request if justified. Routinely repeat the process Fig. 11.1.
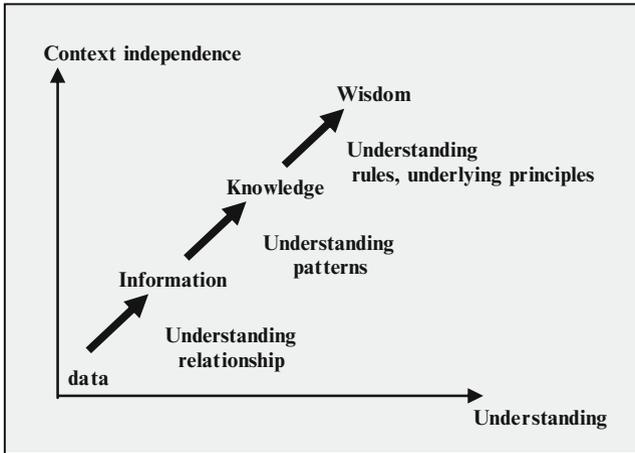
Fig. 11.2 Understanding vs. context independence of knowledge related terms

16:10 The Goal of Knowledge Management

The goal of Knowledge Management is to encourage the knowledge exchange between the team members to the advantage of the project and future undertakings.

16:20 Methods

ISO 21500:2012 foresees a process 4.3.8 Collect lessons learned with the description which fully fulfils the above named goal (ISO 21500:2012 2012). Despite the focus on continuous knowledge acquisition and dissemination during the project process is placed in the (project) Closing Group, diminishing the benefits to the project in the earlier phases. For this reason, in the spirit of the process 4.3.8 Collect lessons, the efficient knowledge in managed in the 16:00 Knowledge Management KM process.

16:21 What Is Knowledge?

The term data is understood as the chains of signs without a structure and independent of a context. The data with a clear structure, presented in a context constitute information. Knowledge is the collection of information and abilities, used by a person to solve problems. Knowledge is based on data and information, however unlike them, it is always connected with certain people (Probst 1999).

Knowledge & Context Independence

Whereas information allows us to understand the relationships, knowledge results from understanding the patterns. The context independence increases. Profound knowledge leads to wisdom – the understanding of the rules and underlying principles (see Fig. 11.2).

The uniqueness of projects creates particular knowledge, which is paired with the tacit knowledge brought in by the project team members to build the sound knowledge base of the project. The profounder this base is, the better the project results are: fewer errors and more likely to meet the goals on time and within budget.

16:22 Tacit and Explicit Knowledge

Tacit Knowledge
Tacit knowledge is bound with an individual. It is unstructured, personal, very often context and life experience dependent, difficult to explain and mostly not documented knowledge. Tacit knowledge examples are:
- Personal unstructured knowledge and natural gifts
- Capabilities, abilities and skills acquired during education
- Team member knowledge about organizational processes in and around the project
- Knowledge about project and cooperation
- Undocumented personal knowledge about company, competition, market.

This knowledge is most relevant to the project course: it is highly operational and efficient as used by its owner.

Explicit Knowledge
Explicit knowledge is the knowledge, which is documented on paper, in date base, in mails, photographs and videos and available to others' knowledge for example:
- Project handbook
- Company rules
- Minutes from meetings
- Data base of other realized or ongoing projects
- Improvements proposals.

16:23 Tacit – Explicit Knowledge Management Model

Tacit knowledge reflects certain unconscious (yet efficient) processes of an individual, which remain vastly uncontrolled and unnoticed by a person.

Successful knowledge management in team is determined by the efficiency of conversion between the tacit (unconscious) and explicit (public, available to others) knowledge.

Nonaka Knowledge Conversion Model
Nonaka and Takeuchi (1995) created a model, ever since then known as Japanese Model of Knowledge conversion (see Fig. 11.3), which depicts well the processes
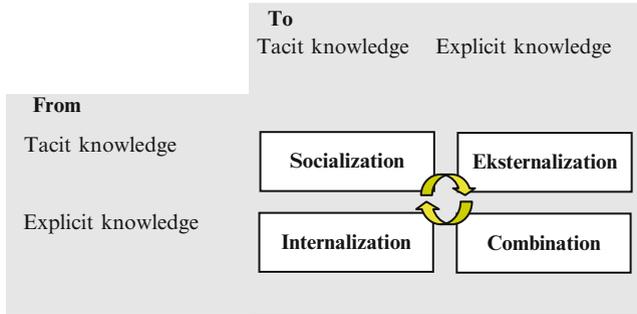
Fig. 11.3 Knowledge conversion model by Nonaka and Takeuchi

which take place during a permanent cycle of knowledge exchange between the tacit and explicit knowledge:

16:24 Structure of Knowledge Management Levels

Knowledge Management Levels
Project Knowledge Management has three pillars:
- Normative. The goals of the project shall be permanently present to all project team members. The repetitiveness of the Planning & Scheduling Process (see Chap. 2, 07:00 Planning & Scheduling: P & S) is way to refresh the goals.
- Strategic. To realize the project tasks team members has to poses specific knowledge. We elaborate this in the Planning & Scheduling Process mentioned above, define the demanded skills in the Organization Management (see Chap. 3, 08:00, Organization Management: OM) and match the role owners, defining the gaps as far as possible in Human Resource Management (see Chap. 14, 20:00 Human Resource Management: HRM).
- Operational. This is the core target of Project Knowledge Management Process: to implement the strategy in order to meet the project goals. In practice it focuses on closing the gap between the target knowledge (which may also dynamically evolve) and current tacit and explicit knowledge.

16:25 Operational Knowledge Management

The operational knowledge management targets the institutional encouragement and support of knowledge conversion processes.

The following sequential sub-processes may be identified here:
- Knowledge identification
- Knowledge acquisition
- Knowledge repository update

- Knowledge distribution
- Knowledge deployment

Knowledge Identification
Knowledge identification shall pinpoint the source of knowledge, level of maturity of the subjected knowledge and tag it for future identification. Whereas it might be a technical issue regarding the explicit knowledge it become a challenge if tacit knowledge is considered (see sections "16:26 Externalization" and "16:28 Internalization" below).

Knowledge Acquisition
Knowledge Acquisition proceeds twofold:
- Extraction on demand
- Articulation of the experience
  Whenever we reach the situation in the project where specific knowledge is demanded we go on shopping. Good identification allows us to proceed straightforward. Most fortunate case is the knowledge identified within the project team, ambiguously tacit or external.

  In case there is a lack of certain abilities to solve the existing problems and tasks, it is necessary to buy information from outside of a project. It can be done both through experts' recruitment, cooperation with clients or suppliers as well as through acquisition from other companies.

  The articulation of the experience may be well supported by the project organizational rules like e.g. summary or report of performed actions. Here we have two cases of gaining the experience, which influence our capability to articulate it:
- Structured experience like e.g. courses, trainings, predefined chains of actions. Her we can already tag the knowledge to be acquired.
- Randomly gathered experience: occasional, often unpredictable learning effects, which strongly depend on the context and prior tact knowledge of the team member. A sort of open questions and possibility to dump these random items in e.g. mail to someone in the project organization might help here.

Knowledge Repository Update
Once we acquired the knowledge very soon we end up with recognition that unless we prepare it in some way for further use, it overburdens the project and lead rather to the deficiency instead of efficiency of operation. Knowledge repository update deals with that problem. Along the identification and tagging system the acquired knowledge is evaluated. If it is unique – it finds its way into the repository along with the identification for easy retrieval.

Knowledge Distribution
Knowledge distribution disseminates the already identified in the repository knowledge. It may be still the tacit knowledge in the heads of few; it may be perfectly easy to use explicit knowledge on the project share. The presentation form orients on the

consumer of the knowledge: some prefer off-line visual presentation, some like direct telephone call.

It is not the aim that everyone knows everything on every subject. Target oriented knowledge dissemination implements the normative and strategic levels of KM.

Knowledge Deployment

The deployment may be only in part controlled by the project organization. To larger extend it is an issue of goodwill and motivation of the team member. We encounter individual barriers, which hinder the applications of the gained knowledge. Those may be both personal barriers (it is better to stay with the old habits, than be open for something new), as well as cultural ones (seeking advice considered as weakness). The readiness to use the possessed knowledge in projects must be supported by shaping the cultural awareness of knowledge deployment. Asking questions proves the readiness to learn and cannot be perceived as a lack of competence. It is the responsibility of a project manager to create trust culture, which is essential to the willingness to deploy the acquired knowledge.

In the following chapters we indicate how the operational KM supports the knowledge conversion processes.

16:26 Externalization

Externalization takes place, when we attain to convert tacit knowledge into explicit one.

Some typical daily situations reflect the need for the externalization:
- The knowledge must be passed between two team members
- Data and information must be immediately available for external project partners in a form proper for them,
- Knowledge possessed by particular team member, must be made available to the project team and a company, so that in case of any problems we could reach fast for experts' help
  How do we proceed?

Knowledge Identification

We deal with tacit knowledge. The externalization can only take place freely; when the subject person is truly motivated to deliver (we exclude here forced knowledge pressing as inapplicable in project we consider in this book).

The suitable methods of identification might be:
– Direct questioning
– Tests, preferably amusing or interesting one
– Hands-on experience with surveillance

Knowledge Acquisition

The externalization on demand may be initiated with concrete problems to be solved by a team member.

The externalization of the articulated experiences is promoted through encouragement of improvements proposals, scheduled reports, documented workshops and meetings.

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The externalization of the articulated experiences is promoted through encouragement of improvements proposals, scheduled reports, documented workshops and meetings.

Knowledge Repository Update

The documented knowledge may be stored on a project share, file management system in an identified and tagged form.

Knowledge Distribution

The distribution of the explicit knowledge follows the usual organizational paths: subscribers, direct addressees, fora and other well defined ways. The questions addressed are:
- Is the knowledge significant for ensuing projects or for the company?
- What content and in what scope it should be stored?
- Does the knowledge being at hand concern one's personal data?

Knowledge Deployment

The deployment of the explicit knowledge may be partially induced in that specific control gates on task progress which are set and the results are accordingly evaluated. To larger extend it depends on motivation – so the willingness of team member to deploy it shall be stimulated by the methods de-scribed in Chap. 19, 06:00 Leadership: L, section "06:23 Engage".

16:27 Combination

Combination takes place when we intend to generate new explicit knowledge based on the available one.

Good example here is the concept elaboration in a project.

Knowledge Identification

Explicit knowledge is available. So it is rather a problem if we apply the correct identification mechanism and know the right tags. The best way is an error-and-trial approach. With a progress in our e.g. concept elaboration our queries are more precise and our search better focused. This applies ambiguously to the project own data (e.g. Customer Terms of Reference) as well as public (e.g. internet explorers).

Knowledge Acquisition

The acquisition of the explicit knowledge is the process of extraction of the identified items.

Knowledge Repository Update

The repository of the identified explicit knowledge remains usually available so there is seldom a necessity to download it. In most cases the successful identification tags (e.g. links to the subject internet pages) are stored.

Knowledge Distribution

The distribution in this case deploys the same means as in case of externalized knowledge (see section "16:26 Externalization" below).

Knowledge Deployment

The deployment here is easier controllable, as the sub-processes of explicit knowledge acquisition, repository update and distribution may be repeated as many times as necessary. We all know the issue of several iterations of documents before they get final acceptance by demanding customer.\

16:28 Internalization

The Internalization begins in most cases there, where the previous two processes stops: at knowledge deployment.

We can elaborate a compilation of several documents and still have difficulties to explain what we wrote just about (recall some exams?). The internalization process is time consuming issue of cognitive capabilities and motivation.

Knowledge Identification

The sources of (explicit) knowledge are available. The identification usually is not an issue.

Knowledge Acquisition

(Explicit) knowledge acquisition is neither an issue (see above).

Knowledge Repository Update

Here begins a bit more complicated story. The personal intellectual repository (memory) may vary: some use their left brain side building the algorithmic relationships with the new item; some place the items in the right associations oriented brain part adding to the object groups creation (Langham 1966). Few of us use simple external memory (like PDA) – however, here we are already initiating the externalization process. . ... We can observe here only and try to support the chosen way.

Knowledge Distribution

The knowledge is here internally processed. The distribution process addresses our cognitive capabilities. We may try to stimulate certain mental processes; however, the outcome is out of range for us.

Knowledge Deployment

The outcome of the internalized knowledge is in the rule un-predictable. By setting certain goals we may try to stimulate specific direction where the solutions are

sought, yet it is neither time, nor finances nor goal limited. This is a typical case of complex problem solution in the innovative areas.

16:29 Socialization

Socialization may be one of the most important knowledge development processes in the project. We shall recall that in each project there is a substantial part of non-explicit, i.e. tacit knowledge. Good organizations recognize the value of that knowledge and support the socialization whole-heartedly (Schindler 2001).

Knowledge Identification
It may be upon request, but in most cases it is random. Identification depends on the attention of the acquiring person. If we already socialize, we usually accept the persons in our nearest environment, which in turn facilitates the perception of any random message. Target oriented persons solicit from the plethora of irrelevant news these few messages, which contribute to the person's personal goals.

The proximity of someone might open consciously or unconsciously the knowledge we seek. By ice-breaking during the first contact we create the atmosphere of possible socialization.

Knowledge Acquisition
The acquisition depends wholly on the willingness of the perceiving person. So the source should be psychologically and socially accepted, the atmosphere shall be time-stress-free and the communication shall be facilitated (rather coffee shop than disco).

Knowledge Repository Update
Tacit knowledge development is as mentioned above at the internalization. Not much can be done to support this sub-process here.

Knowledge Distribution
The distribution is the same as in the internalization. The direct social contact allows for additional questions, clarifications which might help to place the items at the right spot.

Knowledge Deployment
Knowledge deployment It is the same process as in case of the internalization. There is a high risk of misunderstanding and thus wrong conclusions. We can contribute by awaking the sensibility for quality and risk assessment.

During the whole process of message store management, the classification of the knowledge gathered by employees plays a decisive role for its utilization and further application. Transition from identification through acquisition, from broad-ening up to information division, makes the employee constantly ask the following questions:
- Is the knowledge significant for ensuing projects or for the company?
- What content and in what scope it should be stored?
- Does the knowledge being at disposal personally concern employees?
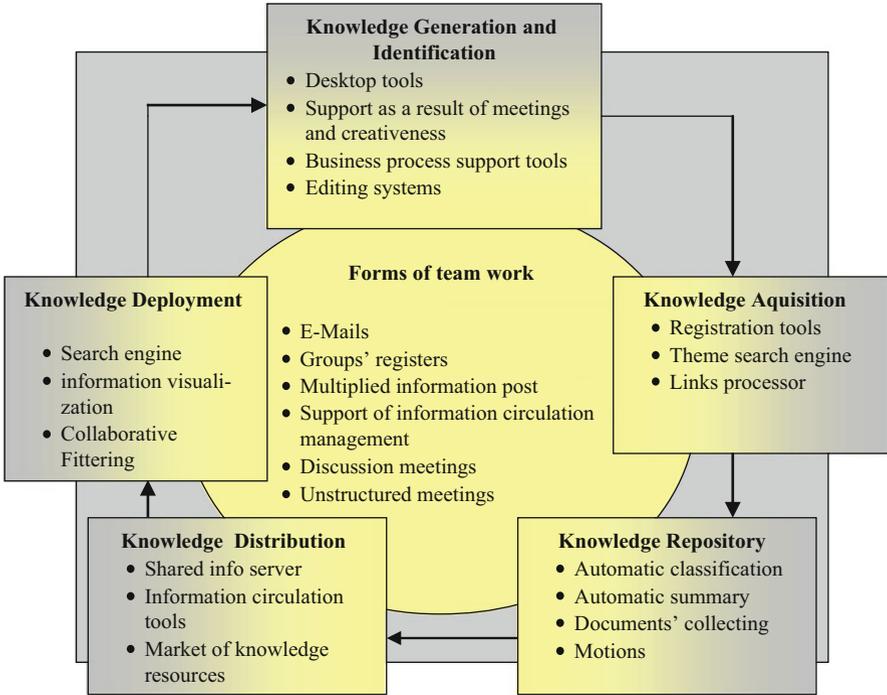
Fig. 11.4 Support of knowledge flow in collaborating project team

The better the project partners understand the goals of gaining knowledge by a company and they do it with a personal engagement, the higher will be the quality and effectiveness of the gathered information.

16:30 Technique and Tools

Knowledge deployment leads to the generation and subsequent identification of the emerging new knowledge. The operational knowledge management in collaborative team loops, comprising both the tacit and the explicit knowledge (see Fig. 11.4).

Hereafter selected technological and organizational techniques and tools which support the explicit knowledge are introduced.

Motivation and human communication techniques and tools with impact on tacit knowledge are described in Chapters devoted to Human Factor later in this book.

16:31 Document Structure and Tagging

Structure of Data Base

The effectiveness of all organisational and technological solutions is given by the accuracy and system logic of stored files.

Most search and aggravating engines apply certain logic while browsing the data files. By designing and observing during project course the rules and structures we secure the correctness of operations.

The structure of the documents shall follow certain logic familiar to the project team. For example by specifying the file structure along L-Timer® we can clearly allocate the subject treated in particular document (all risk related evaluations may be found in Chap. 9, 14.00 Risk Management: RM).

Advantageous is also to set the documents name convention: e.g. "M" for Minutes, "R" for reports, followed by the title key word, two-digit version and date of generation/change.

The tagging convention may go as far as to define the internal single items names and position when e.g. table aggravating tools are applied.

Time intense is the appropriate tagging. It is mostly company wide ruling, so the projects has nothing else than just to follow.

16:32 Data Repository and Retrieval Tools

Paper File Archive

Conventional measures such as papers archives etc., are sufficient in small undertakings. In projects with several team members and duration of 1–2 Years gathering, processing or analysis, repository and retrieval of information are efficiently supported by electronic systems.

File System

The simplest and already well established in project management practice are file systems. All data are stored in a linear tree structures. Access is granted basing on the file system access rules or roles right in active directories.

It is purposeful to set a network file system, which makes the data base less prone to single failures and allows different people to have access over the network. Team may use Intranet, sponsors and stakeholders Intranet Plus and other interested groups Internet.

Knowledge Data Base

The limitations of a linear file structure are prohibitive in wide knowledge dissemination. Possibility to create various chains, queries, cross evaluations and statistics paired with automatic version control favours data base application. Several large worldwide operating companies like IBM or Accenture manage their corporate knowledge with such tools. Draw-backs are time intense data feed-in processes and – particularly in case of project know how – mostly inadequate responses to project management related queries. Knowledge data bases are effective in longer term, less variable know-how storage like e.g. particular technical solution.

Collaboration Platforms

Collaboration platforms, as e.g. Sharepoint or Knowledge Tree combine the access control with data base and distributed simultaneous work in teams, which may be geographically dislocated.

Search Engines

Search engines, as e.g. simple Internet browsers help to find the saved data or information primarily in file systems, but few can handle data bases as well.

16:33 Knowledge Evaluation Tools

Analysis with the Use of Creativeness Technique

Simple data analysis can be conducted using the creativity techniques or pro/contra arguments balance (Chap. 2, 07:00 Planning & Scheduling). We search through stochastically choosing singular items. However, the final result might be too subjective. Due to that, such analysis shall be carried out independently by several people, who at the second stage compare and discuss the received results. The analysis can be also carried out by a team of experts (e.g. the Delphi technique, Chap. 5, 10:00 Earned Value Management: EVM, section "10:34 Time Control Procedures: Trend Analysis").

Analysis with the Use of Statistics Tools

Numerical, in particular statistical analysis can be carried out with the use of statistics tools, the simplest: Excel calculation sheets. As in case of every analysis, also here, in order to present a reliable and compliant results, we should first think thoroughly what the goal of analysis is expected and in what way the data should be tied with each other. This way e.g. the most frequently asked item or the total of specific sources may be evaluated.

Data Base Queries

Another, rather simple possibility of data analysis is based on stochastic data base query. Most frequently asked questions may be stored in inquiry programs, which in case of need are called out by hand or initiated automatically. Such programs can be also connected to an electronic system of numerical indexes, which enables automatic inquiry in case of certain events.

16:34 Tools Supporting Workflow

Workflow Tools

Well defined procedures allow for the deployment of workflow supporting tools. The results of an action are tightly bound with few limited possibilities of the following steps. The actions are supported by possible scenarios, documents to be
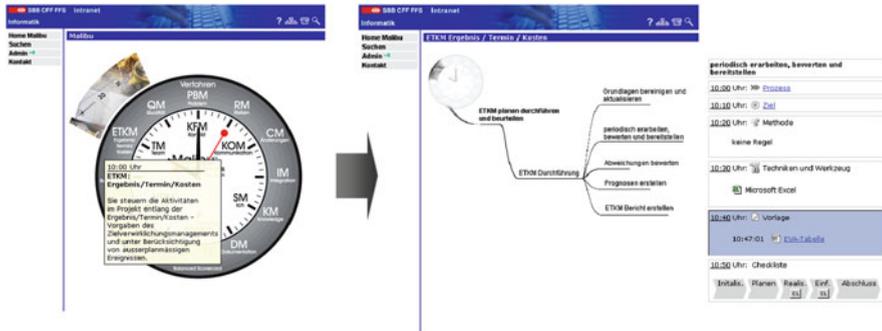
Fig. 11.5 Workflow supporting tool example project management handbook

filled in, explicit knowledge available from the previous actions and does not depend on any particular person, i.e. the tacit knowledge. Typical examples are call centres. Workflow support is implemented also in a concept of project supporting tool, where upon selecting particular action, the related explicit knowledge (methods, techniques, project phase and so on) is displayed to the user (see Fig. 11.5).

16:35 Project Management Office

PMO
The efficiency of explicit and tacit knowledge development and management can be substantially aided through the dedication of selected project team member to handle the Project Management Office (PMO).

PMO Activities
PMO secures that the explicit knowledge is well managed and documents repository is permanently on the most recent level of actualization. Tacit knowledge is supported actively by target distribution of explicit knowledge, communication and organizational activities (e.g. getting workflow bound people working closer, moderating the creativity (see Google example (Google 2012/2013)) and so on).

16:36 Project Management Handbook

Typical Project Management Handbook
One option while choosing the procedures to be followed by project team members is to apply the company or broader standard. However, most likely some items are irrelevant in our project (each project is by definition unique), other are not treated. We find demanded actions without a word on how to execute it (methods, techniques) and methods with no relevance to our project.
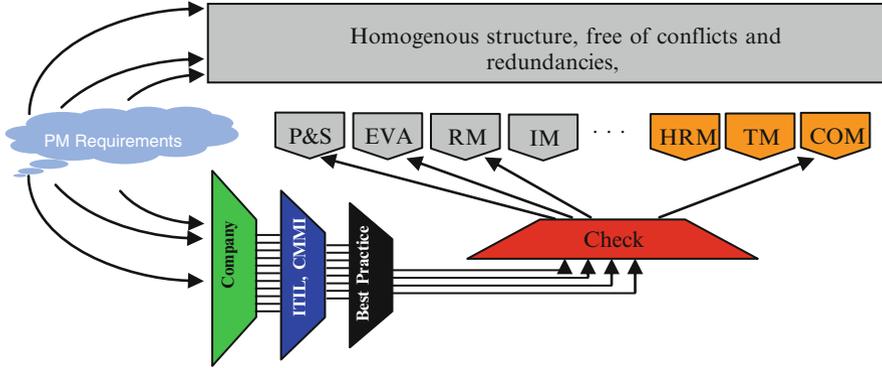
Fig. 11.6 Recording and structuring of actions

Requirements Based Project Management Handbook

The solely reasonable approach is to identify what are the actions demanded in your project beginning with customer expectations, your company formal and legal requirements, followed by your goal dedicated intentions and then to choose the proper methods, techniques, forms and checklists related to this specific action. The following generic approach apply to all type projects.

Step 1: Record and structure expected actions in your project
Upon identifying all actions you put them in certain homogenous, conflict free (best case: orthogonal) structure, adapting several filters: standards, best case, your personal experience (Fig. 11.6 gives an example of L-Timer® induced structure).

Step 2: Detail and weight the skills and requirements related to the expected actions
Project Management comprise between 500 and 2,000 actions (Lent 2010, page 270). It is unrealistic to expect someone to perform all of them the same best way. Also not all activities has the same importance. So in this step we shall choose and assign the relative importance of action (by e.g. dividing total of 100 % between 7 actions in the example below) and then weighting between 0 and 10 the relevance of the specific action in performance of a specific role. For each role we define such a profile. The allocation is not binary: 0 or one; it put more stress on certain activities (by allocating 10) and less on others (allocating 2). This way we may also define the fall-back responsibilities (deputies). Figure 11.7 exemplifies this approach.

Step 3: Answer how should the project manager carry out the activities?
Firstly we observe that the behaviour of specific role owner in project (e.g. project manager) is given by a sum of rules: B-rules, which are always mandatory (B for Basic, e.g. travel expenses form to be filled in) and such, which depends on some event: R-Rules (R stays for Relative, e.g. the realisation may be started if concept has been accepted).

Activity	Action importance	Role relevance
Examples	Relativ %	0 - 10
formulate project proposal	20	10
develop project vision from project proposal	20	10
draft the coarse project plan	10	8
write the project manual	15	2
define the project objectives	20	6
register the project	5	10
structure the library of results	10	10

Fig. 11.7 Step 2 Weighting actions and role relevance
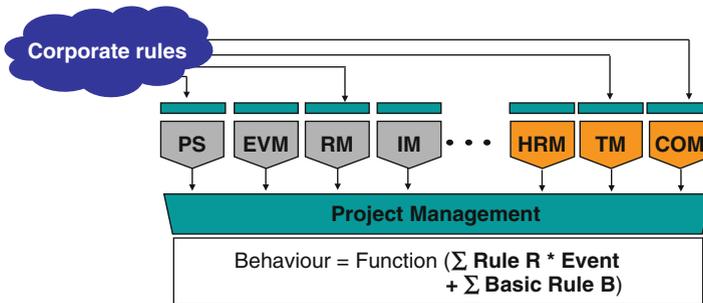
Fig. 11.8 Step 3 Assigning the rules to the activities

All actions shall be performed along specific rules: methods, techniques, tools, templates, checklists.

So now we search all rules which relates to the selected and weighed activities and place them accordingly (see Fig. 11.8).

In the result we may reach the exemplary matrix as depicted in Fig. 11.9.

Please observe that in the above example few places are left empty. This is frequently the case: a customer or our company requests from a project manager e.g. to control the costs, but seldom define which method is to be applied by cost evaluation, how the results should be written down (Tables or Text?), are there any templates available or which checklist applies?

The requirements based project management handbook developed along the above presented steps has following advantages:

• Activities of demanded project management are defined clearly and without contradictions
• Activities are allocated and weighed allowing for priority decision making

Activity Examples	Activity import. Relativ %	Role relev. 0 - 10	Methods Techniques Templates Checklist			
formulate project proposal	20	10	R1	R5	B1	P&S
develop project vision from project proposal	20	10		R2		P&S
draft the coarse project plan	10	8		R3, B3		P&S
write the project manual	15	2	B1	B2	B8	P&S
define the project objectives	20	6		R1		P&S
register the project	5	10		B1	R3	P&S
structure the library of results	10	10	B1			P&S
	Contents Event oriented Always applicable		Project Manual = Σ Rules R and Σ Basic Rules B			

Fig. 11.9 Activities and rules = project management handbook

- Only activity related rules are considered. We search for rules regarding the activities demanded in our project. We disregard the rules irrelevant to us.
- Only defined rules apply
- If no rule regarding certain activity is specified, the project manager is free to choose his behaviour
- No unnecessary theory. Irrelevant activities or rules are omitted
- The requirements based project management handbook is a clear contract between the company and the project manager on what and how he shall do.

16:40 Templates

16:41 Project Documents

The following document regulates the use of project knowledge base (Table 11.1):

16:42 Documentation of Project's Results

As an example the Project Management Handbook document is presented hereafter in Table 11.2:

Table 11.1 Example knowledge management rules in project

Rules concerning KM
0. General information
1. The aim of this document
2. Rules concerning the data retrival (data acquisition)
It describes how to use the tools of knowledge management system for project purposes. It also includes the description of the users or their authorization
3. Rules concerning updating
It regulates how knowledge updating shall take place.. Also here we must grant right to particular users, project partners, etc.
4. System availability
We must enumerate all possible known and planned breaks in the system (e.g. as a result of maintenance work or updating) and pass the information about the breaks to the users in proper time
5. Rules entailing statistical register
It includes statistical data concerning the utilization, breaks, etc.

Table 11.2 Example table of contents project management handbook

Project management hanbook
0. General information
1. The goal of this document
2. List of Sources
It describes the sources of the information used in the following chapters
3. Actions and Rules of Project Management Processes
Actions and rules solicited from mandatory documents like purchase contract, company regulations, structured and weighted, for example:
18 Chapters, which corresponds with each with one L-Timer® Process
Goal or Scope of each Chapter (process)
Actions weighted against other in the process
Roles with actions' relevance to the particular role
Identified methods, techniques, tools, templates, checklists for each action
4. Appendices
Additional informations like e.g. abbreviations, general reference documents

16:50 Activities and Deliverables of KM

16:51 Initiation Phase

Tasks
- None

Results
- None

16:52 Planning Phase

Tasks
- Plan of the knowledge management strategy processes, people, organizational culture
- Identify the available tacit and explicit knowledge with suitable measures
- Analyze the project goals with regards to the KM
- Set the first estimation of knowledge deficits in team
- Review with team the KM processes and organizational culture
- Set Project Management Office PMO
- Develop with team KM acquisition sub-processes
- Develop the KM repository system
- Develop with team the explicit and tacit knowledge distribution sub-processes
- Set the initial knowledge in the KM supporting system
- Develop and set the KM efficiency control system
- Make first reviews of the KM efficiency in the project.

Results
- Defined strategy, processes, organizational culture.
- Identified tacit and explicit knowledge in project
- Implemented processes of knowledge management
- Project Management Office PMO operational
- Project Management Handbook PMH elaborated
- KM supporting system and repository operational
- KM efficiency control system operational
- Project team acquainted with project KM
- Singular deployments of KM acquired in project verified.

16:53 Implementation Phase

Tasks
- Keep PMO and KM supporting system operational
- Stimulate team to develop both tacit and explicit knowledge
- Update PMH
- Reviews the KM efficiency in the project and execute the suitable actions

Results
- PMO, KM supporting system and repository effectively deployed
- Tacit and explicit knowledge developed
- PMH updated and effective

16:54 Closing & Evaluation Phase

Tasks
- Same as in the Implementation Phase and additionally
- Evaluate the efficiency of Project KM

Results
- Same as in the Implementation Phase and additionally
- Project KM evaluation report

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Quick Look

What Is It?

Documentation describes the products, delivered by project, for service staff, operators and users. Documentation Management secures its correct, complete and recipient conform elaboration during the whole project course.

Who Does It?

Good documentation managers are project team members with an experience in service, first level support (hot line) or in application of the similar products, or in business field, where project results are to be deployed.

Why Is It Important?

Service, Operators and Users in most cases were not part of the project team – so they do not have any knowledge about the product. The documentation of changes is usually inferior. Yet, the recipients have to use and maintain the product – in some cases with vast financial impact. There-fore, proper documentation is crucial.

What Are the Steps?

Define the DM criteria for recipients: users, operators, service staff, and the procedures. Develop the sustainable documentation management system. Each new element in product specification turn into product documentation. Than check what shall be changed in users and operator documentations. Inform the initiator of the documentation input about the results of your actions. Initiate the DM process changes if appropriate.

What Is the Product?

Nominate your documentation manager already in the project initialization phase.

Initiate the DM steps as soon as possible and get already first draft of documentation separately for the users, operators and service based on project goals and specifications. Include the validation procedures and results, as well as business process considerations, in a recipient conform manner. Keep trace of all changes and update the documentation duly.
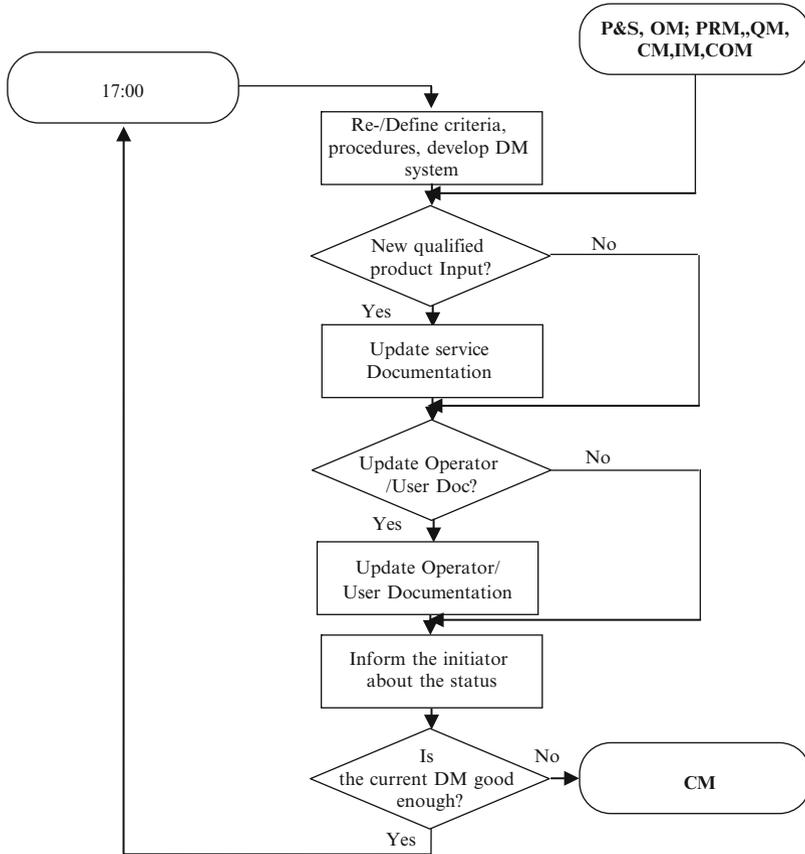
Fig. 12.1 Documentation management process

How Do I Ensure That I Have Done It Right?
Start with the first product specifications and actualise the documentation continuously during the project course. Split the documentation into the recipient conform results. Focus on what all really each recipient wants to know.

Process

Documentation Management first sets all the criteria, procedures and supporting system and later during the project course continually verifies if reworking is needed. Each registered input is qualified along the adopted criteria. If suitable firstly the product, than the Operator and Users Documentations are adjusted. The initiator is duly informed, whether his input is considered or needs improvements Fig. 12.1.
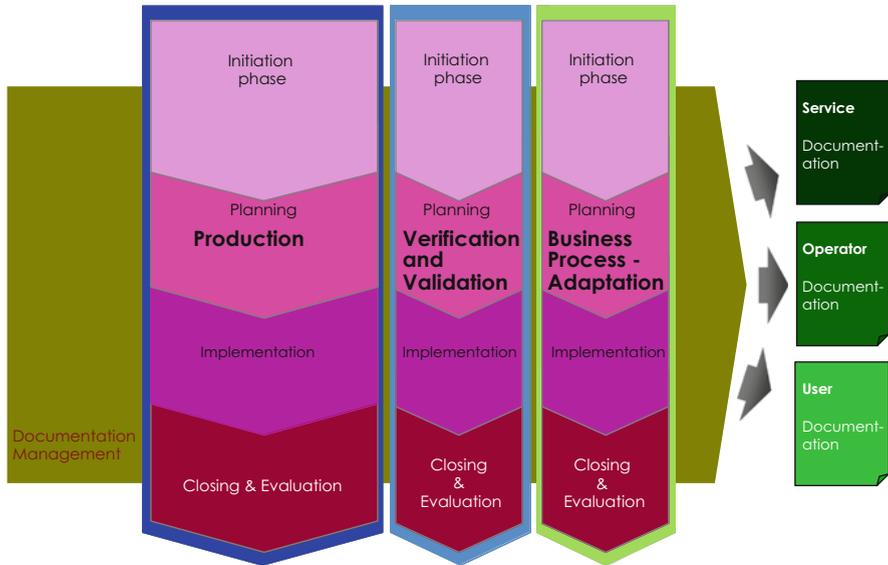
Fig. 12.2 The phases changed names acc. to ISO Standard

17:10 The Goals of Documentation Management

The goal of the process of Documentation Management is to secure the financially efficient service and operation of the project products and to ensure the fullest users acceptance of the recipient conform documentation.

17:20 Methods

ISO 21500:2012 does not sees documentation as a process. Parts are covered by the communication processes (4.3.38 Plan, 4.39 Distribute and 4.40 Manage communication), part as the working tasks in Work Breakdown Structure WBS (ISO 21500:2012 2012). However, the activities in a project, which target the post-project product life cycle, determine the perception and acceptance of the project deliverables. Therefore, binding and optimization of those activities into the documentation process are considered vital to the project success.

17:21 Documents Elaboration

Sources of the Documentation
Documentation of the project products originates from the three process areas (see Fig. 12.2):
• Production Process (which actually deliver the result)
• Validation Process (which assure the conformance with the original specifications) and

- Business Process Adaptation (which handle the changes imposed by taking the project products in operation)

and in each of these areas in all project phases :

Phases and Documentation Origins
- Initiation (Goals and Requirements)
- Planning (Concepts, Specifications, Terms of Reference (ToR), Architectures, Business Process Adaptation Considerations)
- Implementation (Product Description, Validation, performed Test Cases, Draft Service Manual, Documentation of Changes)
- Closing & Evaluation (Implemented Business Reengineering, Service Manual, Operator Manual, Users Manual)

17:22 Service Documentation

Service Documentation shall comprise all the information needed to cost efficient maintenance aimed to secure the agreed grade of service. In particular these are:

List of Service Documents
- Functional and non-functional description of the product (Goals, Requirements, Concepts, Specifications, ToR, all Changes)
- Architectures, Interfaces, Implemented Security including all Changes
- Acceptance Test Cases, Validation, Verification and Test Procedures and Results
- Documentation of Service Support Diagnostic and Maintenance Management Systems
- Documentation of Service Organization
- Service Manual

17:23 Operator Documentation

Operators work on fully operational products adjusting their parameter to actual business processes' needs. They are in-betweens of Users and Service. The operator's documentation comprises:

List of Operator Documents
- Functional description of the products with all Changes
- Implemented Security and Operator Authorization
- Description of Interfaces
- Documentation of Users' Settings and Parameters
- Documentation of Operational Statistics and Data Collection and Management Systems
- Documentation of Service Contacts
- Documentation of Business Contacts
- Operator Manual

17:24 Users' Documentation

Users are main target recipients of the project results. They should be documented sufficiently to perform along the business processes, which are changed and supported by the newly introduced products of the project. Users Documentation comprises:

List of Users' Documents
- Supported Business Processes Descriptions
- Functional and Non-Functional Description of the product in terms of how it support the Business Processes
- Description of all parameters and settings along the default values
- Documentation of Operator Contacts
- Documentation of Service Contacts (Escalation)
- Users' Manual

17:25 Efficiency and Quality Criteria

Results and their documentation are created in the whole project course generally by different project members. The efficiency and the quality of documentation is determined by the criteria, set at the early project stages and the supporting procedures and tools.

Contents Requirements
First the contents expectations of the recipients are to be met. Each of the groups defines its needs. In most cases they include: short introduction to the scope and purpose of the product, functions overview, user parameters and settings and fast error tracking and corrective procedures.

As different the recipient groups are as different may be the understanding of each of the above items.

Documents Recipients Anonymity
Basic distinguishing factor of MD target recipients is their anonymity. They are usually not involved in the project and do not have any knowledge neither regarding the product nor the team, that developed it.

Thus all documents have to be written in a way and in language, which is fully understandable by outsiders. Project team members seldom think about that by using very specific terms, context and abbreviations known to project team only.

Documents Usability Criteria
Crucial to all documents are recipients usability criteria. Each document shall be created, written and finally presented to the recipient in language and form, which he understands. We may use technology oriented description for service and operators, we should use business language for the users. Whereas today English in service and operation became de facto standard, users are local and expect their native language.

Recipient Way of Thinking as Acceptance Criterion
Finally, the logic in presentation shall correspond with the usual logic of thinking of recipients: different for service engineers, different for operators and even more deviant for users, which come from the target business.

Criterion of Fast Access to Needed Information
All recipients evaluate the usability by the quickness of references. In most cases they take the documentation in hand facing the problem, which is not solvable with the current knowledge. All means of fast search: keywords, margin notes, transparent structure, computer browser versions, just to name the few, are suitable means to forge high recipient acceptance.

17:26 Documentation Manager

The core of the documentation is created by the project team. It is difficult for them to think in an alternative way of anonymous recipient, and this three times different. The documentation manager, who brings with him an experience of direct user, preferably operator and service employee, is an optimal choice. Call-center employee, first level supporter with some communication skills will do.

17:27 Deployment of Document Management System

Document Management Systems (DMS) are suitable support to reach the DM process goals. Their basic advantages are:

DMS Advantages
- Trace of all changes
- Version and Document Release Control
- Cost efficient storage
- Fast Retrieval.

Fast retrieval is primarily given by the search keywords and logic. Here two contradictory positions have to be merged and resolved:

Project Team Versus Recipient DMS
- DMS deployed by the project team
- DMS used by the service, operator and/or user organization.

The first one secures the proper content, the second one the proper usability. Therefore, it makes sense, to consider both at the project initial stage and draft the DM procedures in such a way, that the advantages of both can be fully exploited.

17:30 Technique and Tools

In the process of documentation management we can basically apply the same techniques and tools, as in the process of knowledge management. However, we must remember that in case of the process of documentation management, the target

group is not the group of managers or project team but the users and staff responsible for system maintenance, so people from outside of a project. They are in principle not interested in the project course history, but solely in possibly complete documentation up to their needs.

17:31 Document Structure and Tagging

As in case of KM, the effectiveness of technological solutions is given by the accuracy and system logic of the stored files.

The logic shall follow here the recipient groups and their individual criteria. Structure shall depict the concrete needs of the recipients. Tagging – e.g. the most frequently asked questions.

17:32 Data Repository and Retrieval Tools

Paper File Archive

Basically same as above, all KM data repository and retrieval tools may be used in DM as well. Yet in today practice the following tools are mostly used:

- Paper file documents. They are easy to distribute among anonymous recipient.
- File system, in particular with push-in option. This is particularly often deployed in operator and service support, where the recipient address is known. This way target oriented information may be passed.
- DMS in connection with browser is currently gaining in acceptance, as the manufacturers provide all and up-to-date product information available upon choosing any search data in any browser. Access control allows to differentiate the closed registered user access over Intranet from wide anonymous, unrestricted public internet access.

17:33 Data Management Systems

DMS (see above) advantages as it can handle documentation of various product versions simultaneously.

17:40 Templates

17:41 Project Documentation

An Example of Users Manual Table of Contents is given in Table 12.1. below.

Table 12.1 Users Manual table of contents example

Creating users manual
0. General information
1. The Aim of the document
2. Project terms of reference for Users Manual
The original terms of reference, specifications and other mandatory documents are here reviewed form the point of view of the Users Manual requirements
3. Policy of product related information gathering
It defines how the information about the products shall be collected, assembled and stored during the project course
4. Change handling policy
This chapter defines how the changes in ToR and in product related changes are to be entered into the documentation
5. Presentation guidelines
This part contain the guidelines on how the Users Manual shall be presented, which are agreed and accepted by the representative (opinion liders preferably) of the user
6. Documentation manger and his team selection
Here the role of documentation manager and the roles of his team members are specified according to Chap. 3, 08:00 OM and the above considerations
7. Documentation management system
Documentation manager leads the selection of the appropriate DMS for the project
8. DM process planning
Here the basic parameters shall be evaluated and decided: deliverables, budget and time schedule
9. Project team trainings an coaching record
The efficiency of product related information gathering depends most of all on the right collaboration of the project team. Suitable trainings and coaching secure this
10. Users Manual elaboration trace record
Evolutionary development of the Users Manual shall be traced for improvements
11. Users Manual elaboration process improvement record
We learn with a time and improve the elaboration of the Users Manual process, too

17:42 Documentation of Project's Results

One of the results, Service Manual, must include the following information (Table 12.2):

17:50 Activities and Deliverables of DM

17:51 Initiation Phase

Tasks
- Evaluate candidates for Documentation Manager

Results
- Documentation Manager chosen and on board

Table 12.2 Service Manual table of contents example

Service manual (HERMES 2005)
0. General information
1. The aim of a document
2. System outline
Describe technical connections between system components and provides the general description of a system. It contains a.o.:
Technical architecture of a system and external interfaces
Goals and main functions of a system
General information about the safety, data protection, practical functions
3. Start-up
Initial conditions and parameters
Start-up procedure
Restart procedure
4. System operation and monitoring
Describes measures taken in order to keep the operations and monitoring of product and in particular:
Traits of brake-downs and functional reduction of grade of service
Measures taken in order to evade breakdowns and functional downgrading
Measures taken in order to locate the source of problems and to remove them
5. Temporary stop-overs or deinstallation
Describes measures taken in order to finish or to discontinue the exploitation:
Exceptional and regular Stopovers or De-installation
Measures taken in order to temporary stopover or final deinstallation
Additional and final works
6. Rules/Arrangements concerning safety
Describes rules/arrangements and measures necessary to guarantee the required safety. They refer to the area of infrastructure, organization and personnel as well as preventing disasters and insurance
7. Enclosures
Technical comments and lists
Notification about errors (including reasons and measures leading to solutions)
Dictionary
Index

17:52 Planning Phase

Tasks
- Analyze project goals from the point of requirements concerning documentation
- Analyze the scheme of product organization/product structure plan as a pattern for document structure
- Include the needs of recipients in the structure and presentation form of documents
- Appoint people responsible for documents management

- Set the information gathering and change polices
- Chose and get tools and DMS in order to support the process of documentation management
- Set the criteria of documentation information qualification
- Work out the processes of documentation records inside the project team and put it into practice
- Determine the process of modification with reference to documents' management
- Register documents in the project initial stage
- Plan the deliverables, time schedule and budget of DM
- Plan project team trainings and coaching in information gathering
- Prepare the DM improvement procedures

Results
- DM Team and DM process operational
- Determined documents' structure and their versions administration
- Implemented processes of documentation build-up
- Ready to use DMS and other tools of documents management
- Registered documents from the initial stage
- Tested processes from the moment of putting it into records until the moment of usage
- Training and Coaching Plan to gather the information in project team

17:53 Implementation Phase

Tasks
- Train and coach all project team members in information gathering
- Assure information gathering by the project team
- Assess the change proposals and include the changes in appropriate documents.
- Keep the DMS and other DM tools operational
- Elaborate the documents' drafts

Results
- Operational DMS, tools and information gathering under surveillance
- All relevant project team members trained and coached
- First drafts of documents available

17:54 Closing and Evaluation Phase

Tasks
- As in the Implementation Phase except:
- Elaborate the final version and obtain the recipient acceptance for all product related documents
- Elaborate and made operational the after-sale-support of documentation

Results
- Verified and accepted product documentation
- After-sale-support of documentation operational

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18:00 Balanced Scorecard: BSC

13

Quick Look

What Is It?

In Earned Value Management (EVM) process we evaluate the progress in elaboration of project deliverables. BSC process is the only process of balanced evaluation of all aspects, which are relevant in successful project realization: customer, finances but also processes and people.

Who Does It?

Project manager is the second choice. Best process owner is the one responsible for quality management (QM) or EVM process.

Why Is It Important?

EVM provides progress information, QM informs about the deviations in processes pinpointing possible reasons. Human Resource Management (HRM) measures the people attitude towards the work and their expectations. We have to balanced all in a reasonable, explainable to project sponsors and customers, way.

What Are the Steps?

Verify the strategy of your company, that of your customer. Set the goals in various perspectives relevant to your project. Define their mutual importance. For each perspective Choose the indicators and the target values which defines their achievement. Collect the real data, compare with target value and assess the degree of objectives achievement. Evaluate the results and propose the improvements. Repeat this process periodically.

What Is the Product?

It takes some time to evaluate the strategies, choose the right perspectives and to balance between them. Certain effort cost the individual objectives, measures and the target values in each perspective. Set for data collection and collect simultaneously for all perspectives. Assess each target achievement and balance measures and objectives along the perspective relative value.
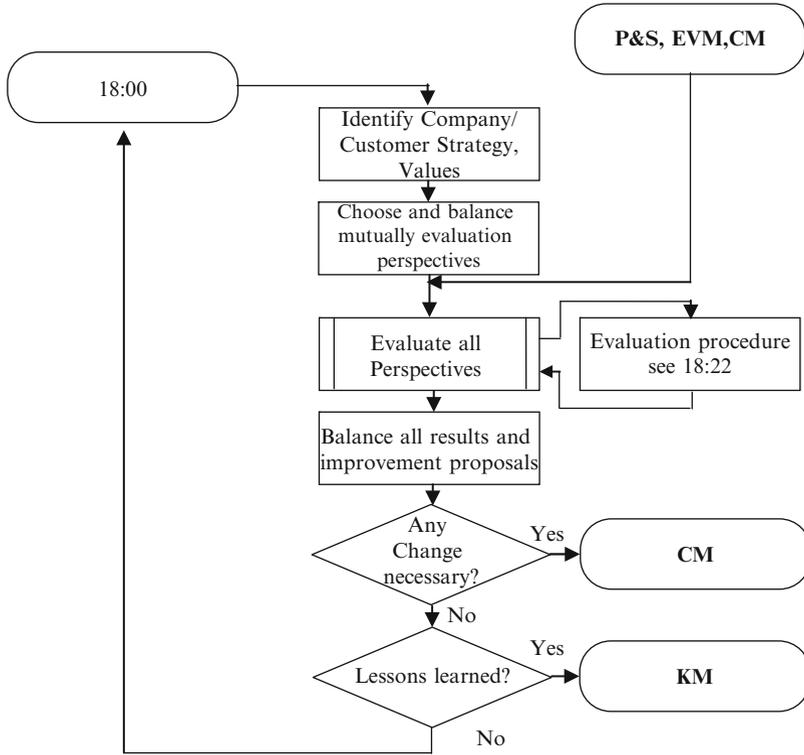
Fig. 13.1   Balanced scorecard process

How Do I Ensure That I Have Done It Right?
Agree the value of each perspective with your sponsor and with customer. Assure the
measurability of objectives: choose right targets and assure that the suitable data
may be collected and evaluated. Analyze and if possible avoid the interdependent
objectives.

Process

In relation to the strategies and values the evaluation perspectives are chosen und
mutually balanced. Each perspective is evaluated. Final results are put together.
Necessary changes are initiated and lessons learned appropriately stored. The
process shall be periodically repeated; evaluation may be initiated by other pro-
cesses, too. Figure 13.1 depicts this process.

18:10 The Goal of Balanced Scorecard

The goal of Balanced Scorecard is the integral, overall assessment of the whole project comprising both the current project results evaluation as well as an evaluation of the project course, targeted in sustainable positive contribution towards the implementation of the project handling company's strategy.

18:20 Methods

The BSC process closes the day of L-Timer® project manager: he evaluates how good the performance that day was, with an impact of human factor the night before and the night to follow. The results might lead to changes – directly affecting all other L-Timer® processes, Planning & Scheduling in particular. This starts just the next L-Timer® day morning...

Two processes in ISO 21500:2012 models the project evaluation: 4.3.7 Close project phase or project and 4.3.8 Collect lessons learned (ISO 21500:2012 2012). Although the titles and positioning in the Closing processes group are misleading, the descriptions of both processes match the goal of the balanced scorecard of a project... up to the balancing. This is not tackled by these two processes neither by any other. And as project manager needs clear and unambiguous guidelines, the balanced scorecard process is a unique source of such a critical provision.

18:21 Balanced Scorecard Concept

Kaplan and Norton formulated thesis that "can not be managed, what can not be measures" (Kaplan and Norton 1992).

Project management comprises the administrative measurable processes and the more complicated to measure human factor related processes. The last have decisive impact on the overall project performance.

Successful project management balances all processes in a way, which allows project manager to set right priorities and undertake suitable actions.

In order to find a common base for the balance we shall:

1. Balance the importance of all processes mutually
2. Choose the specific objectives in each process and balance them mutually between themselves.
3. Choose the measures for each objective and target values which define the objective achievement.
4. Define the data measurement procedures.
5. Perform the measurements and compare the results with objectives measures target values.
6. Balance all objectives' results and all processes results and elaborate the final project evaluation.

Fig. 13.2 BSC evaluation

An aggregation of processes allows for easier interpretation of the results. The new aggregated views on project are called further perspectives. Two aggregated models: Balanced Scorecard of Kaplan and Norton and Project Excellence are presented later in this chapter.

18:22 BSC Balanced Scorecard Evaluation

An evaluation whether objectives have been achieved proceed the same way for all objectives and all perspectives, including the objectives and measures revision (see Fig. 13.2).

18:23 Kaplan and Norton Balanced Scorecard

Kaplan and Norton choose four perspectives related to the company strategy (see Fig. 13.3) (Kaplan and Norton 1992):
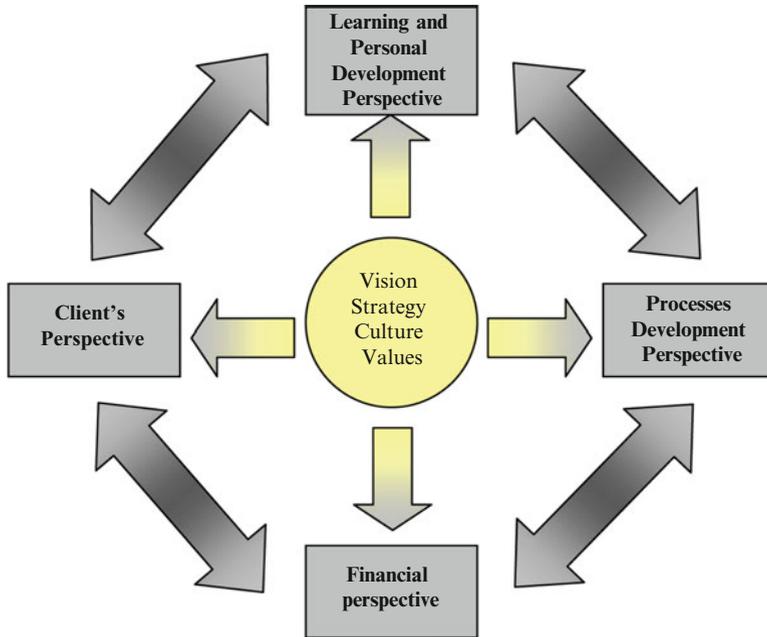
Fig. 13.3 Results assessment

– Financial perspective
– Client's perspective
– Process development perspective
– Learning and Personal development perspective

Financial Perspective
Financial perspective entails value measures, which characterize financial goals. In case of a project it may be e.g. profitability index (e.g. the relation of costs and profits).

Client's Perspective
In the client's service we evaluate comprehensively the relationship with the client. We may set the quality or timely delivery as a criterion, but we may measure also the general satisfaction of our client with the overall project performance and attitude towards his needs.

Processes Development Perspective
We assess the quality of a process and care for process improvements in Quality Management process (QM). However, where there is a limit of the optimisation and where there is justifed action needed is settled in BSC. In processes development
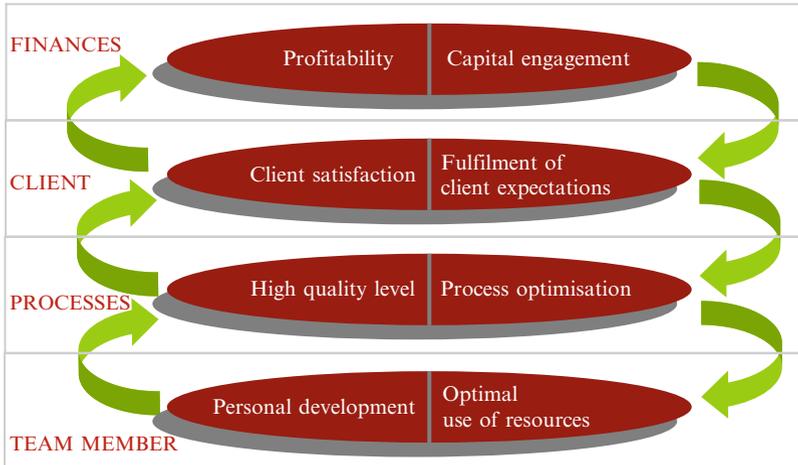
Fig. 13.4 Results assessment

perspective we set the process development goals like e.g. change management decision improvements.

Learning and Personal Development Perspective
Processes are implemented by humans. So their qualifications and motivation directly influence the results of process execution. The improved performance feedbacks to customer the improved deliverables. These in turn generate new financial possibilities for project or project handling company. Figure 13.4 shows these relationships.

The aggregation bears some risks of interrelated objectives as shown in Fig. 13.5.

The resulting measures may mislead to false conclusions: not realizing that motivation has an impact on process effectiveness we may focus on symptoms dealing with clients' satisfaction.

18:24 Project Excellence

Project Excellence (Project Excellence 2013) splits the perspectives into two equally valued at 500 points areas:
– Project management
– Project results.

Further in each area arbitrary valued are individual perspectives as shown in Fig. 13.6. The achievements in each perspective are measured against this maximal value. The assessments are performed by project external auditors, which might contribute certain objectivity here.
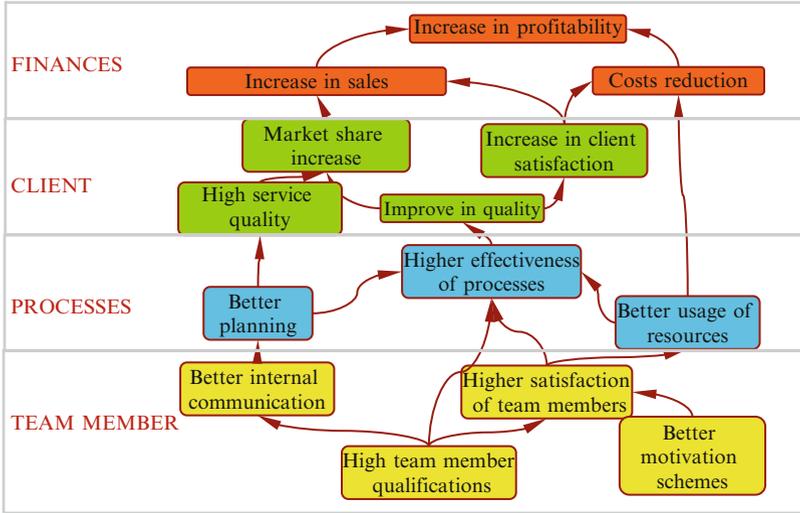
Fig. 13.5 Examplary objectives interrelation
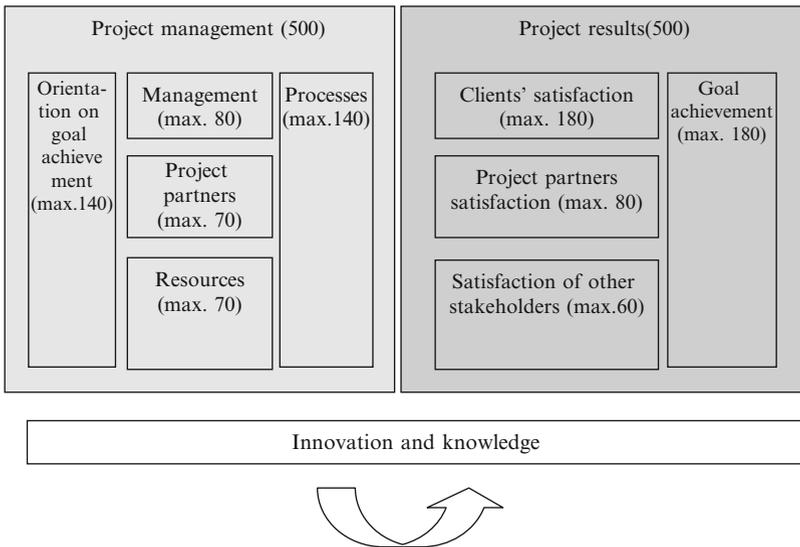

Fig. 13.6 Method of project assessment – project excellence

18:25 Kaplan and Norton Balanced Scorecard and the Project Excellence Model Interrelation

Table 13.1 shows relations between the assessment along Kaplan and Norton Balanced Scorecard BSC and the model of 'Project Excellence'. Each area of Kaplan and Norton BSC is mapped onto the Project Excellence assessment.

Table 13.1 Interrelation between the Kaplan & Norton Balanced Scorecard and Project Excellence

Assessment criteria of 'Project Excellence'	Project Excellence points assignment	Vision, strategy, culture, values	Financial perspective	Clients' perspective	Processes development perspective	Perspective of learning and development
Project conduct (500 points)	Orientation on goal	140	28	28	28	28
	Conduct	80			40	
	Partners	70	35			
	Resources	70		35		35
	Processes	140				70
Project results (500 points)	Clients' satisfaction	180			180	
	Partners satisfaction	80				
	Satisfaction of other stakeholders	60			60	
	Goal achievement	180	36	36	36	36
Total		1,000	99	99	344	169	289
Shares in percent %		100.0 %	9.9 %	9.9 %	34.4 %	16.9 %	28.9 %

The maximal values in Project Excellence perspectives are assigned indivually to Kaplan and Norton BSC perspectives. In ambiguous cases a proportional split has been adopted.

We observe, that Kaplan and Norton BSC perspectives obtain in Project Excellence model predefined different values. So for example the area 'Financial perspective' plays rather a minor role (99 points). In contrast, the area 'Clients' perspective' has a dominating position (344 points). Figure 13.7 shows these interrelations.

It is nevertheless recommandable to preserve the same selected method of BSC over the longer time period.

18:30 Technique and Tools

The below techiques are described along the Kaplan and Norton BSC perspectives.

18:31 Clients' Perspective Techniques and Tools

Surveys

Surveys and questionnaires are efficient tool to collect anonimous, thus better reflecting the actual mood, project opinions of client representatives. This technique is descirbed in Chap. 7, 12:00 Problem Management: PBM and also in (Kühn und Fankhauser 1996, 2009).
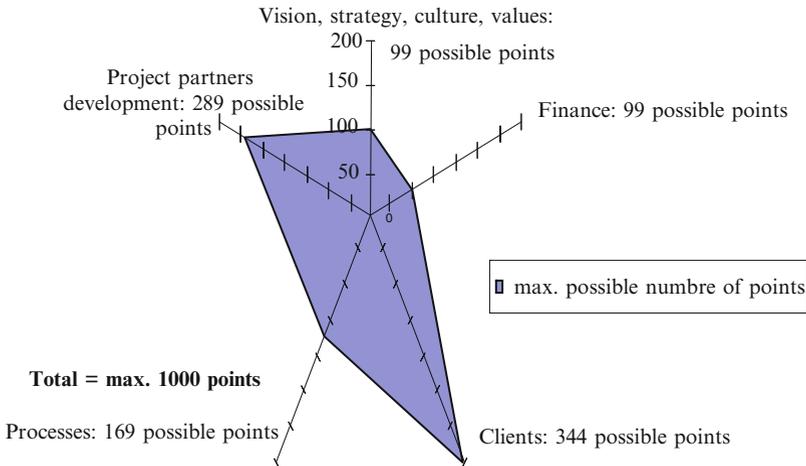
Fig. 13.7 Interrelation between the Kaplan and Norton BSC and project excellence

Interviews and Checklists

Analogically, like in case of questionnaires, information about clients can be gathered also through interviews. Checklists are suitable supportign tools here.

Feasible Client Perspective Objectives

Feasible objectives and measures might be (Phillips et al. 2012):

- Measured value of an indicator or index of clients satisfaction,
- Number of complaints for one client or a group of clients, together with the efforts and costs needed to solve the problem,
- The required time of reaction needed for each client's question, their order, problem, etc.

18:32 Financial Perspective Techniques and Tools

Feasible Financial Perspective Objectives

Feasible objectives and measures might be:

- Budget control: earned value (see Chap. 5, 10:00 Earned Value Management: EVM).
- Profitability calculation: return on Investment (RoI) and pay-back calculations (see Chap. 2, 07:00 Planning & Scheduling: P & S).
- Internal Interest Rate (IRR); also called net present value of the project comprises all interest rate charged cash flows (see Chap. 2, 07:00 Planning & Scheduling: P & S).
- Concrete saving targets, limits on expenses or turn-overs.
- Functional usability value.
- Values elaborated in Balance of for and against arguments (see Chap. 2, 07:00 Planning & Scheduling: P & S).

18:33 Process Development Perspective Techniques and Tools

Systems of Process Numerical Objectives and Measures

Analogically to the systems of numerical measures in financial perspective, we can also create systems of numerical measures concerning a process.

Feasible objectives and measures might be:

- Estimated operational time (see Chap. 5, 10:00 Earned Value Management: EVM).
- Number of production errors in a process.
- Number of necessary procedural interactions.
- Current productivity (efficiency).

Balance of Pro and Contra Arguments

Balance of for and against arguments serves to assess the immeasurable amounts (see Chap. 2, 07:00 Planning & Scheduling: P & S).

Process Assessments and Appraisals

Process assessments and appraisals are carried out in order to gather information about the processes in some standardized way. They are carried out with a certain goal and require careful planning (see Chap. 6, 11:00 Quality Management: QM).

18:34 Personal Development Perspective Techniques and Tools

Observation

Observation is relatively effective technique to determine the present capabilities and future areas of personal development.

Project team members should be rather observed in their natural, regular work environment. Observation is very time consuming, thus carrying it out is limited by time. The documentation is mandatory for proper evaluation.

It must be noticed here, that in case of observation, the real motives of project team members performance are very often hidden from the observer. Thus, it is suggestible to validate the observations with a third person, preferably another project team member, in order to place the efficiency also in a function of motivation of observed person (e.g. highly gifted but unmotivated programmer might be falsely judged by his work performance).

Surveys and Interviews

As in case of client's perspective similar techniques, namely surveys and interviews may be deployed.

The assessment of team members situation may include following examplary objectives and measures (Phillips et al. 2012):

Feasible Personal Development Perspective Objectives

- Satisfaction with project organization, team members, project manager etc. This numerical indicator is in strong correlation with the index concerning employees replacements and absence.

- Engagement in goals, values, culture and activities set by a company and a project. We can observe multiple correlations with achievements and productivity.
- Atmosphere in the place of work connected with communication, openness, trust, return information etc.
- Number and kind of complaints from project team members within certain period of time.
- Number of personal changes within certain period.
- Number of absences within certain period.
- Number of inquiries concerning reorganization received over certain time period.

Example

In Table 13.2 the possible objectives, measures, targets and perspective mutual interrelationship are set and hipethetical results are evaluated. For the simplicity of the example only one measure is given for each objective.

We have case of results between the limits, (e.g. Terms of Reference ToR fullfilled) and results beyond: below the minimum (e.g. Satisfied with work) and above (e.g. budget kept).

The results might be in percentage of feasible maximal objective achievements (e.g. customer perspective) or even exceed (e.g. finances) if we allow to reach more than 100 % objective achievement (e.g. budget kept).

We may have various distribution functions between the zero and maximal target achievement (linear, heaviside, delta Dirac, nonlinar) as well as below and above. Choice reflects our policy regarding the objective achievement evaluation.

18:40 Templates

18:41 Project Documents

The achievements during project course may be documented in different way. It is recommendable to include the results of Balanced Scorecard. Exemplary report is given in Table 13.3. below:

18:42 Documents of Project's Results

The financial results of a project may be given in a plan, which should include the following elements (HERMES 2003 (2003)) Table 13.4:

18:50 Activities and Deliverables of BSC

It is advisable to perform the BSC evaluation at least in each project stage past Initialisation or after the 6–12 months period.

Table 13.2 The example of balanced scorecard

Kaplan & Norton BSC Pers.	of 100 %	Objective in perspective	of 100 %	Measure	Target	Zero results	Distribution	Real data	Reached %	Total %
Customer	40 %	ToR fullfilled	60 %	No of acceptances at first tests	>8 of 10	<2 of 10	Linear 0–10	7	7/8 × 60 %	37.80
		Changes accepted	30 %	No of accepted changes	>5 of 10	0	Linear 0–5 unlim.	7	7/5 × 30 %	
		Satisfied with work	10 %	% of positive feedbacks	>70 %	<40 %	Linear 40–70 unlim.	30 %	0 × 10 %	
			of 100 %							
Finances		Budget kept	80 %	Deviation from budget	<10 %	>15 %	Linear unlim.	8 %	(15–8)/(15–10) × 80 %	33.60
Cash spendings reduced	20 %	500,000 US $ less		> 500,000	<500,000		upwards unlim.	450,000	0 × 20 %	
			of 100 %							
Processes		Changes implemented	70 %	% of implemented within 1 week	>90 %	0 %	Linear limited	50 %	(50 %/(90–0 %)) × 70 %	6.89
Interactions reduced	30 %			<4	>8	linear limited	3		100 % × 30 %	
			of 100 %	No of steps needed to do things						
Personal	20 %	Team motivated	100 %	Team satisfaction	100 %	<100 %	Heavi-side	98 %	0 × 100 %	0.00
Totally achieved										78.29

Table 13.3 Project evaluation example

Report "Realization of stage x of a project" (HERMES 2003 (2003))
0. General information
1. Aim of a document
2. Summary
Short and clear summary of the next chapters. It takes max. two pages and preferably a different paper colour is used for this purpose
3. Initial state
Results from the earlier periods
Framework conditions in accordance with a project management handbook
4. Results related to project goal achievement
Summing up the present results concerning:
4a. Project planning and project organization:
Project plan
Quality safeguard plan
Plan of Risk Management
Plan of Knowledge Management
Concept of implementation
Concept of training
System integration plan
4b. Economic profitability
Incomes/Expenditures
Budget
Financial indicators
4c. Team
State of knowledge and education
Effectiveness
Conflicts
4d. Clients
Questionnaire results
Presentation results
4e. Solutions and processes
Description of business processes
Organization description
Organization hanbook
Exploitation handbook
Application handbook
IT system
System requirements
System Design
Prototypes
Migration process
Migration method
We should also report on the level of safety and data protection requirements completion

Table 13.3 (continued)

Report "Realization of stage x of a project" (HERMES 2003 (2003))
5. Ressources
Material measures
Personnel
Training
Services
6. Consequences
Effects (organizational, personal, constructive, regulations/guidelines)
In case of lack of realization
In case of postpones realization(in relation to a demanded deadline)
Assessment of risk rate
7. Motions
Approval of a report "Realization of stage x of a project"
Permission to begin the next stage
8. Enclosures
Supplementary documents
Position papers
Protocols

18:51 Initiation Phase

Tasks

- Clarify the relevant strategy, mission, values
- Draft the perspectives, objectives, possible measures and targets
- Make a plan of BSC realization

Results
- BSC draft and realization plan

18:52 Planning Phase

Tasks

- Gather data
- Refine the current BSC structure, target values in particular
- Conduct the BSC evaluation for the 'Planning' stage
- Decide and take appropriate measures

Results
- Gathered data
- BSC Evaluation of the Planning Stage
- Eventual change requests and Knowledge Inputs

Table 13.4 Project results plan example

Plan of project's financial results
0. General information
1. Aim of a document
2. Project's own costs
All one-time costs of development(total costs) divided according to costs categories and sources. Total costs, are transferred (amortized) to system costs accordingly to an expected period of utilization
3. Own costs of exploitation
The yearly constant (among other things amortization of project costs) and variable full total costs resulting from system utilization, its exploitation and infrastructure as well as maintenance/service of a system, allocated according to costs categories and sources
3.1. System utilization
Costs of utilization (the indirect and direct users)
3.2. Exploitation/system infrastructure
Costs of system's operator and infrastructure, which are necessary to system exploitation
3.3. Maintenance/service of a system
Costs of maintenance/service born by users, operators and constructors
4. External costs
Cash flow based external project and operational expenditures (identical cost structure as in internal cost plan)
5. Profits calculation
5.1. Measurable profits
5.2. Immeasurable profits
6. Summary
6.1. Comparison of costs/profits
6.2. Personal effects
Referring to time and quantity: increased demand, increased burden, reduction, relieve
7. Information concerning economic profitability
Information if the numbers have been estimated or effectively calculated
Reliability/risk states of the taken assumption/estimations: deadlines, costs, quality, quantitative and voluminal development, etc.
Explanations and details concerning the above items (chapter)

18:53 Implementation Phase

Tasks.
• As in the Planning Phase, repeated periodically if suitable

Results
• As in the Planning Phase

18:54 Closing and Evaluation Phase

Tasks
- As in the Implementation Phase
- Elaborate final BSC of the project

Results
- BSC of the project

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Part II
Human Factor

Ms. Angelika Gifford, Microsoft EMEA Services Public Sector Head, Manager of the Year © Microsoft

The chapters in this part have one common denominator: a human being. A hectic life during a day is replaced by 2-h pace of processes at night called 'Human

factors'. Similarity is purposeful. The following chapters are systematically elaborated:
- 20:00 HRM Human Resource Management
- 22:00 TM Team Management
- 00:00 CFM Conflict Management
- 02:00 COM Communication
- 04:00 SM Self Management (Work & Life Balance)
- 06:00 L Leadership

Human Interactions are complicated and never very crisp and clean in their effects, but they matter more than any other aspect of the project work.

If you find yourself concentrating on the technology rather than the sociology, you're like the vaudeville character who loses his keys on a dark street and looks for them on the adjacent street because, as he explains, "The light is better there"".

Demarco T., Lister T. (1999) Peopleware: productive projects and teams. Dorset House, USA

20:00 Human Resource Management: HRM 14

Quick Look

What Is It?
Human Resource Management (HRM) assigns the right people to roles elaborated in Organization Management (OM), cares about their individual performance deficiencies and their job satisfaction.

Who Does It?
It is advisable to charge someone in team with psychological background to manage the HRM process. Casually project manager misuses HRM to strengthen his position.

Why Is It Important?
People make project done. So the right role owner decides about the project fate. His performance depends on his capabilities and his motivation. HRM takes care about them.

What Are the Steps?
Verify and close pending process improvements and tasks. If there is a noe or changed role – perform the appropriate procedure. If there is unsatisfactory role efectiveness or role owner unsatisfied – start appropriate procedures, too. Candidates recruitment including evaluation and personal development best to outsource to professional HRM departments. After verifying all roles check if Change Request or Knowledge Management shall be addressed.

What Is the Work?
Most unlikely you will not find an ideal match to the vacancy. In most cases you have to manage projects with role owners already set. You have to assess the deficiencies and the probability of improvements with right HRM measures. Balancing act is the adjustment of formal, informal roles and personal needs of all team members. As people develops with project progress, the HRM has to be run perpetually in order to secure the best feasible team performance.

How Do I Ensure That I Have Done It Right?
Be attentive to personality traits and their impact on role performance. Plan sufficient time to deal with role ownership deficiencies, evaluate thoroughly if personal development might help. Care about people job needs.

Process

Firstly try to finalize all hanging issues, before you take on the new or changed role. If there is one – start the assignment procedure. Next check the efficiency of the role owner as seen by the management and adversely verify the team member satisfaction. Repeat until all roles are verified. Suggest changes, store knowledge and reenter the process periodically (Fig. 14.1).

20:10 The Goal of Human Resource Management

The goal of Human Resource Management is the best possible choice of role owner, continuous monitoring of his performance and personal needs and, if justified, initiation of the appropriate personal development program and results assessment.

The sort of evolution on how the project team members are treated , which project management approaches goes right now is well reflected by the ambiguity of ISO 21500:2012 standard (ISO 21500:2012 2012).

Those who directly contributes in project are named without distinction: team (with and without project manager), stakeholders, personnel, resources or human resources, leading to incongruent treatment of all those persons in a project. The processes in standard cover:

4.3.15. Establish project team. Staffing of the project, selecting the role owners, in the group if Initiation processes

4.3.18. Develop project team, focused on motivation and performance, not distinguishing personal and team performances (Implementation processes' group)

4.3.20. Manage project team: again the (team) performance is treated (Controlling processes' group)

The disparity may result in overall lost of the efficiency. The personal needs of team member are not considered. The process presented in this Chapter streamlines all the requirements related to a role owner in a single, unambiguous approach.

20:20 Methods

20:21 Human Resource, HRM, HR System

Most Human Resource (HR) definitions refer to the companies with continuous mission. Projects by virtue are temporary occurrences. Surprisingly author could not identify any appropriate definition in the literature. The ISO 21500:2012 is not very helpful there, too (see above comments). Therefore, for the purposes of this and subsequent considerations:

Human Resource in Project

Human Resource in Project is defined as all individuals which at least partially join the workforce of the endevaour.
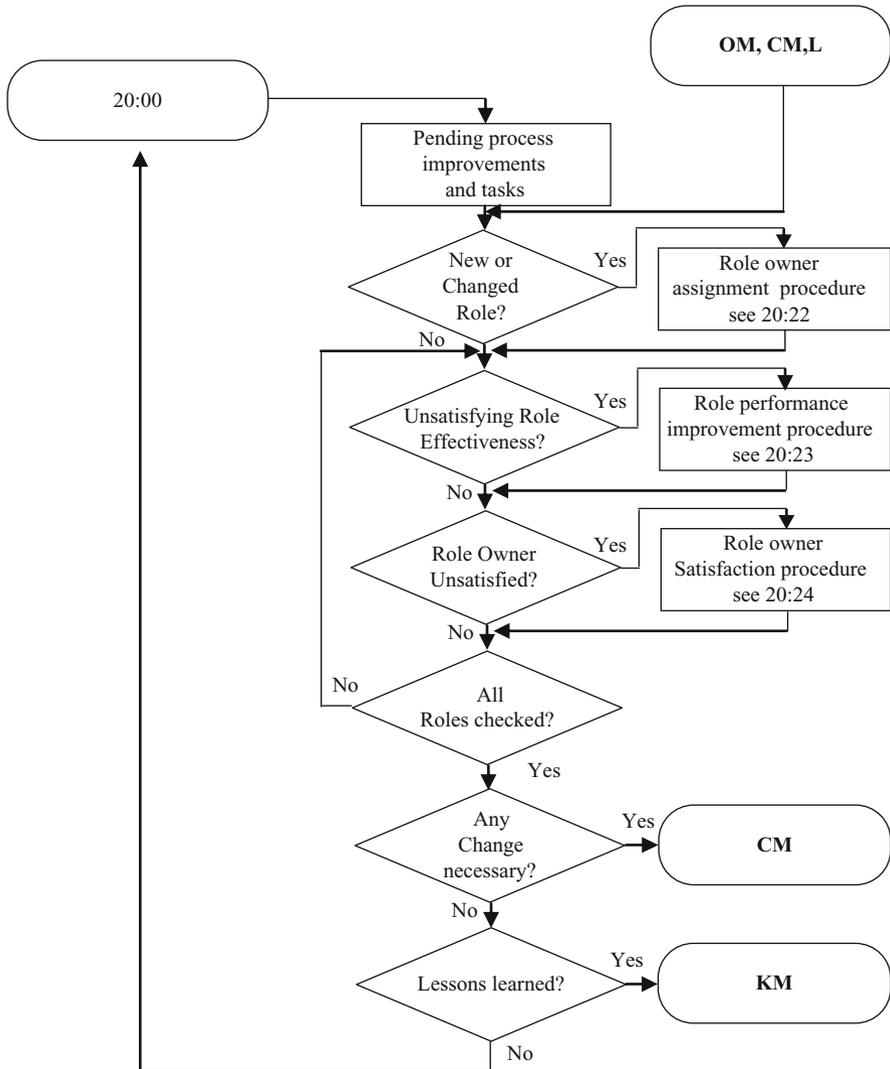
Fig. 14.1 Human resource management process

Human Capital

In this context consciously we refrain from considering the team members as human capital: their development and company contribution are not the primarily objective of project manager. His basic task is to use in the best way Human Resources dedicated to his project. The Grimshaw and Rubery (2007) definition matches best here:

Human Resource Management

The Human Resource Management is about how organisations manage their workforce.

Consciously we refer to Human Resource System in differentiation from more frequently used HRM Systems, which are almost exclusively related to Information systems and follow here Armstrong from his 10th Edition (Armstrong 2006) congruating:

Human Resource System

The Human Resource System brings together in coherent way HR Philosophies, Strategies, Policies, Processes, Practices and Programmes.

20:22 Role Assignment

A new role may have several sources: It may be a regular cyclical check, OM, CM or Leadership process.

After the verification of the conformity of role description with the HR system of the project and company the recruitment is planned (see Fig. 14.2).

Next, the recruitment and evaluation procedure may start. Advantageous is to involve already chosen project team members in the candidates' evaluation procedure. The candidates may be accepted with some deficiencies. In this case the personal development procedure, best outsourced to professional HRM unit, is to be initiated. Here also fall the most common case: adjusting the roles with team members inherited for whatever reason, which are to be employed in project.

20:23 Recruitment and Evaluation

In this sub-process the fundamentals for individuals' performance are set. The influencing factors are abilities, skills, personal traits, needs and personal value system. Their mutual impact excludes the possibility of a priori set up.

The abilities and skills are defined in formal role description elaborated in OM process. Suitable assessment means are assessments centre, interviews, trial periods, certificates, questionnaires.

Among several currently deployed in HRM theories concerning assessment of behavioural and mental impact of personal traits: Big Five (OCEAN) (McCrae and Costa 1987), Big Three (Eysenck and Eysenck 1985), RIASEC® (Holland 1997). HL (Fleming 1981), VBDM (Spranger and Pigors 1928) best suitable for project team members evaluation is based on Jung theory Myers-Briggs taxonomy MBTI® (Myers-Briggs and Myers 1980/1995).

The Myers-Briggs Inventory bases on the personal preferences between extreems in four dimensions building a combination matrix of 16 types. Wideman (Wideman 1998/2013) attempted to classify the MBTI-types for their suitability as project team members. Using the same heuristical methodology, applied to statistics retrieved from CAPT (CAPT 2013) more recently, we qualify up to 45 % of total population as potential good project managers and another 45 % as team members (followers, see Fig. 14.3). We contradict Wideman by stating that only as less as 15 % are likely to be unsuited as team members. We agree with Wideman, that the four extremes: ISTJ, INTJ, ENTJ and ESTJ (Thinking and Judging
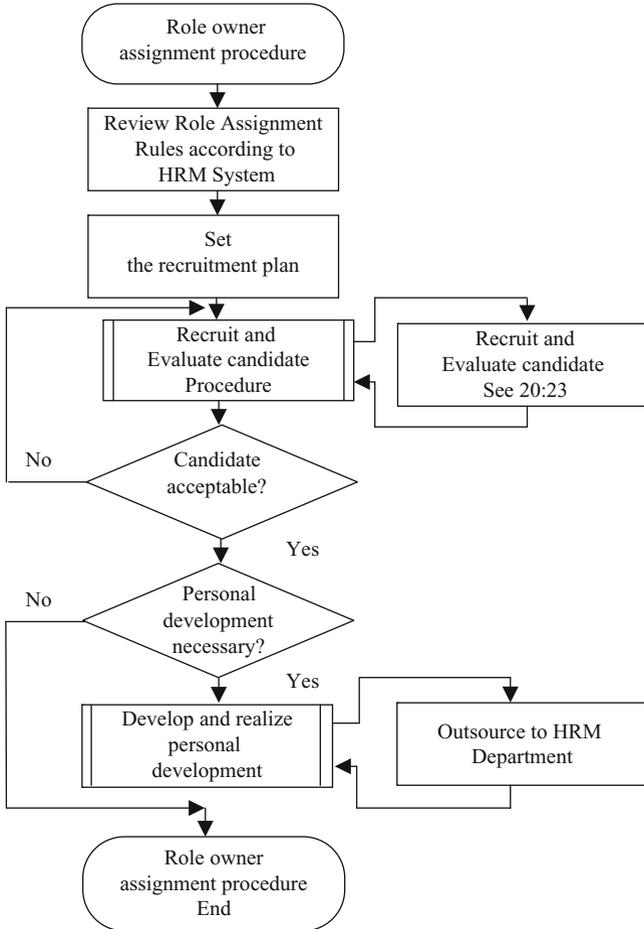
Fig. 14.2 Role assignment procedure in project

combined with introvert sensing/intuitive or extrovert-sensing/intuitive preferences) expose indisputable project leadership potential.

The assignment has to take various aspects of the teams under considerations. Getting best staffers together does not secure the best results as shows the following example.

Apollo Syndrom

The name 'Apollo Syndrom' is known as the epithet of an experiment in certain company, in which teams with different levels of intelligence and education have been set. The best employees were assigned to work in the same team, which was named Apollo. Presumably, it should achieve the best results. However, this team's results were the worst. It resulted from the team members' behaviour, where each
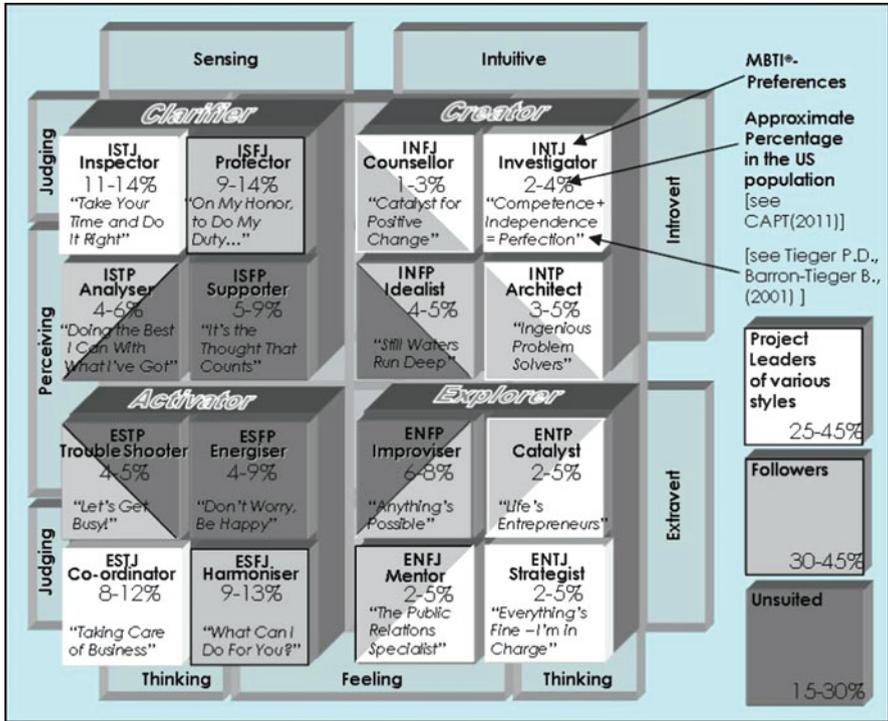
Fig. 14.3 MBTI®-preferences with project suitability heuristics

team member attempted to convince other to his/her concept. Due to that, there was a constant debate instead of work, which resulted in so bad effects (Litke 2007).

Personal Needs

The member of project team must basically have, during the project work, possibility to satisfy his personal needs. The degree of needs of a candidate, which we are willing to satisfy, is put in balance with the potential, which his skills, abilities and personality traits open.

There are two major theories in classifying human needs. One is Maslow pyramid (Maslow 1954) with hierarchical deficit and growth needs as shown in Fig. 14.4. The lower level needs are stronger. Therefore, they have to be satisfied before the upper are to be considered. The motives of growth can never be fully satisfied and thus they are responsible for a constant individual and social developments (Cadle and Yeates 2008).

The alternative Two Factor Theory of Herzberg (Herzberg 1987) distinguishes hygiene factors, which largely correspond with Maslow's deficit factors and motivator factors corresponding with Maslow's growth factors.

Candidates evaluation may be optimized by estimating to which degree the prospective tasks match the candidates personal needs, in particular growth/motivator factors (Glowitz 1999).
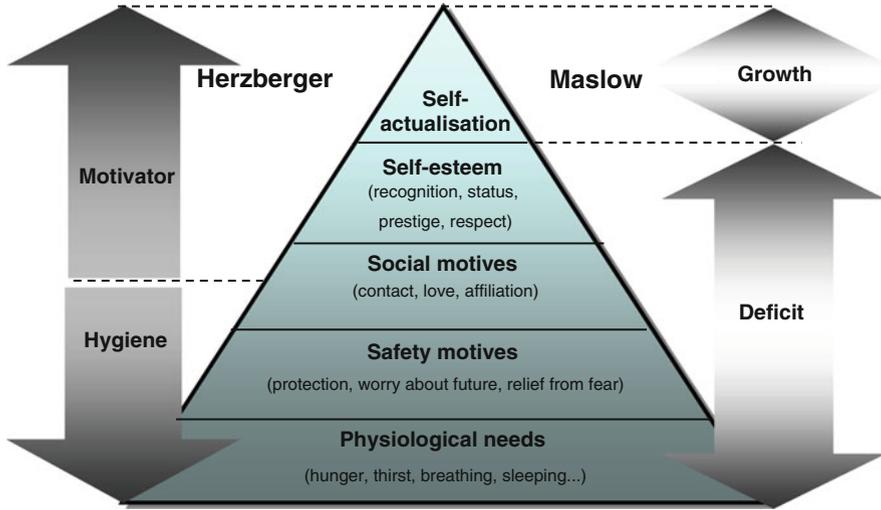
Fig. 14.4 Pyramid of needs according to Maslow (1954) with Herzberg (1987)

It is advantageous in a project to:

- Organize a team, with reference to social motives, in such a way as to develop the feelings of relation ('we') directed on the common project goal,
- Assign the roles, in relation to 'I' motive (self-esteem: status, prestige) would not favour or hurt anybody and the relations were respectful,
- Leave enough freedom in roles shaping for self realization.

Personal Value System/Ethics/Moral Behavior

The decisions taken by a team member are stipulated by his personal value system. The external (social) value system may vary from internalized subjective values which forms the ethics of an individual. Moral behavior is the one, which is congruent with one's own value system (Lent 2012). Team member, and in particular project manager, wins the necessary credibility and acceptance only if his behavior will be moral and his personal ethics will match that of the majority in the team (Galewicz 2010).

Personal ethics may be qualified in one of the four models, consequential or utilitarian type, with not so encouraging results from surveys (Helgadottir 2008). Szczupaczynski (Szczupaczyński 2009) speaks about the ceremonial adaptation of formal ethical standards with separation of pragmatic and moral interpretation of ethical standards and elusion of normative process of qualification between good and bad. Useful guidance to evaluate the candidates and to assess their ethics and moral we may find in integral humanisms and value system of Max Scheler (Scheler 1994).

20:24 Role Performance Improvement

All authors agree, that the individual performance of team member is influenced by his/her motivation in magnitude not only a percentage: 1:3.4 (Boehm et al. 1984), 1:4
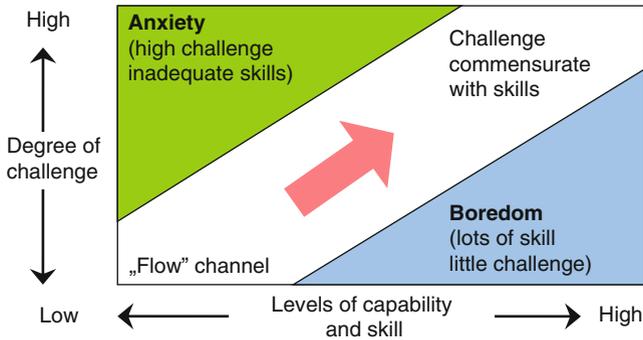
Fig. 14.5   Productivity flow channel

(Boehm 1981), 1:5.6 (DeMarco and Lister 1999), 1:10 (McConnell 1998). Motivation may compensate to certain degree the deficiencies in skills or abilities. McGinnis (McGinnis 1985) call it Pygmalion effect, when "average people, who never worked together and accidentally joined a project, being well motivated behave like gifted, uncommon geniuses, building the well functioning team together". An Environment (Team, Project Manager, Office, Company) is here a multiplicator.

Productivity = Environment * [Motivation = function (time)]

Whatever the internal (intrinsic) motivation of potential candidates and project team members would be, as soon as project takes it course it began to depend on the relation between the capabilities and skills on one hand, and tasks, which they are entrusted, on the other one.

Motivation = ((Capabilities and Skills)/Challenges) * Personality Traits * Luck Coefficient

While keeping the balance in matching the capabilities and skills against the challenges we have a good chance in obtaining high motivation of project team staff. Mismatch, as a consequence of personal projection (it went wrong, all will go wrong, causality theory of Heckhausen (Heckhausen et al. 1987)) will lower motivation and subsequently productivity. Similarly, unused skills lead to boredom and loss of motivation.

When environmental, skill and individual motivators are in place, "flow" (Czikszentmihalyi 1990) or the highest productivity possible is reached (see Fig. 14.5).

It may be noticed, that productivity and motivation are transient in nature: they may change rapidly and thus require permanent care by project management. Challenges, which one faces do not change that rapidly. Here, the longest "time to change" takes the capability improvements and development of skills.

We should avoid employing new team member when his skills exceed his prosperous tasks (leads to boredom) and when the deficiencies can not be bridged over by the personal development plan (leads to anxiety). In case of renewed evaluation of already employed team member by applying these criteria we may have to initiate a change motion (change request).
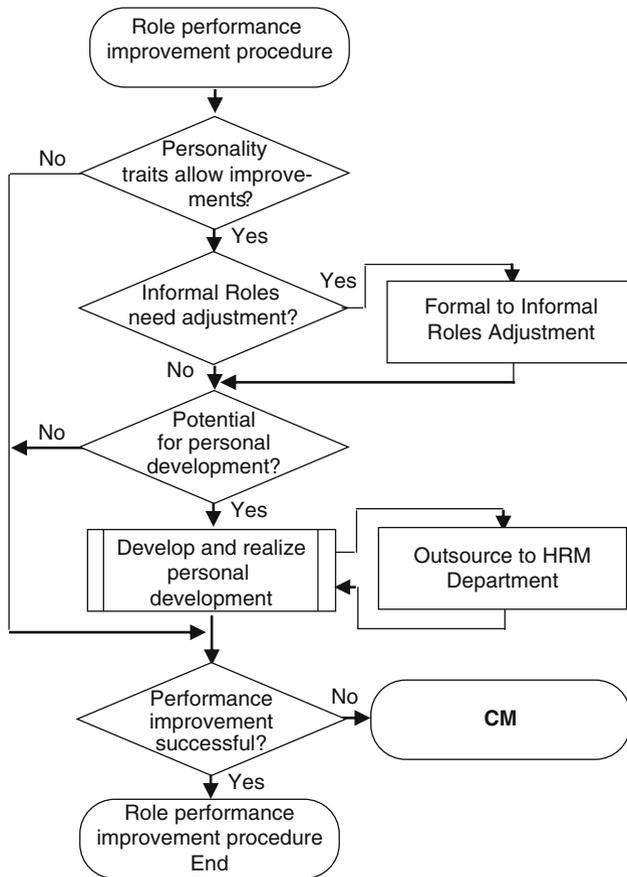
Fig. 14.6 Role performance improvement procedure

If the person is or will be deployed within the "Flow Channel" we evaluate if the personality traits are not prohibitive to any adaptation (e.g. eldery team member unwilling to adapt).

If changes are possible the informal roles in team shall be examined and in case of necessity – personal development shall be initiated and realized (see Fig. 14.6).

20:25 Formal to Informal Role Adjustment

Formal roles express in general the expectations which role builder has concerning the tasks and the quality of their execution. HRM do it's best to choose the best role owners. Yet, the team dynamics lead to the development of informal roles, which have an impact on the individual performance (the "environment" factor in our productivity relation earlier in this section).

Table 14.1   Informal roles according to Denisow (Denisow 1999)

Mediator
Show solidarity, increases others status, helps and rewards
Show satisfaction, laughs, jokes, tries to unstress others
Expresses approval, understands, cooperates, expresses agreement
Active co-organizer
Gives tips, instructions
Informs about his/her task, assessment, analysis
Directs, informs, repeats and confirms
Active partner
Asks for direction, information, repetition and confirmation
Asks for opinion, assessment and analysis
Asks for time, instructions, and possible way of conduct
Passive team member
Opposes, refuses to help, shows passive refusal and formality
Is stressed, asks for help, and withdraws
Is hostile, defends himself/herself or stays in the same position, does not treat other people as equal

---

Example

John fulfils faultlessly a task of analyzing the actual environmental legal constrains in an ambitious task, which involves several 100 people from around 50 companies. Project team prepares to move a bridge some dozen meters down the river. He works mainly with internet and legal data bases.

John is also a passionate volley-ball fan. He chairs the national volley-ball association and organises each year successfully competitions of 24 teams countrywide with all together over 20,000 spectators.

It is only but natural, that other team members frequently ask him for his advice on some organisational issues, sparing themselves the awkward consultation with construction manager, located in next city.

John formal (environment specialist) and informal (decision maker) disperses.

The informal network, which emerge in project teams may impact positively the performance (colleagues of John are faster) and negatively the project course (construction manager will not be informed about all, may be crucial issues).

The personality traits and other roles one play in his life influence his behaviour in a team (Denisow 1999). The resulting informal role expresses the expectations one has with regards to his contribution to the team and towards the mutual communication in team. Denisow distinguishes four informal roles (Table 14.1):

Meredith Belbin (Hogan 2007; Belbin 2010) observed for 9 years managers behaviour in Henley Management Game and drafted originally eight, later adding ninth, informal roles in team (see Table 14.2). The denominators used in other sources are extended in brackets. The attractiveness of Belbin approach is higher precision of type identification, proximity to Myers-Briggs taxonomy and

Table 14.2 Belblin's taxonomy of informal roles in team (Hogan 2007) extended

Role	Features	Positive qualities	Allowable weakness	Contribution
Chairman (Co-ordinator)	Calm, controlled, self-confident	Evaluates contributions on their merits-tasks oriented, not prejudiced	Average intelligence and creativity, off-loads his work	Clarifies goals, Identifies problems, establishes priorities, Defines roles, Summarizes feelings of the group
Shaper	High-strung and dynamic, courageous	Energetic, willing to challenge group's performance	Irritable and impatient, offending	Identifies roles, tasks, and responsibilities, Pushes group for performance
Creative thinker (Plant)	Individualistic and unorthodox	Bright and imaginative	Impractical and dis-organized, bad communicator	Generates ideas, Generates solutions, Criticizes current actions
Evaluator (Monitor)	Sober and un-emotional	Discrete and hard – headed	No leadership ability	Analyzes problems, Clarifies issues, Evaluates others' contributions
Negotiator (Resource investigator)	Extroverted, curious, communicative	Ability to build relationships	Easily bored, over-optimistic	Brings in ideas from the outside
Team worker	Pleasant but mild	Responsiveness to people, promotes team spirit	Indecisive in crisis	Emphasizes task completion, Promoting sense of urgency, Finding errors
Company worker (Implementer)	Conservative and predictable	Organized, disciplined, hard-working	Inflexible, resistant to change	Focus, Planning
Finisher (Completer)	Orderly, conscientious and anxious	Perfectionism	Worried about small things	Supportive and helping others, Building on others' ideas
Specialist	Single-minded, self-starting,	Dedicated, knowledgeable, skilful	Contributes within limited area, get lost in details	Solves complicated issues, Trouble-shooter

Fig. 14.7 Role owner
satisfaction procedure
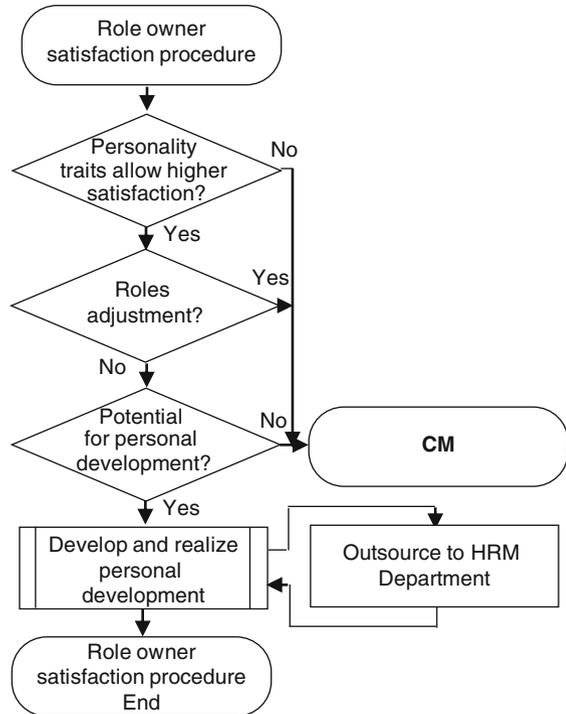
consideration of the dynamics in individual behaviour: each role owner can originally develop to any of the nine Belbin roles. Ideal team would consist of nine persons. In smaller teams, several roles are fulfilled by one person. According to Belbin only when all informal roles are balanced, the team works successfully.

Concluding: in HRM we have to:

• Balance carefully the adjustment of informal roles taking their interrelationship into account
• Balance all informal roles in a team
• Suggest (change request) changes in formal roles to adjust. Do not try reverse.

20:26 Role Owner Satisfaction

Following the assignment or reassignment of formal roles, performance evaluation and adjustments targeted to optimised the results, even if the external indices of performance decrease are missing the dissatisfaction of project team member may result soon in major project problems, as the intrinsic motivation fails.

The motivators, growth needs, as presented in section "20:25 Formal to Informal Role Adjustment", may lead to hilarious demands, exceeding the project possibilities or reasoning. Therefore, a systematic approach as presented in Fig. 14.7 helps to find balance.

Firstly, we verify if the person personal traits allow for higher satisfaction. In case of e.g. permanently dissatisfied persons an attempt of a (possibly) minor adaptation in tasks or remuneration will not bring the desired results – so we rather opt for a major change in a project role ownership.

If the personality cherishes hopes for better performance upon changes we proceed to formal role adjustment decision and appropriate change motion (e.g. more responsibility or task adaptation).

In case role adjustment is not necessary, but the personal needs focus on personal development deficiency with the future performance increase potential, higher motivation may be reached with suitable programme.

20:30 Techniques and Tools

The techniques and tools listed below are specifically selected for project management purposes. The vast instruments of human capital management, applied in a permanent organisation HRM are beyond the scope of this book.

20:31 Target Personal Resource Capacity

Personal Resource Capacity

In the process of Organisation Management (OM) roles has been elaborated in accordance to the tasks grouping and their resource capacity demand. The assumption is made, that the role owner performs in accordance with certain standards. These standards are determined by e.g. demanded education, practice, company best case experience or experts evaluation (see Chap. 2, 07:00 Planning & Scheduling: P & S).

In hiring the role owner certain additional capacity has to be planned and subsequently put into the evaluation criteria, due to the scheduled (e.g. holidays) or accidental (family occurrences, sickness) absences.

Additional Resource Capacity Needed

So in case of e.g. 1,400 productive hours demanded in a project, about 1,800 h (full time employment) shall be set in the required job description (personal resource capacity).

In case the chosen role owner does not provide convincing abilities, demanded by the project or there is a risk due to the approximate candidates evaluation or conscious selection of inferior (because he is e.g. price worthy) candidate, another corrective hours for job performance shall be added (e.g. 10 % of total hours for learning-on-the-job). We land thus in the range of 2,000 h in the above example.

The decision between the maximum efficiency versus low cost learning-on-the-job candidate shall be taken in accordance to the actual human resource market and project sponsor or hosting company policy. Subsequently these total hours shall be charged to the project or split between the project and e.g. company human resource capital management fond.

It is not advisable to speculate about high candidates' efficiency and economies on the demanded hours. Project by definition are new and jobs can not be

Table 14.3 The example of absolute requirements weighting

Requirements criteria	Very important	Important	Less important
1 Acquaintance with the area of job		x	
2 Experience in projects		x	
3 Creativeness			x
4 Thinking in categories of economic profitability	x		
5 Readiness to cooperate		x	
6 Readiness to work overtime			x
7 Ability to negotiate	x		
8 Ability to win the authority	x		
9 Ability of abstract thinking			x
10 Organizational sense	x		

Table 14.4 The example of relative requirements weighting

Requirements criteria		of 100 value
1	Acquaintance with the area of job	10
2	Experience in projects	8
3	Creativeness	3
4	Thinking in categories of economic profitability	18
5	Readiness to cooperate	12
6	Readiness to work overtime	2
7	Ability to negotiate	16
8	Ability to win the authority	14
9	Ability of abstract thinking	4
10	Organizational sense	13

determined in such a degree of accuracy, that any additional demand may be excluded from the start on. So in case of better performing candidate this may be a welcome back-up reserve or – in best and up to author's own experience never happening case – contribution to project total costs reduction.

20:32 Complete Demanded Profile Definition

The abilities demanded to perform the formal role, preferred personal profiles and preferred or open informal roles build together a multidimensional decision matrix. To facilitate the decisions each singular preferred characteristics or demanded skill shall be weighted.

Weighting Demanded Skills and Personal Characteristics
Suggested is the use of Metaplantechnik (Schnelle and Eberhard 1982; Meyer 2003; also in Chap. 2, 07:00 Planning & Scheduling, section "07:30 Techniques and Tools") to elaborate the weighting.

The weights may be set in an absolute (see Table 14.3) or relative (see Table 14.4) way.

In case of absolute weights example profile of requirements for the project manager, several items are set at the same level. In extreme case all will be set as e.g. very important. This does not facilitate the weighting.

The recommendable is the relative weighting. In the above example we allocate 100 points among the demanded abilities and job characteristics as shown in Table 14.4.

20:33 Candidates Evaluation Techniques

Assessment of Knowledge and Experience

The assessment of knowledge and experience may be done in one of the four following different ways:

(a) Review of previous achievements of the candidate, based on school certificates, references, curriculum (CV), available results of his work. The critical point here is the assessment of the competences of the persons issuing the references, the objectivity of the information in the CV or the evaluation of the candidates' contribution towards visible results. This procedure may be applied if we have good reasons to trust the data.

(b) Certification of the experience by the acknowledged certification bodies like PMI, IPMA (through national societies), SAQ (for Swiss HERMES) for project management. In all cases all levels of certification except the lowest one (CAPM for PMI, D for IPMA, HSPTP for HERMES) are issued only to professionals with proved track of records in project management. The certificates testify also certain level of knowledge, acquired by the candidate. Other professions dispose of similar experience based certification schemes.

(c) Assessment centre conducted by the hiring organization or by a third party on behalf of the hiring one. This is the most reliable yet most expensive way to evaluate one's experience. Therefore, it is usually applied to the jobs with major impact (Seiler and Lent 2005).

(d) Evaluation of the current performance in a project of the present staff on the base of direct personal interviews with the candidate or his superior, periodical qualification review or customer feedback.

Analysis of Needs

Needs analysis is well supported by the personality profiles elaborated in this process. Ambitious extrovert person will be more interested in personal development plan and career opportunities, while family oriented person seeks rather children friendly neighborhood. To certain degree hiring organization may anticipate some needs and address them directly in published job offer. However, the actual needs of the candidates has to be extracted upon concrete prosperous job negotiations.

Most obvious needs like remuneration are usually set in a direct personal talk with candidate. Less obvious expectations and needs, yet relevant both according do Maslow or Herzberg schemes, may be additionally extracted with the help of questionnaires.

Table 14.5 The example of needs cost function

Needs cost function		Coefficient	Candidate demand
1	Yearly fixed salary	1.0	x.x
2	Yearly variable results depended reward	0.7	y.y
3	Demanded job related education	0.2	z.z
4	Support in family dislocation and assimilation	0.8	v.v
5	Fringe benefits (car, insurance)	0.4	w.w
6	Status office and furniture	0.3	u.u
7	Career opportunities	0.1	t.t
Needs = (1.0 *x.x) + (0.7*y.y) + (0.2*z.z) + (08*v.v) + (04*w.w) + (03*u.u) + (01*t.t)			

Table 14.6 The example of hypothetical evaluation

| Requirements criteria		of 100 value	Candidate A	Candidate B
Scale		0–100	0.0–1.0	0.0–1.0
1	Acq. with the area of job	10	0.8	1.0
2	Experience in projects	8	0.8	0.4
3	Creativeness	3	0.5	0.7
4	Thinking in cat. of econom. pr.	18	0.9	0.4
5	Readiness to cooperate	12	0.6	0.9
6	Readiness to work overtime	2	0.5	0.9
7	Ability to negotiate	16	0.8	0.2
8	Ability to win the authority	14	1.0	0.5
9	Ability of abstract thinking	4	0.7	1.0
10	Organizational sense	13	1.0	0.5
Total score in this area			82.9	54.8

Finally, all needs may be summarized into certain cost function (see Table 14.5) of e.g. total costs to the company over the project duration. Where not explicitly named, hiring party makes some assumptions like in case of e.g. career opportunities.

Candidates Evaluation

In this step we summarize the evaluation of each candidate and measure it against his needs cost function results.

The degree of fulfillment of each criterion we set between 0.0 (not available) and 1.0 (fullest). Direct comparison of two exemplary candidates is given in Table 14.6. Hypothetical candidate A is an experienced professional, candidate B – bright clever school graduate.

The scores achieved in each area may be visualized with Kiviath graphs. In reference to the L-Timer we evaluate candidate's skills and abilities related to each project management process. Outer shape (brighter) reflects administrative processes capabilities, inner one – the human factor capabilities. Considering that perfect 12-corner figure for administrative processes and hexagon for human factor processes reflects 100 % fulfillment of the composite criteria two candidates may expose their profile as shown in Fig. 14.8.
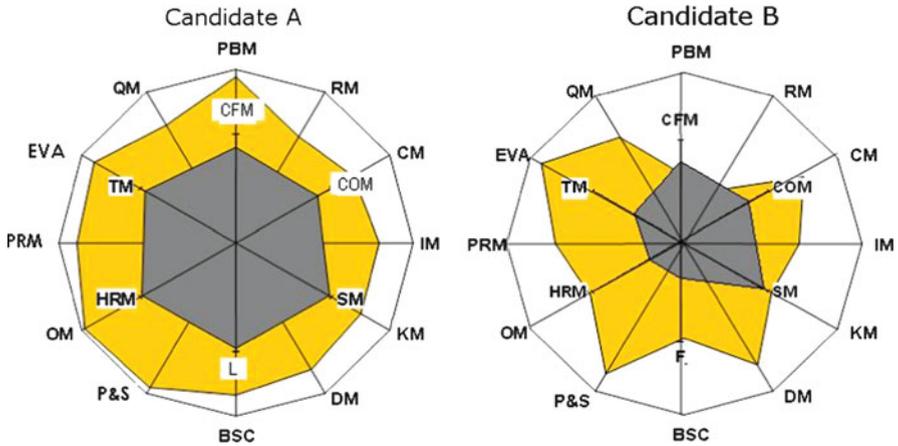
Fig. 14.8 An example of graphical presentation of capabilities of two candidates

The above grade of fulfilment is to be matched against the needs cost function. It is advisable to clearly separate: what project seeks (and candidate offers) from what company has to deliver (candidate needs satisfaction). At the end it is not a simple mathematical equation between both: the experienced person in charge of human resources put a notion of perceived and not contained onto the final candidates' evaluation.

20:34 Internal Recruiting

Internal Recruiting
Frequently projects are built out of the people within the project sponsor organization. Usually only rough approximate match between the project requirements and candidates' skills is done; needs are usually already absorbed. Yet, the awareness of the deficiencies of the internal candidates helps to identify the necessary skills development and to assess the risk potential.

20:40 Templates

20:41 Project Documents

In order to identify the skills and capabilities of each team member, full L-timer scheme of all 18 process suitability is recommended. For demonstration purposes simplified following template is hereafter presented in Table 14.7.

20:42 Project Results' Documents

The optimal personal development plan foresees the trainings which ambiguously fulfil the needs expectations of the team member and contribute towards reduction

Table 14.7 The example of assessment scheme

Assessment candidate A
0 General information
1 Aim of the document
2 Required Skills description and tables
The skills and personal traits required to fulfil the specific project role are listed here
3 Formal role requirements fulfilment
Table of demanded skills
Chosen assessment method (interview, certificates, assessment, case study)
Results for the candidate
Conclusions and suggestions
4 Personality traits evaluation
Most desired profile
Chosen assessment method (interview, questionnaire, assessment, case study)
Results for the candidate
Conclusions and suggestions
5 Team suitability
Most desired profile
Chosen assessment method (interview, questionnaire, assessment, case study)
Results for the candidate
Conclusions and suggestions
6 Personal needs
Most desired profile
Chosen assessment method (interview, questionnaire, assessment, case study)
Results for the candidate
Conclusions and suggestions
7 Summary and final evaluation of a candidate
The overall evaluation of a candidate or team member is briefly summarized. Recommendations are formulated

of possible gaps between the current team member skills and abilities and those, which are needed to achieve the project goals. An example is given below in Table 14.8.

20:50 Activities and Deliverables of HRM

20:51 Initiation Phase

Tasks
- Identify core team which initiate the project
- Perform general assessment of core team members
- Let the team selected their roles
- Secure the each team member's motivation

Table 14.8 The example of assessment scheme

Personal development plan, team member A
0 General information
1 Aim of the document
2 Identified target development areas
Describes the actual assessment results of the team member indicating the areas of target growth potential
3 Feasible trainings
Describes the suggested trainings in the sequence of their priorities:
Relevance to specific area and its' priority
Goals of training and learning
Prerequisites, initial knowledge required
Contents of the training
Measures of the training results assessment
Training infrastructure (materials, rooms, IT, services, auxiliary measures)
4 Planning and organization
Setting particular sequence of trainings, deadlines as well as their mutual relations (who, when, what, and where)
5 Resources and commitments
Financial resources
Non-financial resources needed to realize the trainings
Team member commitments to remunerate the expenditures of trainings
Financial plan
6 Evaluation of the carried out trainings
List of documents with the analysis of trainings and training results in order to improve their quality
7 Enclosures

Results
- Motivated core team with first roles assignment

20:52 Planning Phase

Tasks
- Specify particular formal roles in a project
- Plan the demand for project team members
- Set the profile of requirements concerning particular roles
- Analyze abilities and traits of potential team members
- Analyze the needs of potential team members
- Assess the qualifications to perform the assigned roles in a project by the potential team members
- Assign the initial role owners to specific roles
- Adjust core team members' roles
- Evaluate the deficiencies and personal development plans
- Administer selected trainings (optionally)

Results
- Roles fully specified (formal, informal, personality traits)
- Demand for resources formulated
- Roles in a project assigned to best feasible owners
- Personal development plans formulated and agreed
- Revised core team members roles and first roles modifications

20:53 Implementation Phase

Tasks
- Carry out the roles and role owners changes
- Carry out the individual performance evaluations
- Anticipate and react to team member needs

Results
- Revised and dynamically optimised role assignment
- Personal needs addressed

20:54 Closing and Evaluation Phase

Tasks
- As in the implementation phase
- Prepare the final team member evaluation and certificate

Results
- Fully operational role ownership till the very end of the project
- Final team member evaluation
- Certificates of project participation issued to all team members.

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22:00 Team Management: TM

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15

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Quick Look

What Is It?
Team Management (TM) welds together team members chosen in HRM towards best possible efficiency of the whole team.

Who Does It?
It is primarily task of project manager to exercise the leaderships (L) and steer the team towards optimal efficiency.

Why Is It Important?
Working in a team, one likes, is the second, past the project goal, most motivating factor; and motivation lead to tenfold performance. On the other side, people underperform, when they take time to find their social position in team – and this is unavoidable. Their productivity is influenced by interpersonal relationships and multicultural impact. So it is the question of productivity to care about in Team Management.

What Are the Steps?
Verify and close pending process improvements and tasks.

If there is a new team member initiate the process of his fastest integration in team. Watch if team performs – start appropriate procedure, in case any improvement potential emerges. Carefully observe the multicultural interrelations – do not hesitate to initiate clarification or adaptation of any rituals.

After verifying all roles check if Change Request or Knowledge Management shall be addressed.

What Is the Work?
Team works efficiently if there are no major internal differences. Any new team member starts the team positioning from the scratch – so it takes time to settle.

And this shall be minimized. The higher is the team cohesion the better is it's performance. Yet only project goal oriented teams are efficient – any hidden agenda of highly coherent team is disastrous – definitely, has to be avoided.
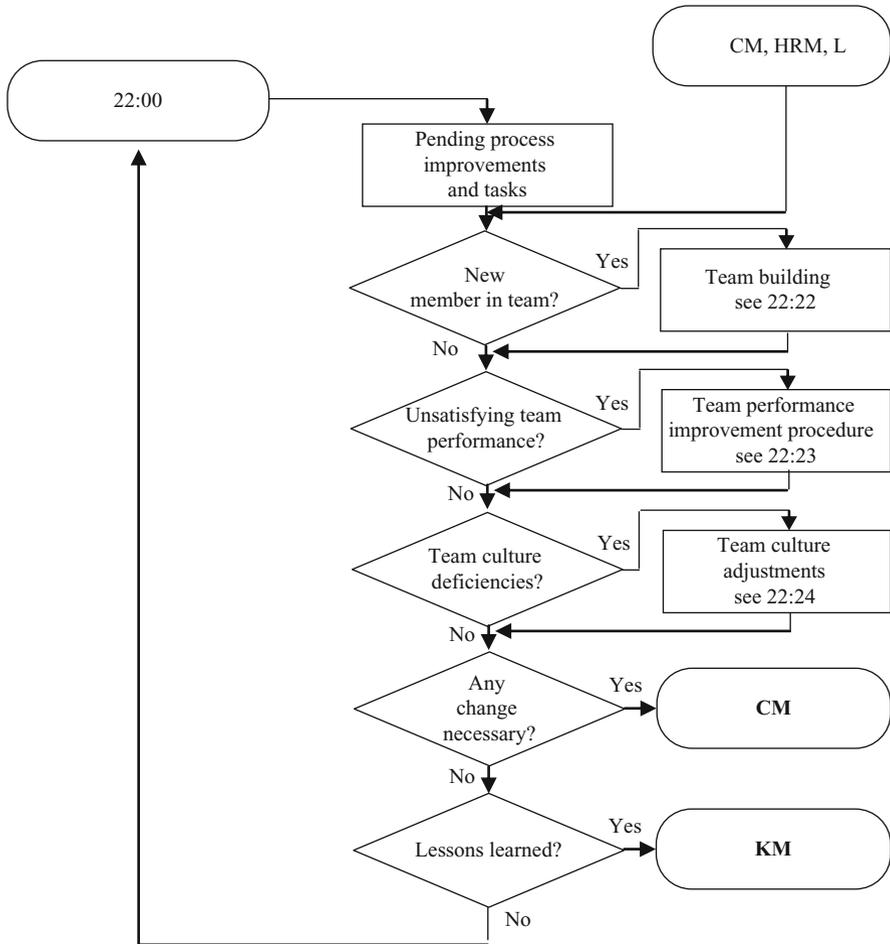
Fig. 15.1 Team management process

How Do I Ensure That I Have Done It Right?
Organize and lead fast team building activities, support multicultural knowledge and growth of mutual tolerance, take care about true focusing of the team on the project goals.

Process

Firstly try to finalize all hanging issues, before you take on the new or changed role. Initiate the team building process each time someone new join the team. Work hard on team performance and multicultural aspects next. Suggest changes, store knowledge and reenter the process periodically (Fig. 15.1).

22:10 The Goal of Team Management

The goal of the process of Team Management TM is to maximize the effectiveness of a group measured according to the following criteria:

- Team performance,
- Satisfaction of team members,
- Satisfaction of clients,
- Improvement of a process,
- Atmosphere of work in a group,
- Team integration.

Clients satisfaction is measured in QM-Process, that of team members in HRM-Process. Evaluation of both is done in BSC-Process – all presented earlier in this book.

22:20 Methods

Team Management viewed as team motivation and team performance issue is treated in two ISO 21500:2012 processes (ISO 21500:2012 2012):

- 4.3.18. Develop project team
- 4.3.20. Manage project team

Both processes runs during the Implementation in parallel leading to the ambiguity on where the detection and where the handling of the issue is treated.

Third process:

- 4.3.15. Establish project team although has the term "team" in the name concerns the resources' acquisition and as such is included in the Process of Human Resource Management here (see Chap. 14 20:00 Human Resource Management: HRM).

The ISO-Standard does not foresee explicitly the processes of the changes in the team, which impacts the team dynamics and an impact of cultural background of team members on the overall mutual cooperation in team. These issues are systematically bound into the recursive Team Management process, presented in this chapter.

## 22:21 Social Networks, Group and Team

Humans need social environment to function. The way how we move in our social environment determines whether we are individuals linked by social networks, working in group or joining the team.

TCI Theme Centered Interaction Model

Suitable vehicle of differentiation offers here TCI Theme Centered Interaction Model (Cohn 1975/2009) (Fig. 15.2).

In this model focus of personal orientation is either on personal topics ("I"), on interaction with others ("We") or on common goal ("It"). The environment is taken

Fig. 15.2 TCI theme
centered interaction model
(Cohn 1975/2009)
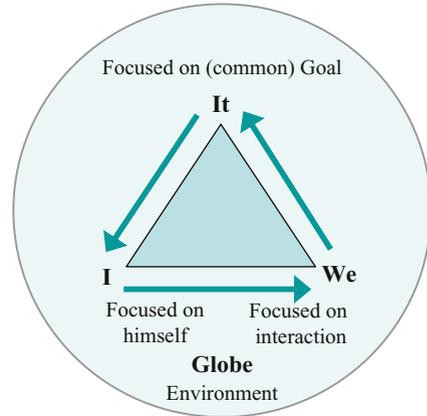
under considerations in closest as well as in broad meaning into account, while considering each of the perspectives. There is certain impact of thinking: while focusing on "I" we influence our "We" thinking, "We" thinking leads to common goal focusing ("It") and goal oriented thinking influence back our egocentric orientation.

This differentiation allows us to classify our social adherence.

Social Networks
Social networks are loosely set up interconnections, where individual primary precedes with his "I" goals. We may act passively (being e.g. listed as project managers in some local telephone book) or actively (clubbing, searching partner on Internet social network like Facebook (www.facebook.com)). No common goal, neither any common responsibility characterizes this status.
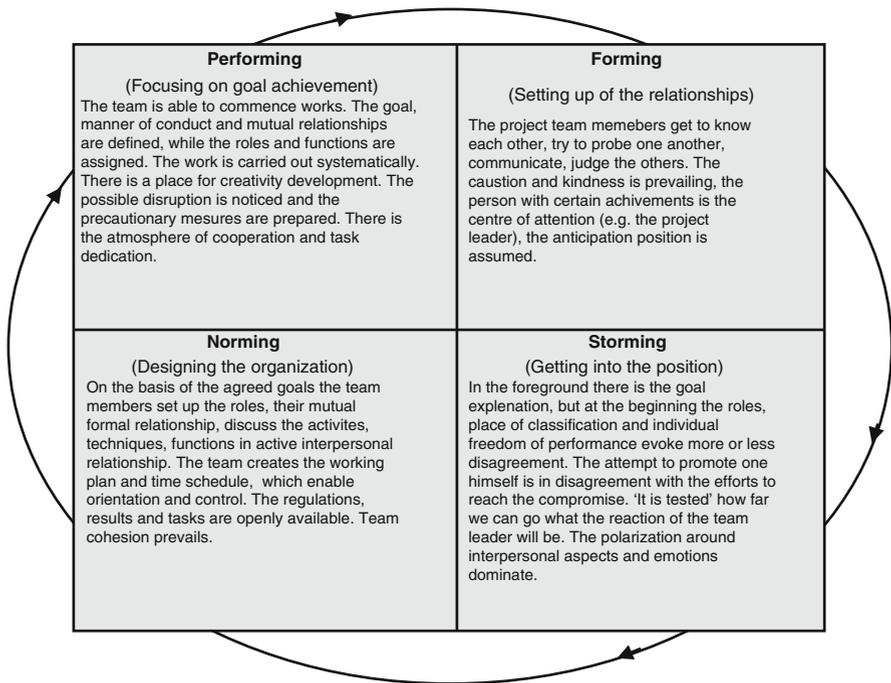
Groups
Individuals with a common base (social, national, ethnic) forms a group. Certain direct interaction with each other for a longer period of time characterizes group (Denisow 1999). Common interdependence forces to consider "We" aspect (e.g. traveling together on public transportation). The resulting social group coherence may vary from low (coincidental travelers) to very high (usually triggered by some occurrence leading to the dawn of certain relevant common goal – and in consequence to team building!). Formal groups form structure, informal groups: visible group culture. The last has usually high degree of coherence, which might be highly powerful, both in supporting as well as prohibiting project management (Group Thinking in Chap. 16, 00:00 Conflict Management: CFM).

Team
When the identification and focus on common goal become predominant in thinking of the individual, we land at "It" – the distinguishing factor of a team. Goals has to have all SMART-features (see Chap. 2, 07:00 Planning & Scheduling: P & S).

Table 15.1 Social relationships in TCI Model categorization

No.	Characteristics	Social network	Group	Team
1.	Predominant	"I"	"We"	"It"
2.	Goals	Individual uncorrelated	Individual correlated	Common
3.	Roles	None	Coincidental	Defined
4.	Relationship	None	Coincidental	Established
5.	Activities	Individual uncorrelated	Passive awaiting	Coordinated, focused
6.	Responsibility	One for own activities	Individual in a group	Common for c. goals

Performing

(Focusing on goal achievement)

The team is able to commence works. The goal, manner of conduct and mutual relationships are defined, while the roles and functions are assigned. The work is carried out systematically. There is a place for creativity development. The possible disruption is noticed and the precautionary mesures are prepared. There is the atmosphere of cooperation and task dedication.

Forming

(Setting up of the relationships)

The project team memebers get to know each other, try to probe one another, communicate, judge the others. The caustion and kindness is prevailing, the person with certain achivements is the centre of attention (e.g. the project leader), the anticipation position is assumed.

Norming

(Designing the organization)

On the basis of the agreed goals the team members set up the roles, their mutual formal relationship, discuss the activites, techniques, functions in active interpersonal relationship. The team creates the working plan and time schedule, which enable orientation and control. The regulations, results and tasks are openly available. Team cohesion prevails.

Storming

(Getting into the position)

In the foreground there is the goal explenation, but at the beginning the roles, place of classification and individual freedom of performance evoke more or less disagreement. The attempt to promote one himself is in disagreement with the efforts to reach the compromise. 'It is tested' how far we can go what the reaction of the team leader will be. The polarization around interpersonal aspects and emotions dominate.

Fig. 15.3 The phases of team integration

Team coherence, stipulated by common goal orientation is major contributor to the team efficiency (section "22:24 Team Performance Improvement Procedure"). Further characteristics of a team are common tools and shared responsibility for goal achievement, which usually result in dedicated, in best case complimentary role ownership. This way personal goals ("I") are impacted by the "It".

Table 15.1 summarizes the characteristics of the mentioned social relationships.

22:22 Team Integration Phases

When the project team first time meets or the new team member join the crew, the group dynamics process commences (Tuckman 1965).

The process starts with the Forming phase, in which team member get known each other, get through the Storming phase, where social hierarchy is set until the Norming – assignment of the roles – allows finally to perform in Performing phase (see Fig. 15.3).

A decade later same author extended the cycle with Adjourning – when team member leaves the team, and the remaining team members have to rearrange themselves, or when the whole team dissolves (Tuckman and Jensen 1977). Team dissolves when project is finished or discontinued. In other case this leads to immediate change in the OM Process, where the roles have to be reworked or HRM Process, where new role owner is sought. The adjourning certainly accompanies the persons who leave the team, so it is justified to consider it in context of personal impact and emerging informal groups (typically alumni associations, military units' combatants). It is considered irrelevant in the project team building process; therefore four phase model is further adopted.

22:23 Team Building Process

Forming Phase
Relatively smooth and yet crucial to further team development is the initial Forming phase, triggered by team first set-up or new team member. The development of the relationships is impacted primarily by the trust atmosphere enabling the individual personality impact. Precondition of trust is mutual knowledge about each other in a team. Here Johari Window is considered to be a suitable technique to follow (section "22:31 Johari Window").

Storming Phase
In most cases it is impossible to clearly mark the end of the Forming phase and begin of the Storming. We may judge only by some indices that the Storming is arising when the first role and task assignments does not go smoothly (Fig. 15.4).

The Storming may take a long time if not accelerated by conscious and target oriented moderation by project manager or the person in charge of the HRM. Only when alpha-animal in team is set, and all others find their position in team social hierarchy Storming may be considered as absolved.

When one or more team members, even without any personal change, mentally did not reached the Norming phase, automatically the whole team falls back into the Storming phase, too.

Norming Phase
The usually high coherence reached in Norming in most cases leads to changes: in OM, in HRM, culture of conflict solutions CFM or Communication rules redefinition. So it is reasonable and advisable to openly accept the teams' drive to adapt the
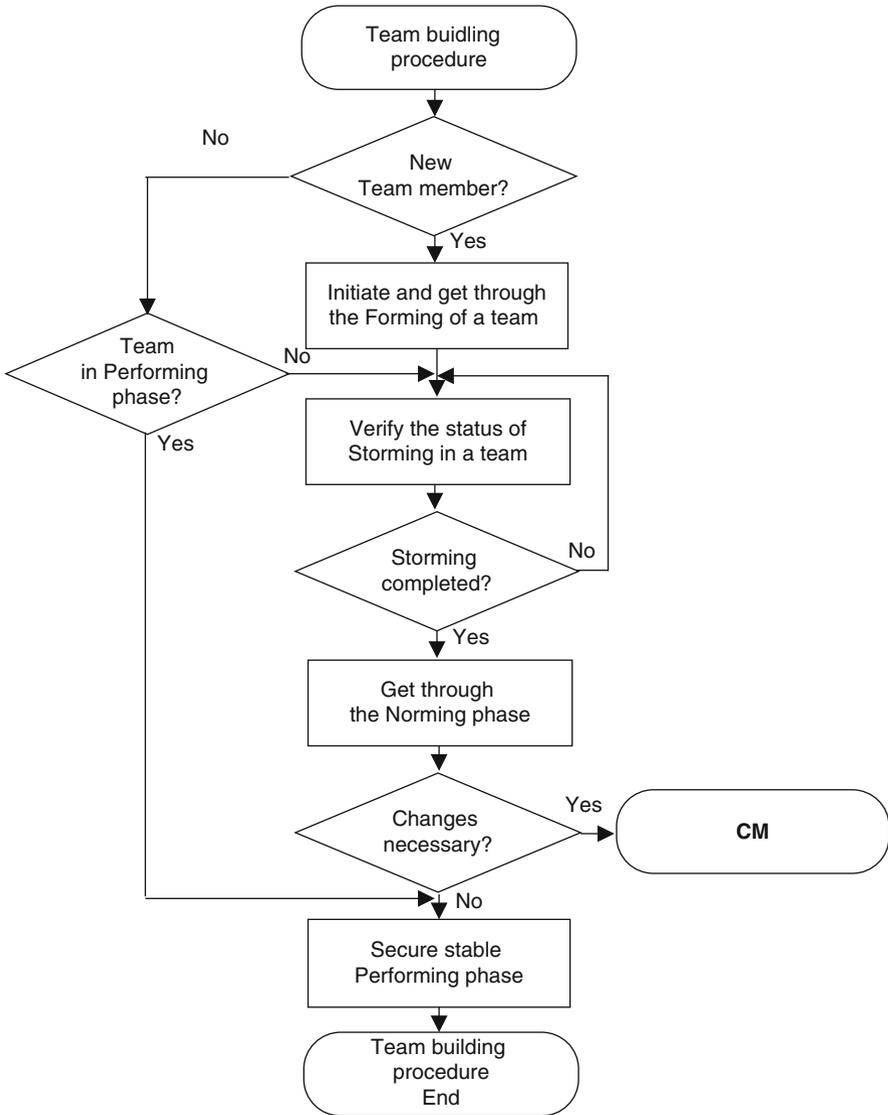
Fig. 15.4 Team building procedure in TM

OM structures and HRM assignments towards most effective, team deduced organization.

Performing Phase
The faster the performing stage is reached, the higher is feasible team performance. We recognize this phase in team development process by following indicies:

Recognizing Performing Phase
- Team members communicate openly and directly
- Any criticism is constructive and not personal
- All team members accept themselves mutually
- There are no major conflicts open
- Trust atmosphere dominates
- No evident hierarchy is seen in team decisions
- Any obstacle is jointly approached and solved
- Decisions are taken in team
- Any success is a team success

Yet, even the best performing team subjects to various influences, having negative impact on team spirit and – if not anticipated and countered with appropriate measures – may drop team back to the storming phase:

Negative Impact Potential in Performing Phase
- Rejection of someone's else idea because it was 'Not invented here'
- Refusing of external, in particular relevant negative, healthy criticism
- "Gate keeper Effect": Only one member of the team communicates with the external world, also in situations when it is not necessary, reducing the team performance
- The isolation of the whole team from the external world and the application of information 'filter' with reference to certain goals and techniques.
- Unsatisfied team members becoming Mr "No" in team.
- Excluding individuals from the team and mobbing (Denisow 1999).

22:24 Team Performance Improvement Procedure

Team Performance Indicators
We build teams because teams are more efficient than the individuals; they are more flexible and use the more efficiently the individual capabilities. TEAM means Together Everyone Achieves More (author unknown).

Performance evaluation firstly is done in Earned Value Management. The overall performance, which includes non-monetary criteria, is evaluated in Balanced Scorecard. The individual performance is evaluated in HRM process. Everywhere we collect the results – and not necessary can identify the reasons of performance deviation.

In Team Management we evaluate the performance and performance potential on the basis of the behavioral indicators.

Effective Teams:
- Know their strengths and deploy them effectively
- Assign the role and tasks along the team members strengths
- Strong leader keep all in team highly motivated
- Team members trust each other
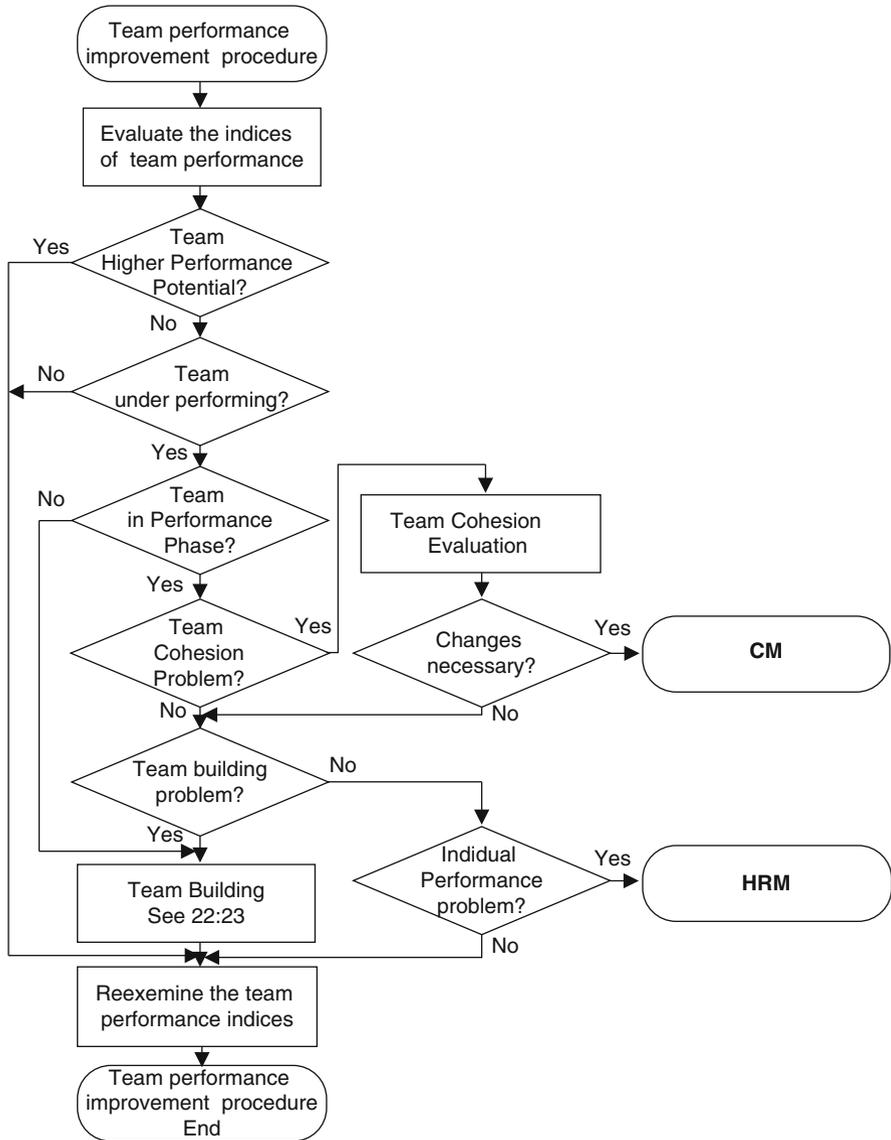
Fig. 15.5 Team performance improvement procedure in TM

- All are committed to common goal and pursue it with maximal engagement
- Communicate internally and externally openly and efficiently
- Collaboratively solve the problems
- Have good internal and external supports
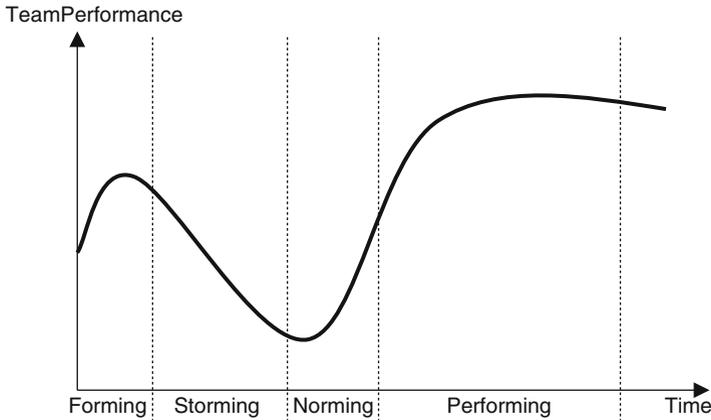
TeamPerformance

Fig. 15.6 Team performance in various team building phases (Tuckman and Jensen 1977)

Ineffective Teams show deficiency in one or more of the above indicators and additionally:

- Does not identify and assign the tasks along the capabilities of project team members
- Several team members try to execute same task, difficult tasks remain untackled
- There is no clear tasks assignment
- One person (not necessary project manager) usurps the authority over the team, while others just "float"

The results of the evaluation initiate sequence of operations shown in Fig. 15.5 below:

The team performance indicators may point at higher performance potential. In this case we shall reexamine the performance indices – and either increase the productivity criteria or for whatever reason reserve this detected potential for possible short notice emergency deployments.

Similar situation takes place when team performs as expected. The demand fot indices reexamination is not that strong in this case, but still useful.

Team Efficiency in Team Development Phases

Team efficiency (Tuckman and Jensen 1977) varies in various team building stages (see Fig. 15.6). Therefore we have to apply different levels of expected performance adjusted to the current phase in which team performs.

Impact of Cohesion on Team Efficiency

If team in Performance phase does not perform, the reason may lay in the team cohesion, which Lakhanpal (Lakhanpal 1993) after having analyzed 31 projects consider to be the main reason for the team performance variations.

If primary cohesion factor of team members is social adherence, the project goal drops to the second plan and team becomes a group with attributes described above and negative impact on team performance.

The goal induced cohesion has a decisive impact.
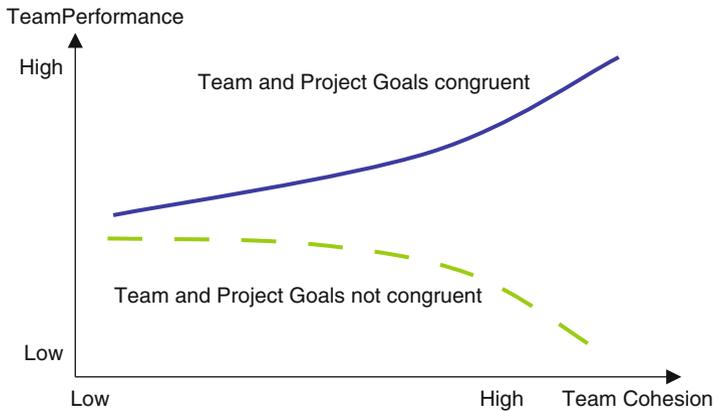
Fig. 15.7 Impact of cohesion on productivity for congruent and deviating goals

The goals of team may be those, common goals of the project, but they may vary up to the completely deviating one like social needs of this group members. Often informal groups with negative impact on the project are built under these circumstances. An impact of not congruent goals may be adverse: high team cohesion leads at deviating goals to productivity loses instead of increase, although at lower pace as compared with impact of cohesion on productivity, when the goals are congruent (see Fig. 15.7).

Virtual Teams Cohesion
Performance is impacted by direct lost in the individual productivity and by the secondary effects of resistance of such a team to leader changes and what may be called "Groupthink" effect: part of team formulates and follows informal goals up the point of their full contra productivity (Janis 1982). Particularly endangered are here virtual teams, which works in distributed environments,

Upon assumption of congruent goals it is reasonable to work on highest possible cohesion in team by:
- Defining a homogenous organizational structure
- Being conservative and restrictive on organizational structure changes unless otherwise justified
- Promoting frequent interaction of team members
- Continuously securing that the team goals are present
- Letting team to celebrate the successes on the way.

22:25 Team Culture Adjustments

The easiness of today migration, international projects, multinational team members introduce today a new factor, influencing the team performance: cultural

differences. Shaking hands in Europe versus bowing in Asia, German time precision versus South European "about then" – the examples are numerous.

Culture is a system of common standards, beliefs, value systems and customs, which bind together certain people groups and create a feeling of unique identity. Hofstede (Hofstede and Hofstede 2005) calls it mind programming. And projects are where common goals meet different minds.

The package contained in different minds determines one's perception of the situation and environment and his actions, what in turn affects the team performance. Both, the team development phases as well as team cohesions are tangled. Individual performance is otherwise evaluated in HRM Process. The individual cultural backgrounds of a team member influence practically his participation in each of the L-Timer® processes. To gain the optimal team performance one has to open himself to other way of thinking and accept maybe sometimes un-understandable reactions.

Belgian CU-Factor (CU-Factor 2013) company developed a taxonomy to evaluate cultural impact on projects, based on the analysis of cultural impacts in all European countries.

The four differentiating criteria are:
- Cultural influences (Working hours, dress code, dress relevance, punctuality, lunch/dinner habits, gifts)
- Communication (language, style and way of expressions, handshake, general perception)
- Organizational structures (organization, orientation of management on goals or people, role of networks, flexibility of adaptations)
- Cooperation style (trust development speed, base and way of decision making, role of rules, way the partner are treated, way of dealing with uncertainty)

The cultural influences and communication habits may be mastered in a short time, once we wake up our awareness and put some attention to these issues. It shall be noticed, that language is not only grammar and style, but also idioms and understanding of the whole phrases. "Tomorrow" for Spaniard does not necessary means, that it will be just next day.

Two dimensions of cultural traits define one's approach to the organizational structures. Hofstede (Hofstede and Hofstede 2005) defines them as:
- Power distance and
- Individualism (versus Collectivism)

Power distance cultural traits determine our reactions to collaborative tasks and project manager leading. A team colleague from Thailand will find it difficult to work in changing teams – he prefers to have a clear hierarchy decision on that. Swiss will not hesitate to demand highest competence from the project manager and will openly disavow his decisions. Generally the larger the distance between the social classes in a culture is, the more authoritarian and hierarchical decision taking is expected.

The second dimension defines the value system and responsibility. Western cultures, American being best example, place some value on personal responsibility

	Known to themselves	Not known to themselves
Known to others	**A** Area of open activity (public person)	**B** Area of unconscious activity
Not known to others	**C** Area of avoidance and hidding(private person)	**D** Area of unknown activity

Fig. 15.8 Johari's window

and personal gains. This against the controlled or free adopted preference for team orientation in action and in responsibility: to certain degree an Italian and Asian virtue.

Morris and Peng conclude that the collectively oriented Chinese have greater problem-solving utility (Morris and Peng 1994). So depending on the cultural trait we may well place an individual in collaborative environment, we may or we have to allocate a bunch of tasks to the whole team from India.

Generally: to keep higher efficiency to your team learn the cultural heritage of all team members and apply the relativity of culture in unbiased way. Choose right way for each person – than the team will perform, too.

22:30 Techniques and Tools

22:31 Johari Window

Johari Window name comes from its' inventors Joseph Luft and Harry Ingham (Luft and Ingham 1955). It defines the area of activities known to us and to others resulting in the four combinations shown in Fig. 15.8.

Inventors prepared also a questionnaire of 56 adjectives, of which up to six shall be chosen to describe ones own personality. Closer analysis shows relation to MBTI presented in Chap. 14 earlier there. Johari window is deployed to speed-up the Forming phase of team development process. The goal of group's development is the increase of area A, where we and the others know what we do and why we act this way, and to reduce the areas B and C. In the frame of group development, there are only few possibilities of the reduction of area D. The development should be actively supported by the project manager (see Fig. 15.9).
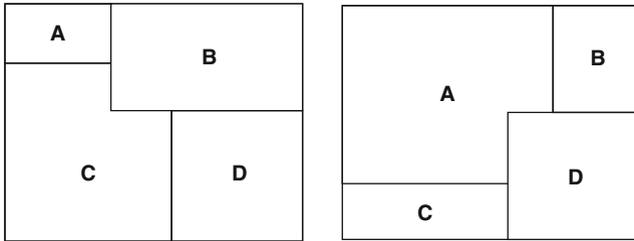
Fig. 15.9 Johari's window at the beginning (*left*) and after (*right*)

22:32 Team Integration Measures

Observation
Observation of team members suits well for the purpose of gathering information concerning the informal roles assumption, behavior of particular project team members or their potential for the integration in their actual or future teams. However, it is conditioned by significant social competence and experience of the observer. Since during the observation it is only possible to have a look at the events from outside, it is advisable to verify the results with some third persons – from inside or outside the team. An indirect verification of our opinion might add objectivity to this verification.

Kick-off Meeting
Good starting point to obtain some knowledge each about each is the project initial meeting: causally called Kick-off meeting. When all or few prospective team members meet for the first time the Forming phase is initiated. It is useful to deploy the Johari Window Technique, the Metaplan for personal presentations, informal meetings for testing own cultural traits and work preferences. Paired with project Initiation Phase (see Chap. 2, 7:00 Planning & Scheduling: P &S) perfect motivation to strive for the common project goals achievement may be set.

Based on the knowledge about the informal roles in team, we should plan and carry out common workshops, trainings and meetings. The goal of this activity is to enable team integration, through direct contacts in the team, which consequently leads to the realization of the processes incorporated in the phases of team integration Forming, Storming, Norming and Performing. Depending on a phase and the present works of the team, different forms of common activity can be in the limelight.

Workshops
During workshops, in the merits we work for the realization of the set project goals. The team integration is supported here first of all by professional interaction between particular team members and is performed rather unconsciously. If the team is at an early stage of its development, then the informal roles have not been

assumed by the participants yet. The participants of the workshops in certain way go for it by using certain words, performing certain activities, etc. However, at a later phase of team development the informal roles are already assumed and they may exert even strong influence on the distribution and assignment of formal roles – what actually in most cases is advantageous to the project.

Trainings

In case of trainings the most important thing is to equip the project team members in the abilities or knowledge necessary for the preparation of future tasks connected with the project. On the one hand it allows to go through the processes of team integration in an unconscious way. However, on the other hand, especially training can contribute to a conscious focus on different elements of team integration and this way to enhance consciously the understanding of the processes of team integration. This way, the earlier unconscious experience of the processes of team integration becomes the subject of conscious interaction between particular project team members. Owing to this, it is possible to improve not only the acquired knowledge but also mutual understanding.

Off-the-Job Meetings

The meetings of the project team can be organized regardless of the merits sphere. The partners meet more or less voluntary in their leisure time, in order to run together sport or cultural activity etc. This activity itself is not particularly important as long as it can be carried out by each member and is at least a little similar to the interests of particular partners. However, for the further development of team integration, a minimum interaction is necessary while performing those activities. If the team is at its later stage of integration, then in case of need it is possible to invite to the meetings also people close to the partners.

Rules of Interaction in a Team

Especially in the preliminary stages of the process of team integration it is profitable to work out together with the team the so called rules of integration in a team for the need of workshops etc. The rules are then written down on flipcharts and are hang up during meetings in a noticeable place. This way everyone always keeps it in their mind. The term rules is understood as all the issues well known to everyone, nevertheless it is worth to summarize it shortly. The rules among others include e.g. the basic rules of conversation, as e.g. the ability to allow one another to express their opinion, the rules of expressing criticism towards the subject matter and not the person involved or not revealing personal issues outside the team. If any of the rules is violated by anyone, the group notifies the person about the fact. This way it is possible to evoke the feeling of justice, openness and terseness bringing real effects (see Fig. 15.10).

Integration Events

Originally conceived for military trainings and buddy-system development camps like that of Ranger School, gradually they migrated towards less hard versions for top management and today are available for each, even financially less
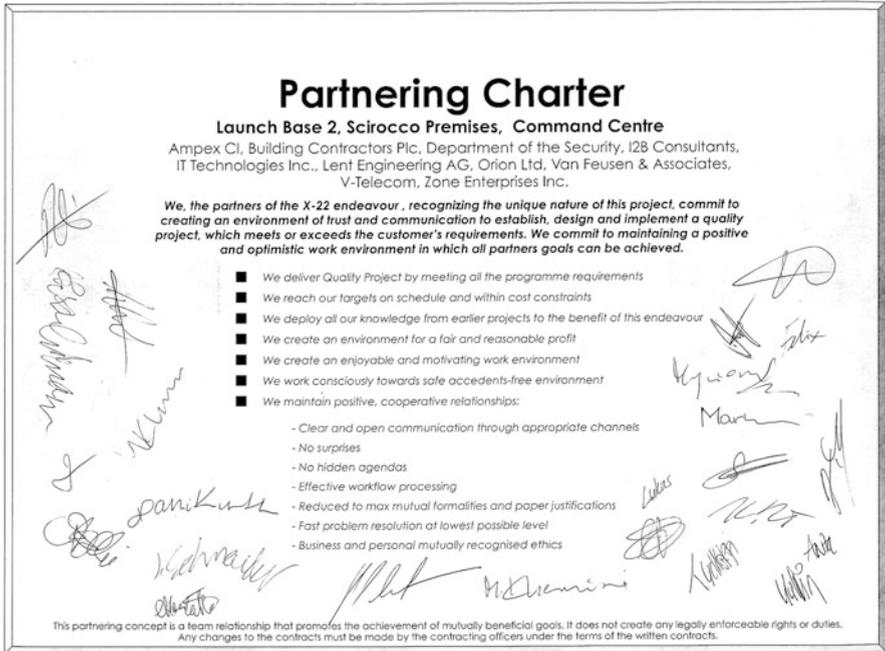
Fig. 15.10 Illustration of partnering charter for team integration

potent teams. Survival camps, paint-ball camps, thorns, peak climbing are good examples there.

Less demanding are joint games and team exercises within more or less usual environments: company, nearby restaurant, football field round the corner. Excellent source offers Gellert (Gellert and Nowak 2010).

Other sort of common integration events are occurrences, which go beyond the usual daily life of team members like joint participation in a concert of a world star, championship match gala dinner and so on.

22:40 Templates

22:41 Project Documents

The Forming phase may be supported by the following Check-list, elaborated on the base of Gellert (Gellert and Nowak 2010) (Table 15.2):

Table 15.2 Checklist for the Forming phase

No	Checklist for the forming phase	Status?
1	**Expectations of the team members met?**	☐
1.1.	What will happen now?	☐
1.2.	Who are the others?	☐
1.3.	Where is my place?	☐
1.4.	What will be my task?	☐
1.5.	Who is the project manager and how will he manage?	☐
1.6.	How do the general working conditions look like?	☐
1.7.	What are the rules here?	☐
1.8.	Will my expectations be met?	☐
1.9.	What others expect?	☐
2	**Project manager's tasks**	☐
2.1.	Deliver relevant informations about the project	☐
2.2.	Secure clear structure (general, time, treated items)	☐
2.3.	Explain the origins and goals of common project	☐
2.4.	Draw the competences needed in a project team	☐
2.5.	Care about a friendly atmosphere	☐
2.6.	Provide the necessary space for personal distance needs	☐
2.7.	Approach with respect the primary resistance	☐
2.8.	Secure the situation against the devaluation of the actions	☐
2.9.	Express your confidence in capabilities and competences of team	☐
3	**Feasible team activities**	☐
3.1.	Moderated contact between small groups, pairs	☐
3.2.	Activity developing "we" feeling in the team	☐
3.3.	Activities related to the project subject	☐
3.4.	Possibility to express fairs, needs and expectations with no need to justify	☐
3.5.	Leaving the team members to decide the level of their openness	☐
3.6.	Getting closer look or feeling who is the project manager and his style	☐
3.7.	Enable in team desire to play, motivation and trust	☐
4	**Possible obstacles**	☐
4.1.	Team members go on distance and activate defense mechanisms	☐
4.2.	Few team members dominate and discourage the others	☐
4.3.	Energy is spent on self-defense instead of on team results	☐
4.4.	Spreading atmosphere of passivity and symbiotic expectations	☐
Final result: Project Charta reached?		☐

22:42 Documentation of the Project Results

Good estimation of the performance potential in the team is an exercise of Francis and Young, quoted in Gellert (Gellert and Nowak 2010) (Table 15.3)

Table 15.3 Example

Team for sale
1 Description of the situation
Team is assumed as being a department of large company in possibly related business area. The times are hard for the company. The department manager had a day before a meeting with his superior, who informed him, that company is in critical situation and it's existence is in question. Under these circumstances Company management sees only two solutions for the department of the team:
1. Department will be closed and the tasks will be outsourced to external companies
2. The services of the department will be offered on a free market and company covers only 50 % of the department costs.
Superior is aware about the difficult market situation and strong competition, yet consider the chances for the department to survive as profit centre on a free market as high. He let the department to hire or purchase on a market also additional Know-how if it will be necessary, however at won cost of the department
Department Manager and team has 6 months to elaborate the convincing business plan and start of the profit centre
2 Tasks
Team as a whole or in small groups elaborate the following aspects:
Analysis of the capabilities and know-how which might be offered on a free market
Evaluation of the deficits in capabilities and know-how of the present team and decision if these deficiencies can be acquired by team members or has to be purchase externally
With 6 months to go which steps shall be taken to strengthen the strong side of the team
Design the sale's materials and product presentation for potential customers
Summarize the experiences of this exercise and verify which capabilities of the team now truly can be strengthen, which capabilities are missing and what can be done about. Note down the results
3 Team performance improvement potential
Collect the results of team own evaluation. Consider it's impact and decide about further steps

22:50 Activites and Deliverables of Particular Project Phases

22:51 Initiation Phase

Tasks
- Go through the "Team for Sale" (section "" above) exercise with your core team

Results
- Core team capabilities and Know-how draft assessment

22:52 Planning Phase

Tasks
- Estimate by indicators in which team building process phase your team currently is
- Identify the cultural traits differences in the team
- Initiate activities to accelerate the team building process
- Decide at which phase to team building are at the end of the planning phase.

Results
- Team building phase identified
- Team members aware about their mutual cultural back-ground
- Team building accelerated
- Project Charta drafted and signed by team members

22:53 Implementation Phase

Tasks
- Care about the proper team building phase initiation upon each change in people in the team
- Identify, when the team goes back to the storming – work to get the cycle as fast as possible through
- Evaluate team performance indicators and take suitable actions
- Evaluate the degree of cohesion in a team
- Go through the "Team for Sale" (section "22:42 Documentation of the Project Results") exercise with your whole team occasionally

Results
- Team building process kept alive and steered
- Team performance factors evaluated and suitable actions taken
- Team cohesion with positive impact on the project reached
- Team members benefits from mutual cultural differences and can deploy optimally each individual.

22:54 Closing and Evaluation Phase

Tasks
- As in the Implementation Phase and beside
- Prepare Team for the Adjourning Phase

Results
- As in the Implementation Phase and beside
- Alumni-relationship initiated
- Final conclusions for Knowledge Management Repository elaborated

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16

Quick Look

What Is It?

Project pressure, personalities, reorganisation often leads to conflicts in team. Conflict Management (CFM) attempt to detect emerging conflicts as early as possible, solve them and start preventive measures for the future.

Who Does It?

It is wise to evaluate team members' personalities and choice best suited as prospective moderator of conflict solutions. Second option are external stake holders. The last, and in crisis situations the only solution, are professional psychologists.

Why Is It Important?

Conflicts bipolarize the project fate. They may revolutionize the procedures (positive case) or (unfortunately most common case), they are contra productive. Worst case team get checkmated – crisis and complete paralyse spread around. Being well prepared we can act timely and mitigate the effects.

What Are the Steps?

Verify and close pending process improvements and tasks. Check for conflict symptoms, be open for hints. Approach meticulously each conflict. If the team is in crisis – call professional psychologist. Learn and set preventive measures for the future. After verifying all roles check if Change Request or Knowledge Management shall be addressed.

What Is the Work?

Conflict solution takes a lot of time and energy. Each single cause of conflict has to be evaluated and agreed by both conflict parties. Than each solution – the same way. Lastly the choice of an acceptable solution for all parties and securing it's sustainability take time, too.

How Do I Ensure That I Have Done It Right?

Choose the moderator, preferably from inside team with qualities making him acceptable to conflict sides. He should talk first individually, than together with each party. Each party shall evaluate the possible strategies and choose its position.

Only cooperative approach both sides truly works in projects. Agreed solution has to be set with check date. Upon reaching agreement change of atmosphere, pleasant thoughts are mandatory to fix it.

Process

Firstly try to finalize all hanging issues, in particular preventive and detection measures before you evaluate the situation in team. Initiate the conflict solution process if necessary, crisis solution if team gets that far. Learn out if that and set the new prevention or detection measures. Suggest changes, store knowledge and reenter the process periodically (Fig. 16.1).

00:10 The Goal of Conflict Management

The goal of Conflict Management is as early as possible recognition of conflicts and conflicts potential; proper reaction on the conflicts through the application of proven methods and elaboration of preventive measures against their re-appearance.

00:20 Methods

Although in the dozen of years of praxis of the author, conflicts always emerged in project teams, ISO 21500:2012 does not foresees any special action or process dedicated to handle this issue, leaving project manager virtually unprepared (ISO 21500:2012 2012). This process shall close this gap.

00:21 The Definition and Indices of a Conflict

Conflict takes place when the plan of actions of one person limits or significantly hinders the plan of action of another person (Triebe and Wittstock 2003; Verma 1996).

Thus, the signs of a conflict are the following:
- The presence of at least two parties of a conflict,
- No possibility of agreement regarding the tendencies of actions,
- No possibility of agreement regarding behavior.

The following, general symptoms can indicate a conflict in a team (Triebe and Wittstock 2003; Antons 2011):
- Lack of patience in mutual communication and presence,
- Ideas are questioned before they are fully formulated,
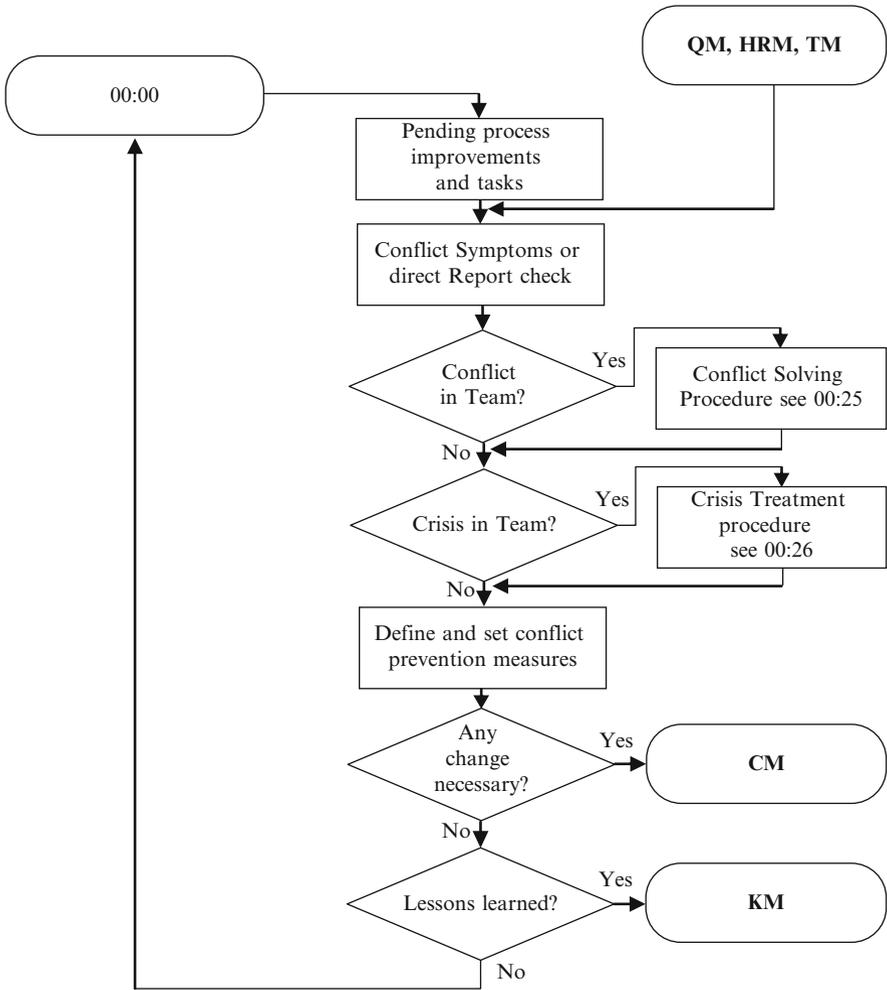
Fig. 16.1 Conflict management process

- Team members are not able to reach compromise concerning plans and proposals,
- Argumentation is very vivid and full of emotions,
- There are parties of a conflict, nobody is open for com-promise,
- Negative utterances concerning other people and their achievements,
- No agreement concerning the common point of view,
- Members accuse each other of the lack of understanding,
- Others' opinion is misapprehended,
- No trust in the team.

Table 16.1 Potential factors of conflicts in an organization

Source	Examples
Identity	Social role of an organization, mission, sense and goal, pattern, basic values, image
Strategy	Long term strategy, the policy of a company, key note, plans, **priorities**
Structure	The principles of structure, hierarchy in the process of management, **administrative procedures**, posts of the line structure and the management positions, central posts and the decentralized ones
People, groups, atmosphere	**Interpersonal**, Knowledge and abilities of the team, **personalities**, attitude, relations, style of management, informal group creation, roles, power and conflicts, atmosphere in the work place and project team
Particular functions, bodies	Tasks, competences and responsibility, the contents of tasks, groups and project teams, coordination
Processes, their conduct	**Processes** and **schedules** of tasks realization, informative, decisive, planning and steering processes
Resources	**Human resources (workforce), budget**
Physical measures	**Technical resources**, Instruments, a phone, a computer, machines, material, furniture, rooms, premises, financial measures

00:22 Potential Sources of Conflicts

Table 16.1 combines the conflicts potential in the organizations as seen by Triebe and Wittstock (Triebe and Wittstock 2003), with the project specific (bolded in Table) sources as seen by Thanhain with Wilemon and Posner quoted by Verma (Verma 1996) and Gray and Larson (Gray and Larson 2007):

Even if the authors disagree on the ranking of the sources, bottom line is that the bolded sources are most common. Most recent (2007) Gray and Larson indicated the differences in the project phases as shown in Fig. 16.2.

We observe that most or second most conflicts occur around the schedules. This confirm also Spiess and Felding in (Spiess and Felding 2008). So, good planning and team involvement in planning might be a good conflict prevention policy in a project.

Classification of conflict sources along the involved parties allows project manager, team members and moderator to position themselves. We distinguish:
- Intrapersonal conflict one has with himself (torn by opposite personal goals) and attempt to carry it out on a team forum,
- Interpersonal conflict between the individuals in team
- Intra-team conflict, when grouping creates opposite camps within project team and
- Inter-team conflict between project team and e.g. rivaling team from the company or competitor.

We mostly have to deal with interpersonal conflicts. Intra-team conflicts are complex and end up in most cases in crisis (Chap. 16, 00:00 Conflict Management: CFM, section 00:26 Management of Crisis Situation).

Inter-team conflicts are subtle – they may be handled for certain time, but sooner or later the negative impact over helm the initial rivalry benefits and demand again
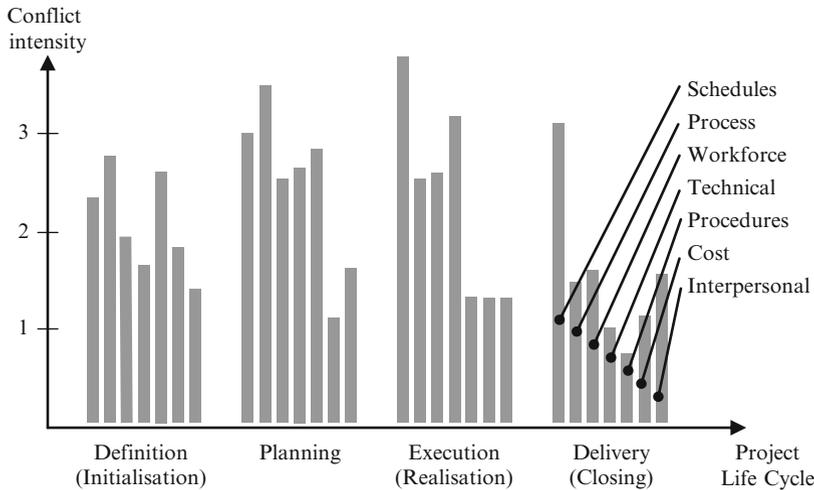
Fig. 16.2 Conflict sources according to Gray and Larson (Gray and Larson 2007)

complex external solution approach. Intrapersonal conflicts may be delegated to HRM.

Glasl (Glasl 2004) developed a conflict model based on three levels of conflict dynamics:

– Level 1: "win-win". Both parties still can win
– Level 2: "win-lost". Clearly there is a winner, and
– Level 3: "lost-lost". No one really can win anymore.

If unaddressed, conflicts evolve from level 1 to level 3. Level 3 we can view as a crisis. Level 1 is the best option to reach the results in conflict solving. At level 2 each partner tries to convince the other one about his arguments, sure to be in his own rights, leaves already limited options to find a common solution.

We may conclude that in view of Glasl dynamics only Level 1 conflicts may be solved by team themselves.

00:23 Conflict Impact on Performance

Verma (Verma 1996) distinguishes relatively unambiguously the three epochal views on conflict impact on organizational team performance. He consider it

- "Classical view", when we see the conflict negative impact on performance as a monotonous deceasing function, which was up to him carried until 1940s
- "Behavioral view", given up in the 1970s, which admits conflict both negative and positive impact, but suggest rather to minimize the conflicts intensity in a team and
- "Interactionist view" where Verma sees relatively long time of increased performance as the level of conflict increase. Certainly the creativity in this phase improves and parties clarify their positions.
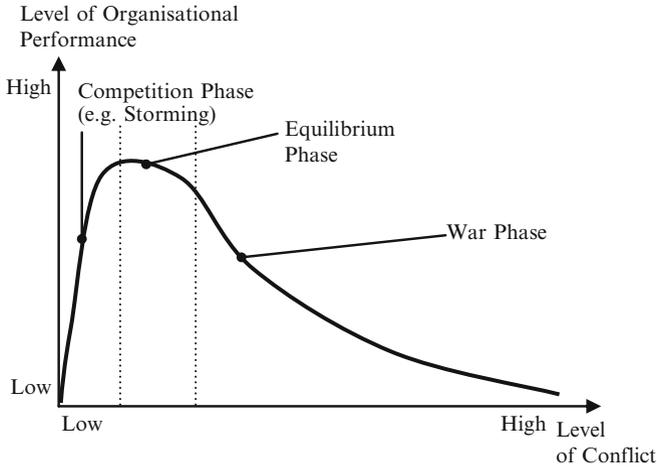
Fig. 16.3 Conflict impact on team organizational performance

The strict time allocation by Verma seems to be purpose derived. The "Interactionist view" of positive impact of conflict was already treated by Mary Parker Follet, who advocate to put the conflict to work in her second lecture on the psychological foundations of business management, to the Bureau of Personnel Administration conference group, in New York, in 1925 (Graham 1995/2003)

Gellert and Nowak (Gellert and Nowak 2010) contradict Verma also and approach the conflicts from the behavioral point of view.

In authors' opinion conflicts may have positive impact but for the relatively low intensity conflicts and within a short period of time. It is called "Competition Phase" on Fig. 16.3. Very soon a stage of "Equilibrium" begins where we can keep team delivering, but for a limited time period only. This may be the case when e.g. we are in the last project phase, and it is just the questions of days until project get finished and team dissolved.

In reality soon the performance degrading "War Phase" starts and if not counter measured – deteriorates the performance up the final crisis in a project. The relationships brake, team is less willing to enter any collaborative ventures, communication brakes, groupthink, static views and violence develop.

Consequently author contradicts Verma and lends credibility to "Behavioral approach" of Gellert as still holding true and rather opts for conflict overcome than exercise with "Competition Phase".

00:24 Conflict Solution Approaches

Conflicts emerge on the base of personal values, beliefs, interests and soon become emotional. Dealing with a conflict we have first to dissolve the emotional issue – than address the interest and at the very end – the beliefs and values.
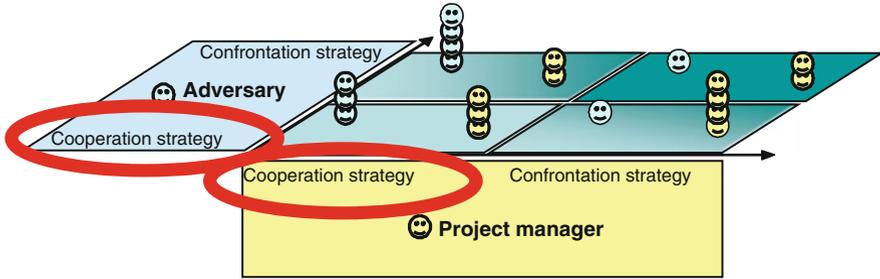
Fig. 16.4 The strategy of confrontation and cooperation

Two aspects define our approach:
- Strategies followed by the parties during the conflict phases and in the initial phase of solution approach
- Conflict solution style chosen by the parties.

It is worthy to consider project manager as one of the parties, what actually often happens.

Whereas, in the common practice of project management the conscious measurable strategies are only those of the people taking decisions, and at best also intuitive external impact was taken into consideration e.g. that of sponsors or stake-holders, here the successful project management is considered as such, which integrates to the same extend the strategies of a project manager as well as his adversaries, like e.g. of team member or project supervisor.

Project manager can choose one of the following strategies:
- Cooperation strategy or,
- Confrontation strategy.

This holds true also for his adversaries. They may also select between:
- The strategy of cooperation or
- The strategy of confrontation

The resulting combination of all these strategies is illustrated in Fig. 16.4. In the example possible results for a person taking decision are marked with smileys in light colour and those of an adversary in dark colour. Possible gains are expressed in number of smileys one can reach, if he choose the specific strategy and the opponent another one. Thus, e.g. when project manager adopt cooperation strategy and his adversary goes on confrontation, project manager wins two smileys, his adversary four, together the total number of smileys is six. As it is maximum in this play, it suggests that such strategies of both sides lead to the best results. Unfortunately it is illusory: project manager has to achieve team goals and such a case sets precedence for future collaboration: always compromising project manager will deliver inferior results.

The only reasonable and successful strategy in project management is both sides cooperation strategy. Projects by nature are innovative and in part unpredictable. So a looser will sooner or later have a chance to revenge – and certainly he will escalate. By adopting both sides cooperation strategies neither is giving up and both share the feeling of a success.
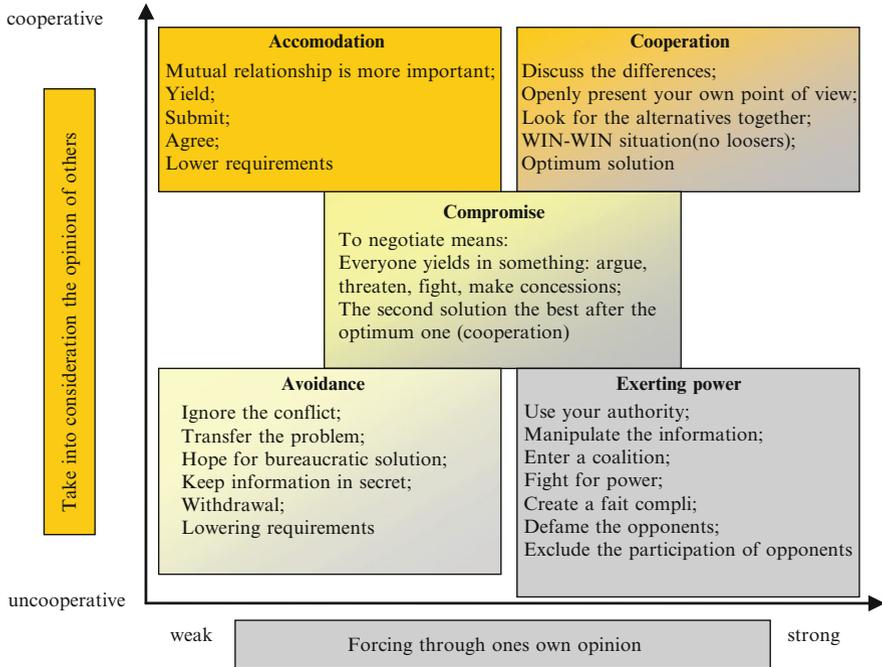
Fig. 16.5 Types of conflicts' solutions (Triebe and Wittstock 2003)

This leads us directly to the choice of style, which we intend to follow in conflict solution as shown in Fig. 16.5. (Triebe and Wittstock 2003)

The avoidance is useful, when the matter is of lesser importance to us, trivial and we intend to calm the situation. However, it is temporarily limited (Equilibrium Phase).

If the things become unavoidable we can proceed to accommodation or power exertion.

Accommodation is useful, when we acknowledge, that actually we have weak arguments, to push our intentions through, when the things are less important to us, than to our adversary, when we want to preserve and further develop good team spirit, harmony and possibility of self learning.

Power exertion is a must, if we are under enormous time pressure to make decisions of great relevance, when we have to make unpopular decisions, like budget cuts or towards non performing persons.

We can compromise (style, not strategy!), when the things are important, but both sides are strongly emotionally engaged in completely incompatible goals, we are under time pressure and the thing is not worthy an effort. It is a good intermediary style before entering the exerting power or collaboration style.

Finally, with a cooperation strategy in mind, the collaboration style offers the best sustainable results. The equally important goals of both parties are integrated, both parties perceive the result as their own win.
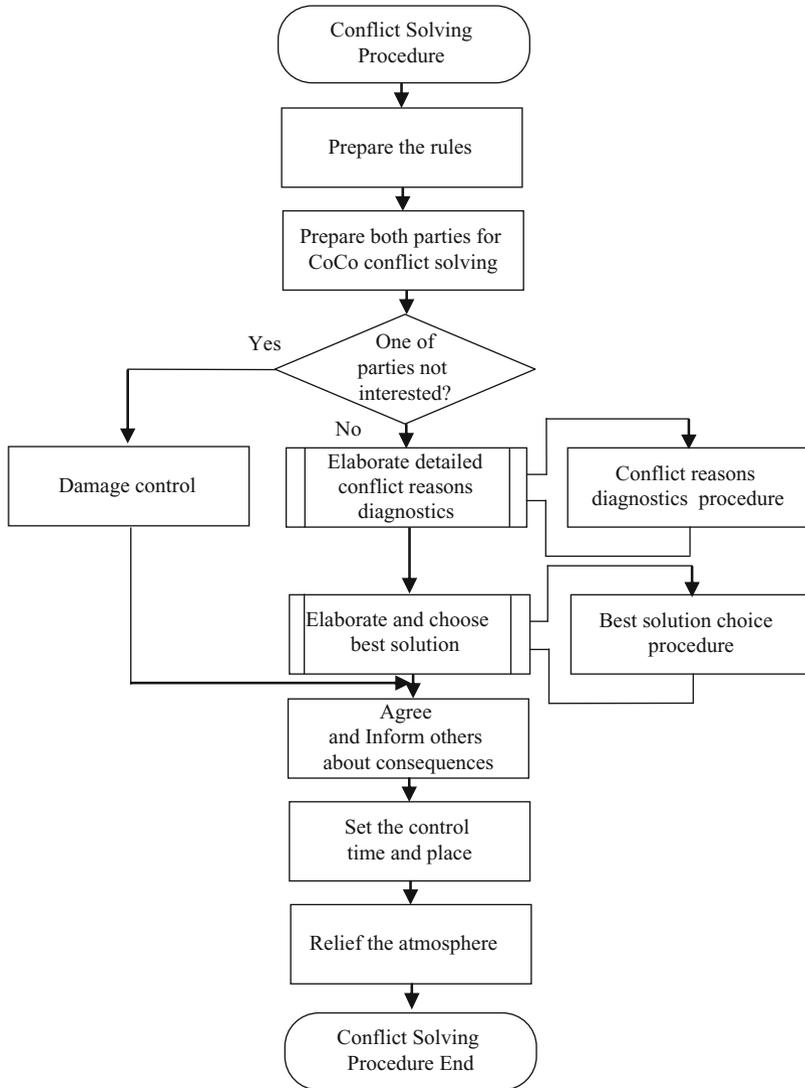
Fig. 16.6 Conflict solving procedure

00:25 Conflict Solving Procedure

Conflict solving is never a fast track procedure. It is an intensive, exhaustive multiple steps process, which takes hours and days (Fig. 16.6). The procedure her follows (Triebe and Wittstock 2003).

Each of the conflict dimensions demands a solution (Spiess and Felding 2008) as shown in Table 16.2:

Table 16.2 Conflict dimensions and attained goals

No.	Dimension	Content	Approach	Goal
1	Instrumental	Tangible issues like methods, procedures and structures	Problem solving (see 12:20 PBM)	Solution
2	Interest	Allocation of resources like money, time, labour and space	Negotiation	Agreement
3	Value	Political, religious, moral values	Dialogue	Mutual understanding
4	Personal	Identity, self esteem, loyalty, rejection	Dialogue	Mutual understanding

We conclude, that while the conflicts in the first dimension might be diverged to Problem Management, Dimension 2 but in particular 3 and 4 are subject of CFM.

1. **Rules and Parties Preparation**

Firstly we have to choose the person, which will moderate the conflicts. If already set during the HRM or TM process it may easy the tensions. If project manager is part of the conflict – he can not be the moderating person. Chosen moderator prepares the rules of conflict solving for all involved. He may choose techniques given further in this Chapter (section "00:31 Conflict Prevention Techniques"). Once ready, he contacts both parties and let them separately to describe the situation, earlier attempts to solve and express their expectations regarding the future. Each party shall be reflected to abandon the following positions (Lee 2006):

- Mind reading: guessing about someone else motivation, agenda or intension as the truth e.g. "I know what he wants – he will never get it as long as I am here".
- Fortune telling: prefabricated prediction about the future e.g. "This will be disastrous for all if he get his way"
- Indulgence in self-righteous outrage: indignation based on assumptions and guessing, e.g. "How can he depreciate my 10 years work just by doing that?!"

Both parties shall be motivated to see an advantage in common conflict solving (Level 1 Win-Win) and both shall attempt "CoCo": Collaborative Compromise solution.

In case one of the parties tends to follow an alternative strategy or alternative style, damage control substitutes the conflict diagnostic and solution choice. The situation of level 2: Win-Lose occurs. The conflict in this case is just postponed, power-played or lead to crisis.

2. **Diagnostics of conflict reasons**

Now under provision of collaborative cooperative approach of both parties they are encouraged to express their assessment of the situation and reasons of the conflict in a common meeting (see Fig. 16.7). Presence of the moderator secures, that parties present the same views, which were presented in individual contacts with the moderator. If some items have to split (e.g. someone does not like to work in an office and that includes working place, air conditioning and other persons) each of them has to be separately treated. Same happens with the joint description

Fig. 16.7 Conflict reasons
diagnostic procedure
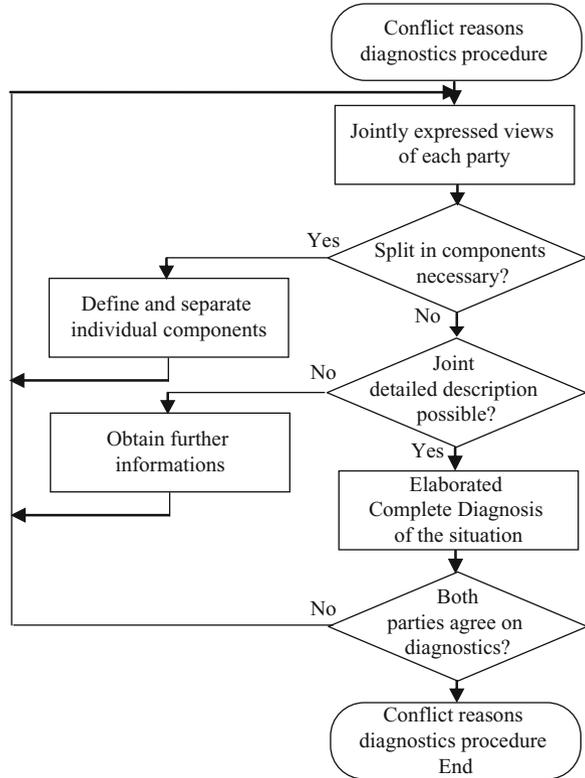
of each singular conflict reason. If finally a complete picture is reached and agreed
by both parties the diagnostics of conflict reasons is completed.

3. **Preparation of solutions**

The solutions elaboration begins with first draft of possible solutions and the
ways of their implementation. If there is not sufficient information to evaluate
different ways, loop ha to be repeated until clear comparison is possible. Subse-
quently the final solution is chosen and evaluated if all sides acceptable. The
procedure is repeated so long until the agreement is reached – which may take
time (see Fig. 16.8).

4. **Fixing the stability of the solution**

The solution and the way to reach it is one side – the consequences, in most cases
behavioral for the involved conflict parties – the other side. So all consequences
shall be carefully evaluated with both parties and only when the control date and
place are set, the consciousness about the consequences of the reached agreement
truly seeds in the minds of all involved.

The whole process as presented in this chapter may take a lot of time and
certainly is exhaustive to all involved. The mutual acceptance at the end is on the
verge of tolerance and the results are very fragile. Therefore, a change in a subject

Fig. 16.8 Best solutions
choice procedure
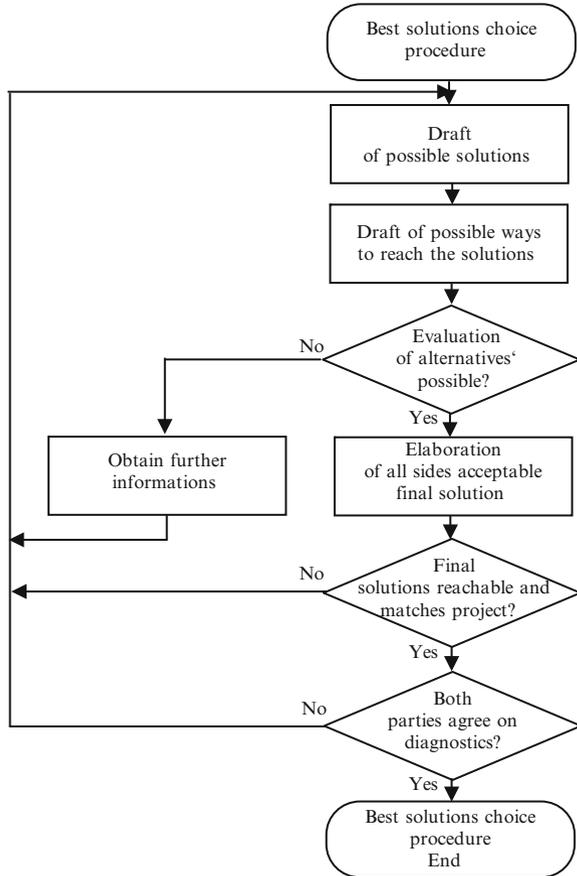
to relieve the atmosphere is most important factor to fix the reached results.
Moderator shall inform himself about the hobbies of the parties, current interests
or personal pleasant occurrences and change the subject towards these themes
(Fleischer 1990; Cadle and Yeates 2008).

00:26 Management of Crisis Situation

Crisis situations are conflicts which deepen the feeling of hopelessness (see
Fig. 16.9). Unsolved conflicts can grow to the state of crisis and paralyze the
whole team (Triebe and Wittstock 2003).

Symptoms of Crisis Situation
We can recognize a crisis in a team by one or more of the following symptoms:
• Blockade of improvements (being attached to strict hierarchy, inefficient roles,
  procedures and peoples),

Fig. 16.9 Crisis treatment
procedure
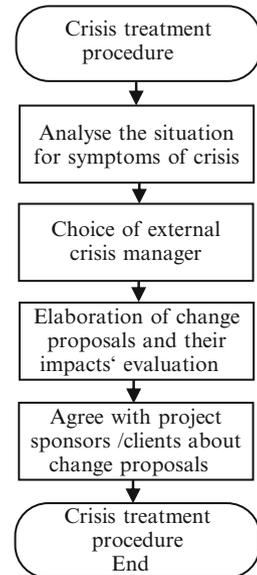
- Taboo topics,
- Too bureaucratic regulations aiming at the avoidance of conflicts,
- The team members who express their dissatisfaction are silenced.

The solution is not any more feasible unaided – team has to search an external crisis manager.

A change in project team is inevitable. The alternatives have to be evaluated and agreed with those, who finance the project: sponsors or clients, before they are passed further.

00:27 Conflicts Prevention

How to Prevent Conflicts

Best conflict solution and crises avoidance is not to let the situation develop that far. Unfortunately generally we can pre-vent the reoccurrence of conflict only after it already happened. Case studies like those of Spiess and Fielding (Spiess and Felding 2008) help to benefit from someone else experience. Bracken G. et al. see partnering as a main method to prevent the conflict emergence. As projects goals span team interests there is a good chance, that focusing on mutual interests binding the team members (section "22:20 Methods") we effectively contribute towards conflicts prevention (Bracken et al. 1998).

Considering, that plans and schedules are the main source of conflicts in any project phase not surprisingly Spiess and Felding conclude, that well elaborated plan and schedules are a good preventive measure (Spiess and Felding 2008).

Glasl and Ballreich approaches this systematically, by focusing on activities in team development process including the personality issue (Glasl and Ballreich 2004).

The systematic conflict prevention is feasible on the following levels:

- Intrapersonal level: get persons truly involved in a project, approach his personal need, assess his match in a team (see Chap. 14, Human Resource Management: HRM, sections on MBTI, Belbin), focus on issue level (Chap. 19, 06:00 Leadership: L, Chap. 2, 07:00 Planning & Scheduling: P &S).
- Interpersonal level: support Forming and Storming phases with profound interpersonal coaching, promotion of honesty, trust and openness (Seifert 2003).
- Procedural level: good effects are reached in teams, where leader was accompanied by someone taking more care about the HRM-issues.
- Meta-level: team shall encourage each other to learn from the current situation and train the adaptation at each level. This corresponds with the change culture in a team. This meta-learning and meta-communication offers each team member an insight into others position, thus increasing the mutual understanding and lowering the conflict potential (Glasl and Ballreich 2004)

Prevention by exclusion of some groups or early warning systems as recommended by Matthies (Matthies 2000) is not considered as particularly effective due to the usually small project teams and innovative character of the projects.

00:30 Techniques and Tools

Prevention is the best approach to conflicts. So the team observation and workshops are briefly mentioned below.

The basic technique in conflict solution is the presented below PACTAR (from Spanish for "to negotiate, to agree"). On the base of PACTAR, Feedback, Constructive Dispute and/or Negotiation may be applied. Feedback and Negotiation are treated here under the criterion of their usability to solve the conflicts. Feedback and Negotiation as means of communication are discussed in Chap. 17, 02:00 Communication: COM.

00:31 Conflict Prevention Techniques

Observation

An efficient way to detect potential conflict or to gather the information concerning conflict potentials is the observation of team members.

An experienced and socially competent team member, which does not have to be project manager can evaluate the symptoms of conflicts (section "00:21 The Definition and Indices of a Conflict") in a team in its early stage. Awareness about conflict sources (section "00:22 Potential Sources of Conflicts") helps to direct an attention towards specific symptoms.

Workshops
Conflict Management Trainings

Trainings regarding conflict management are twofold:

- Training on how to avoid conflict situations
- Trainings on how to handle the conflicts if they emerge.

Already awareness about the potential sources of conflicts helps the team to pay more attention towards avoiding the conflicts.

Training on how to handle the conflict once it occurs, wakes up another wish in team members, to avoid being dragged in such a dispute. Otherwise, the knowledge acquired during these workshops is useful in successful conflict solution, once the necessity emerges.

00:32 PACTAR

PACTAR is an acronym of first letters of the areas, which conveniently shall be considered and applied in conflict solving:

- P for Priorities
- A for Attitude
- C for Conduct
- T for Thinking
- A for Acument
- R for Resolution

The sequence is stimulated by meaningful acronym and does not reflect necessary the logic of an approach, albeit does not contradict it either.

Vast literature on what shall be observed and which techniques are to be used seems rather to reflect the individual views of the authors, than be justified by some systematic or deduced process (Spiess and Felding 2008; Gellert and Nowak 2010.; Glasl and Ballreich 2004; Triebe and Wittstock 2003; Seifert 2003; Van Slyke 1999; Bracken et al. 1998). Whenever the list of good and unrelated advices extend the number of 9 (seven plus minus two, Miller 1956) or even less, according to the newest research: three or four (Farrington 2011), the cognitive load on our short term memory exceed our capability to work with it and the good advices are fruitless. An acronym of six areas shall help to navigate and lead successfully the conflict solving process.

P Priorities

Conflicts occur between people. Their perspective is the source of conflict so it is necessary to solve this issue first. In the hierarchy of perception the emotions block the reasoning, thus only if the emotions will be calmed down, the interests and personal values may be addressed.

Priorities' golden rules:

- Personal affairs have priority over matters
- Emotions have priority over interests and values

A Attitude

Successful approach to conflict solving demands, that both adversary parties as well as moderator share the positive constructive attitude in the sense of Eric Berne (Berne 1964/1996) "I am ok- You are ok". Bon mot of this approach says "I believe I can do it and I think the others can do it, too". The golden rules are an extract of this approach.

Attitude golden rules:

- I am OK, you are OK
- My attitude is that of a winner
- We strive for a Win-Win (1 level) solution for all
- We are equal and have the same rights
- Everyone is as he is
- Everyone is autonomous
- Everyone has right to have his own opinions, needs, feelings
- Everyone responsible for himself
- Everyone is honest and act correctly
- Everyone can make errors and have the right to change
- Abandon any comparison
- Treat everyone openly and with respect
- Consider everyone as important as you are
- Criticize constructively, do not humiliate

C Conduct

The dynamics of conflict solving demands permanent control of the situation. All participating, including moderator shall follow the below golden rules. However, it is moderator, who is responsible for the course of development and therefore he is expected to conduct the conflict solving along the golden rules.

Conduct golden rules:

- React as soon as conflict detected
- Each other address directly
- Encourage adult-adult dialogs (Transaction Analyses, Chap. 17, 02 :00 Communication: COM)
- Promote the reciprocal positive feedback
- Avoid indirect conflict amplifying factors
- Accept blender of emotions

T Thinking

The thinking habits emerge from the rule of effective dialog: make someone else your own truth and see it with his eyes (Tischner quoted by Bozejewicz 2006). Gellert and Nowak modified Peschanel approach (Gellert and Nowak 2010) adding to this the meta-perspective of judgment going above the two adversary positions and evaluating the situation from the third, neutral and independent perspective. The capability to think on a meta-level is most demanding and not common in our daily life. Author was frequently encouraged by his coach to "step aside and look at the situation you are in from outside. Is it going the way you really want?" Here is

where we learn. Moderator takes the responsibility to encourage both adversaries to take at least a glace at the conflict from each position.

Thinking golden rules:

- Think "I": what are your real goals? Does this conflict contribute toward achieving them?
- Think "You": What are his goals? How does the conflict contribute towards his goals?
- Think "Meta": Do both sides works towards their goals? What is the impact on a team, project, and customer?

A Acumen

1979 Harvard University Chair of Negotiations started a series of Workshops under what is now called Harvard Project and developed a series of rules, published by Fisher et al., and revised 10 years later (Fisher et al. 1981, 1991). Geller (Gellert and Nowak 2010) simplified position abandonment by advising to concentrate on motives in Harvard Method rules. Hereafter, the original rules are quoted as sharper acumen formulations, precised with explicitly naming joint effort in common conflict solution goal and options elaboration. The last of the Harvard Method rules concerning the standards is considered as part of resolution ("R" in "PACTAR") and therefore is quoted there.

Acumen golden rules:

- Don't bargain over position.
- Separate people from problem
- Focus on interests not positions
- Jointly set the goals and invent options for mutual gains

R Resolution

Each of the parties consider it's rules to be the right one. By looking for objective standards we rather win the acceptance of the results by both sides. This is the last rule of Harvard Method presented above. The second is the attention to the recurrence. If what seems to be solved does not really make the parties working together, we certainly still did not found the real reason of the conflict – so we shall be back on track as early as possible. And lastly to go along the method presented above and truly fix the solution joyous alternative thoughts shall be spread. So the golden rules for resolution attention are:

Resolution golden rules:

- Insisting that the result be based on some objective standard
- Recurrence means real reason is still undiscovered
- Agreement is a reason for a joy

00:33 Feedback in Conflict Management

Feedback supports the clarification of the conflict reasons and accelerates the evaluation of possible alternatives in search of conflict solution. On the base of PACTAR the parties shall:

- Say all what disturbs, exemplify
- Provide and accept feedback
- Observe, that one speak at a time
- Express direct criticism
- Clear opinions, facts, problem formulation
- No rumours, no complains, no guesses
- Listen actively

Active listening, presented hereafter more thoroughly as part of efficient Communication (see section "02:30 Techniques and Tools") is advocated by Van Slyke (Van Slyke 1999) as the key to successful conflict solution. Van Slyke extends listening concept to the analysis of one's own approach – covered here in PACTAR.

00:34 Constructive Dispute

The disagreement between the parties may be solved in a dispute, where both parties present their views. Whereas negotiations have some goals and an element of bargaining, dispute may end without real changes in the positions or direct wins. It basically clarifies for both parties the views and positions of the adversary, leading to some better understanding of the actions. Dispute is effective only for low level conflicts, still in their initial phase. Burgess and Burgess (Burgess and Burgess 1996), Triebe and Wittstock (Triebe and Wittstock 2003), Seiler (Seiler 2003) and Lee (Lee 2006) extends PACTAR with following rules:
- Every dispute must have its beginning, but also a clear acceptable ending
- Proceed incrementally, atomize the problem,
- Consider long and short terms measures of success
- Wake-up an awareness of unavoidable Win-Loss in case of failure
- Work creatively beyond the written rules and obligations
- If in doubts – ask someone you trust for his perspective of the situation
- Make deposits in your Goodwill Bank Account
- Pursue positive interactions beside conflict issues

00:35 Negotiations

Negotiation is a form of dialog between two parties targeted in clarifying the differences in opinions, values and eventually leading to the gains for both parties. Even if the conflict starts with the immaterial misunderstanding by formulating clear gains for both parties conflict reaches higher probability of successful resolution. The principled negotiation (Fisher et al. 1981, 1991) viewed as bargaining the mutual gains can be pursued virtually between any party and even on the higher levels of conflicts: two (win-lost) or three (lost-lost = crisis). With PACTAR we shall observe the following rules:
- Prepare: goals, trades, alternatives, strategy and results
- Know your BATNA (Best Alternative to a Negotiated Alternative)

Table 16.3 Example

Deciding about strategy based on outcome analysis		
Adversary: _____		
The results when adversary goes on confrontation	His win	His win
	My win	My win
The results when adversary behaves cooperative	His win	His win
	My win	My win
	…in case of our cooperative attitude	…in case we choose conforntation

- Work holistic
- Accept and work on creative solutions
- Create trust
- Support positive, suppress negative emotions
- Consider cultural differences, differences in thinking, time

00:40 Templates

00:41 Project Documents

Good preparation to conflict solution includes the elaboration of the strategy. We evaluate our wins and the possible wins of our counterpart in each combination of cooperation and confrontation strategies. The results are written down in Table 16.3:

00:42 Documents of the Project Results

Example of notes of conflict resolution and control dates documents the progress in conflict solution (Table 16.4).

00:50 Activities and Deliverables of Conflict Management Process

00:51 Initiation Phase

Tasks
- Create a system of conflicts recognition
- Define the process of conflicts solution
- Choose prospective mediator of conflicts in team
- Assure that core team agrees on all processes

Table 16.4 Example

Issue (title)
0 Document information
Participants, minutes writer, date, recipients
1 The parties of the conflict
We should record information about partners, third parties participating in the conflict (both inside and outside the conflict)
2 The reason of the conflict
We should record the reasons of the conflict as well as the framework conditions in which the conflict took place
3 The results of the joint clarification of the reasons
We should analyze the results of recognition carried out in point 1 above. We should also make place for the roles and participants, their tasks with the corresponding scope of responsibility and competence, their personality and situation in the team
4 The evaluated alternative solutions and chosen one
We should document various alternatives jointly evaluated and the results and measures taken in order to solve the conflict, which were agreed with the people participating in conflict solution
5 Control
If measures have been taken, at a further stage we should check their utility in problem solving and the success achieved due to them. If it turns out that the measures are not good enough to solve the conflict, or when the result in not satisfactory, then we should check the measures themselves, form them from the scratch or properly complement them
6 Benefits in project management
We should describe precisely the benefits for project resulting from the taken measures
7 To dos and next steps
Here we shall list what accompanying actions are necessary to proceed with the actions and measures taken by the conflicting parties
The exact control dates for results evaluation shall be set

Results
- Plan of the conflict management
- Agreed project management processes

00:52 Planning Phase

Tasks
- Assure, that team members understand and accept fully project processes, plans and schedules
- Carry out a training concerning conflict solution
- Observe sources and indices of potential conflicts
- Attempt to solve the appearing conflicts as soon as possible
- Introduce changes (with reference to a product and a process) in order to avoid similar future conflicts
- Take other conflict prevention measures, beside those, which lead to changes

Results
- Accepted by all team members project processes, plans and schedules
- Team members prepared to handle and prevent conflicts
- Change requests resulting from conflict solutions
- Lessons learned input to Knowledge Management

00:53 Implementation Phase

Tasks
- Same as in the planning phase
- Care about the shift in sources of possible conflicts

Results
- Same as in the planning phase

00:54 Closing and Evaluation Phase

Tasks
- Same as in the realization phase
- Care about the shift in sources of possible conflicts
- Conduct the project closing review on passed conflicts

Results
- Same as in the realization phase
- Total evaluation of the conflict management process results in project
- General conclusions passed to Knowledge Management.
- Positive feelings of all team members with regard to the successfully managed conflicts in team

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Quick Look

What Is It?

All scientific recognitions, all practical experiences point out, that communication is the most important process and communication capabilities in team as decisive for project success. Here we take care about it.

Who Does It?

Communication is a task of project manager. But he may at least partially delegate this to a gifted team member.

Why Is It Important?

One of main reasons of project failures is inadequate communication. Best specialists rely on inputs from other team members; customer may be soothed with a right explanation of delays, majority of conflicts, deteriorating team performance, may be avoided with sufficient communication.

What Are the Helps?

Verify and close pending process improvements and tasks. Verify communication in team and take suitable action: network adaptation or team member training. Take charge in special cases. After verifying all roles check if Change Request or Knowledge Management shall be addressed.

What Is the Work?

You have various personalities in team and among the sponsors. You have various types of perception and habits. It is a challenge firstly in cooperation with HRM to stimulate the right approach of each team member towards communication, than in collaboration with OM to continuously trace and adjust communication network. Difficult communication cases land with you here – they may take a considerable amount of time.

How Do I Ensure That I Have Done It Right?

Take time to analize the personalities and perception types in your team. Pay some attention to project stake holders. Care about continuous adjustment of communication network to informal roles in team. Work with OM to elabortate most

effective formal organisation. Team members are not trained in communication – identify the deficits and work together to close the gaps. Take charge of difficult communication issues – you may be the best one to solve them.

Process

As in majority of processes first the outstanding issues are to be treated before the team communication may be evaluated. If needed, communication network changes, trainings are to be initiated. Special communication situations are handled in this process. Finally also here change requests and knowledge content are to be passed appropriately. Process may be triggered by Change, Problem or Integration processes Fig. 17.1.

02:10 The Goal of Communication Management

The goal of Communication Management is to assure effective and efficient information flow within internal and external structures of a project with the sole goal of supporting the successful project realization. It comprises both the plain information flow as well as marketing.

02:20 Methods

One of the characteristics of a project is that a project team is created for the time of project's realization. Usually the members of a team do not know one another and have no working communication patterns. Same time project manager in large complex projects spends 88 % of his time on communicating (Holt 2008, p. 1).

Pinto and Slevin consider communication as a key element in transferring project strategy to tactics and successful implementation of the last (Pinto and Slevin 1988). The evaluation of IT financial projects of Bull in UK pointed breakdown in communication as a source of 57 % of project failures (IT-Cortex 2011). According to Skaik communication is a source of 75 % of failures in construction industry in Gulf states (Skaik 2010). Salleh examined and interviewed project partners in construction project in Brunei to find out, that communication was the main cause of failures (Salleh 2009, page 111). Anderson sees communication as one of the three top reasons (Anderson 2010). According to Thamhain (2004) communication is the main driver behind team performance.

We conclude that communication in project management is the key success factor.
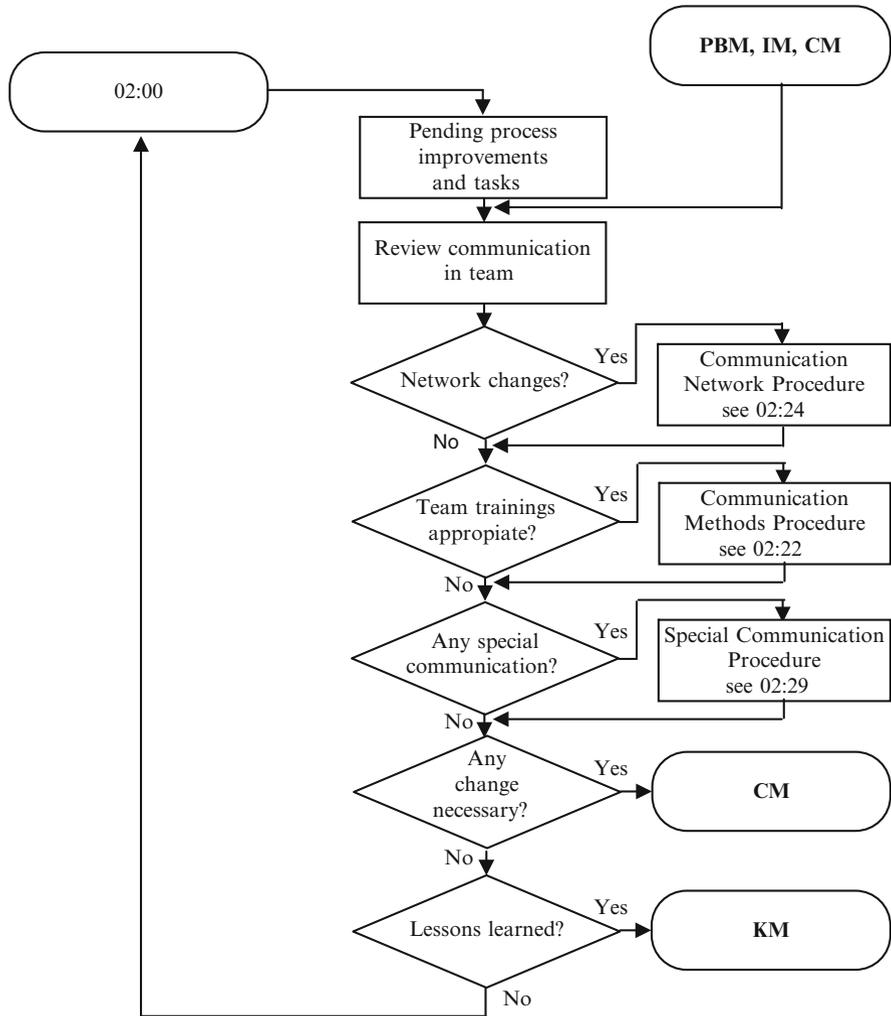
Fig. 17.1 Communication process (COM)

Communication in ISO 21500:2012

ISO 21500:2012 (ISO 21500:2012 2012) which rather reluctantly includes the human factor into the standard processes devotes three major processes to the communication only:

4.3.38. Plan Communication

4.3.39. Distribute Information

4.3.40. Manage Communication

The first of them, process 4.3.38 Plan communication is subsequent to budget and schedule development processes. So far it corresponds with the cybernetic

approach of L-Timer presented here. However, as in the cybernetic operation the feedbacks and loops are part of the concept, so in the ISO standard the recurrence is admitted but not directly stipulated. This has a significant consequence on the correctness of budgeting and planning. Communication induced significant efforts and if not budgeted and planned already on the start, handicaps significantly the project success perspectives.

Similar criticism may be express to the next, 4.3.39. Distribute Information process. It follows the Select supplier and Manage stakeholder processes in the Implementation group, whereas the needs at least of the last in the initiation and during the planning remain void.

Lastly also the process 4.3.40 Manage Communication is bound in a control processes group in loop with control project work and control changes. The relevant contribution of the communication to goal alignment and motivation of the team is in the description considered, but in the operations apparently neglected.

The 02:00 Communication Management: COM process presented hereafter binds in a system all phases of the project, starting with the Initiation Phase through Planning, Implementation up to the Closing & Evaluation Phase, covers all the issues considered in the ISO 21500:2012 standard and goes beyond addressing the issues, experienced by the author of this book in his daily practice.

02:21 Project Team Communication Model

Communication in project focuses on communication between two persons. Therefore it is called interpersonal or dyadic. In a team more or less everybody communicate with everybody – so we have ([N x (N – 1)]/2) combinations of inter-personal dyadic relations. Public broadcasting is not considered as a primarily objective of communication in a team and therefore is not considered in this book. In project with wider social impact where such a communication need may arise, reader is recommended to turn to the broadcasting literature.

Also the intrapersonal communication is beyond the scope of this book – the reflexive part of it is treated in Chap. 18, 04:00 Self-Management (Work & life Balance: SM).

We recognize the role of phatic (small talk) communication in team forming stage and stakeholders first encounters, yet we exclude this from further considerations as we exclude the intimate communication, too.

We view the communication as a process between sender and receiver (see Fig. 17.2).

The original unidirectional (called also linear) model of Shannon and Weaver (Shannon and Weaver 1949) used ambiguously in interpersonal as well as in telecommunication industry, has been refined in 1954 with bidirectional communication by Osgood, leading to the so called transactional model, where both parties are simultaneously sender and receiver (Osgood 1954). Same year Schramm positioned this model on the experience background of sender/receiver (Schramm 1954). Berlo in 1960 defined the communication channel (medium) attributes related to human senses (visual, auditory, kinesthetic, olfactory, and gustatory
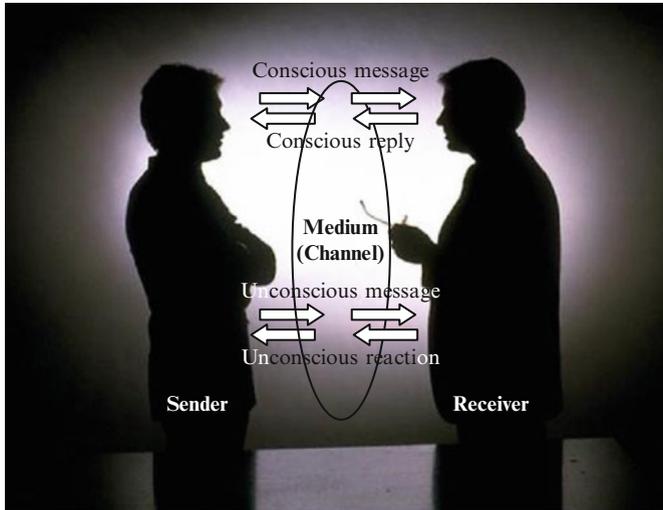
Fig. 17.2 Project team communication model

(Berlo 1960). Verma (Verma 1996) defines the sources in Schramm experience as perceptual differences in words, culture, judgments, values, emotions and personalities. Some authors differentiate between intellect and emotions (Jenny 2001), what in authors opinion diminish the role of judgments and values, others verbal and nonverbal communication (Mehrabian 1972, 2009), which although indisputably relevant, again does not truly reflects the interpersonal dyadic transactional communication.

Author of this book prefer to differentiate between the conscious and unconscious communication following Hymnes (1964). The Sender with the experience background sourced according to Verma send conscious verbal and nonverbal messages, which Receiver in turn perceives with his Verma experience field. Both sides integrate coder (Sender) and decoder (Receiver) and use consciously medium, over which a communication channel is created.

Simultaneously with conscious start of message exchange, both sides begin the uncontrolled unconscious communication: both in verbal part (e.g. addressing senses like auditory sense when unaware one rises his pitch tone) and in nonverbal part (gestures, olfactory effects).

The medium and channel subject to noise disturbances – conscious and unconscious messages may reach distorted the receiver (Is it not often, that our partner get it wrong way, despite our intensions, and prepared speech?)

The second authors' preference is notion of message exchange between the sender and recipient rather than information flow. Information is a chain of characters vastly context free (Chap. 11, 16:00 Knowledge Management: KM, section "16:21 What is Knowledge"). Several such chains may be needed to build a reasonable content to the receiver.

Communication occurs in chunks – each of them containing the information which is encapsulated in some initial and closing signals and which combines both the consciously as well as unconsciously send messages.

We summarize the project team communication model as follows:

1. Sender
   • Initiates the process of communication
   • Chooses the medium and prepares his message for the recipient
   • Send consciously and unconsciously straight and coded messages.
2. Receiver
   • Receives and decoded the messages and by confirming its perception (anyway: conscious and/or unconscious) establishes the communication channel.
   • Perceives both conscious and unconscious messages and with cognitive abilities combines them together with own experience to the received overall message.

3. Channel/Medium
   • Connection between the sender and the receiver
   • Is used both by conscious and unconscious communication
   • Subject to interference and distortions due to e.g. environment.
   • There are different means of communication such as e.g.: spoken or written language
   • Has different human sense related attributes, such as visual, auditory, kinesthetic, olfactory, and gustatory

4. Message
   • The quality of the incoming information depends on different factors, such as e.g.: the exactness of transfer or the level of interference in the channel
   • Medium chosen for messaging has an impact on the message perception (precise language, clear handwriting, unambiguous utterances etc.)
   • The received overall message is the cognitive combination of:
   • Consciously send message
   • Unconsciously send message
   • Experience of the Receiver.

5. Reaction
   • Reaction has conscious reply and unconscious reaction
   • There is a possibility that the message will be properly passed but interpreted in a wrong way,
   • The reaction of the recipient shows the sender whether the message was delivered, in which form and how it was interpreted,
   • The receiver informs the sender, how his/her behaviour is perceived, understood and interpreted,
   • Feedback reflects the thoughts and feelings of the receiver.

02:22 Dynamic Model of Transaction Analysis

Our way of communicating is biased by the Schramm experience with differentiating sources of Verma like personality, values, judgment. Eric Berne conceived an integrating theory, which combined the behavioral analysis with psychological way of thinking, named Transactional Analysis (TA) (Berne 1961, 2001). TA bases on the concept of "Ego"("I") of human personality, which combines emotions, judgements and behavior and offers comprehensive method to evaluate the interactions between the people.

"Ego" according to TA may be in one of the three following states:

- Child (Ego): Behavior is driven by the memorization of internal events like emotions and feelings, linked to external experience, up to the edge of about five. Subsequently the child may be obedient or protesting, free of adaptive. Child calls e.g. for help because is hurt.
- Parent (Ego): Collected experience from external events pushes someone to judge the events and persons and behave along the experiences and learned rules. Parent tends to be either sceptical (compares all to standards, rules, knows always better way, e.g. keep knife in the right hand, fork in the left) or very solicitous (taking care even where it is not any more necessary, like some mothers, who still do household of their 50-plus children). Parent does not reflect, that someone may be left-handed or that children might be better suited to live when left alone.
- Adult (Ego): More or less 1 year old child began to learn from his own experiences; an adult in child is born. Adult evaluate on one side the taught, observed experiences and on the other side the emotional feelings. In other words Adult evaluates the Parent Data and Child data and put them into the context of current situation. It is thus depicted as being between the Parent and Child Egos.

When now Sender initiates the communication, he sends a stimulus from a specific position addressing the specific position of the Receiver. Reply is a transactional response.

Simplest case is illustrated in Fig. 17.3, when an Adult (Ego) addresses another Adult (Ego) and the response is given in the same level: Adult to Adult. If one side chooses to address asymmetrically and the other side from this "Ego" responds to the sending "Ego" the situation is stable, too. Communication based on such complementary transactions can be carried on without any interrupt (Berne 1964, 1996).

The more complicated situation arises, when one or both parties choose the cross transactions (see Fig. 17.4).

Crossed transactions signal the emerging conflict – in most cases the communication brakes down.

The complexity increases, when the social level of communication differs from the psychological one. To large extend our unconscious communication is responsible for this dichotomy, but it can be also purposely conducted by one of the parties (see Fig. 17.5).
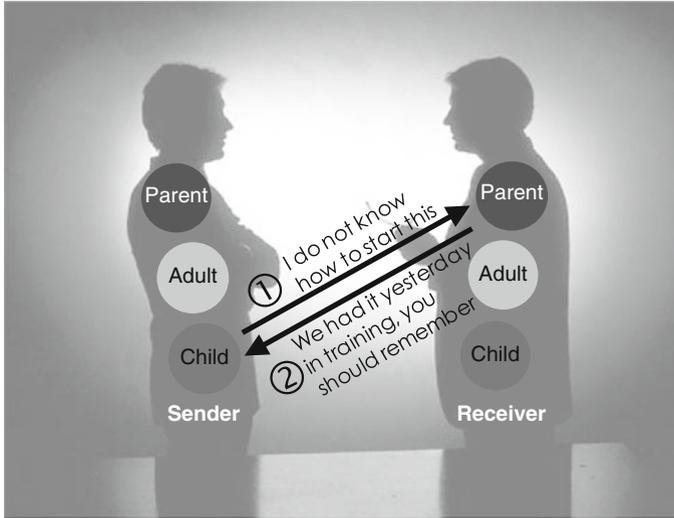
Fig. 17.3 Complementary transactions in TA
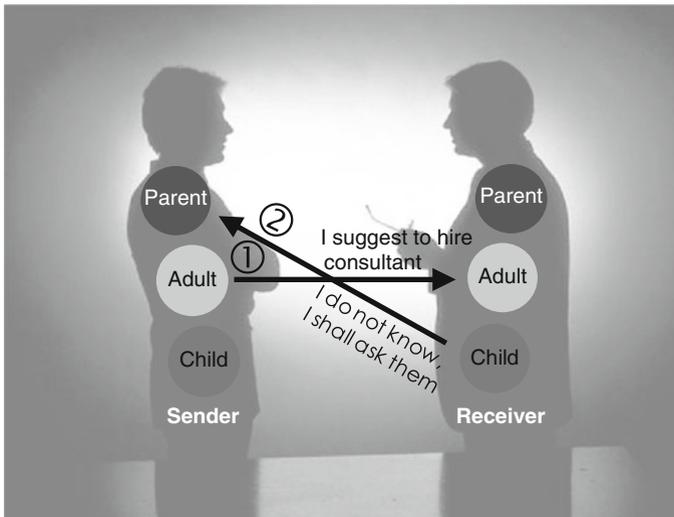
Fig. 17.4 Crossed transactions in TA

Sender, by addressing his message expresses recognition to the other side – much needed "stroke" in Berne's theory. "Stroke" may be positive or negative, but according to Berne the "recognition hunger" is necessary for adult communication (Berne 1964, 1996) and that is what is most productive in project environment.

Personal ego grams nach Jack Dusey are available from numerous resources, like e.g. http://www.psyquo.com/EN/Egogramme/Egogramme.html.
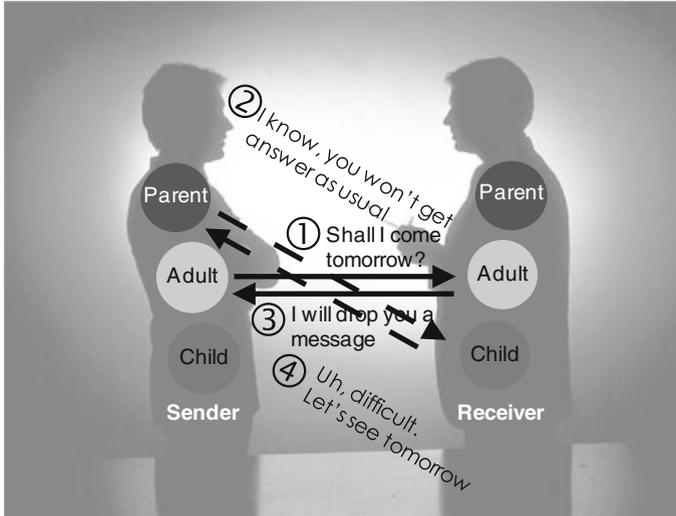
Fig. 17.5 Social (*plain*) and psychological (*dashed*) lines of transactions in TA
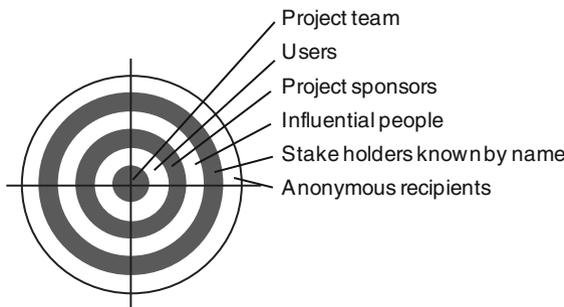
Fig. 17.6 Priorities in communication management

02:23 Sender Priorities in Communication Management

Even if Project Manager would allocate 100% to the communication (he does in fact up to 88 % – see above), he can not satisfy all needs for information and all needs of team internal and project external marketing. So he has to set the priorities.

His first priority is project team. As much information as they need to function and as much of marketing of unpopular jobs as necessary, shall be the main goal of communication in a project. (see Fig. 17.6).

The second most important group are users of project results. They influence the project sponsors opinion and may decide about the project fate by simply denying to use it's results. Only than (Priority no. 3) project sponsors shall be considered – they let themselves to get influenced by users but also by influential people from

their direct social environment. The last shall be the project manager next priority (Priority No. 4). If the needs of the above groups are satisfied, project manager may devote him to people known by name (they may have some impact on project 1 day, Priority 5) and at the end to anonymous recipient (making a web page for a project may be nice, but does not really help the project to meet it's goals).

Each of the groups and each of the cases demand dedicated, target oriented conscious method of communication and the suitable technique.

02:24 Sender Network

Best case communication in a project follows exactly the organizational structures, designed in the Organization Process. However, for the following reasons this never really happens:

- Even the best assignments of roles to carefully selected personalities can not foresee the dynamics of team development and final informal roles, which impacts the communication
- The most efficient teams pursue the free mesh of communications between team members along needs, professional competence and just personal preferences
- Customer or partner places new members in team – the whole process of team integration starts and new role assignment take place.

An example, quoted from Lundgren (Lundgren 2005/2013) shows a constellation, where after contract has been signed, green customer employees (two in raw on the left top) joined the team, which worked in two autonomous smaller teams (violet, 2 rows on the right and all in bottom line). Team members acted along their primary (bold) and secondary Belbin roles (Chap. 14, 20:00 Human Resource Management, section "20:26 Role Owner Satisfaction"). Excellent working communication is marked with heart, good with sun, broken with clouds.

Considering the above, Sender setting his the communication network shall consider the following strategies:

- The functional interrelation between sender and receiver is weak (in the example in Fig. 17.7 SL: project leader and RH: data base expert). The unidirectional linear (Shannon and Weaver) information flow with most efficient medium shall be chosen. The receiver is expected to acknowledge the message reception. No content agreement is attained. The group dynamic may be neglected. Examples are minutes of the meetings passed to superiors (here from data base designer to project leader).
- The functional interrelation is strong and relevant to project fate. Both parties have to agree on common understanding of content. The interpersonal communication has to work at its best. The Osgood-Schramm-Berlo-Verma model shall be explored to obtain the best understanding and negotiated results.
- Sender addresses larger group of team members to stipulate certain actions (marketing). Receivers do not need to agree with the sender, but their actions should conform with sender expectations. The unconscious reactions of Receiver are not relevant.
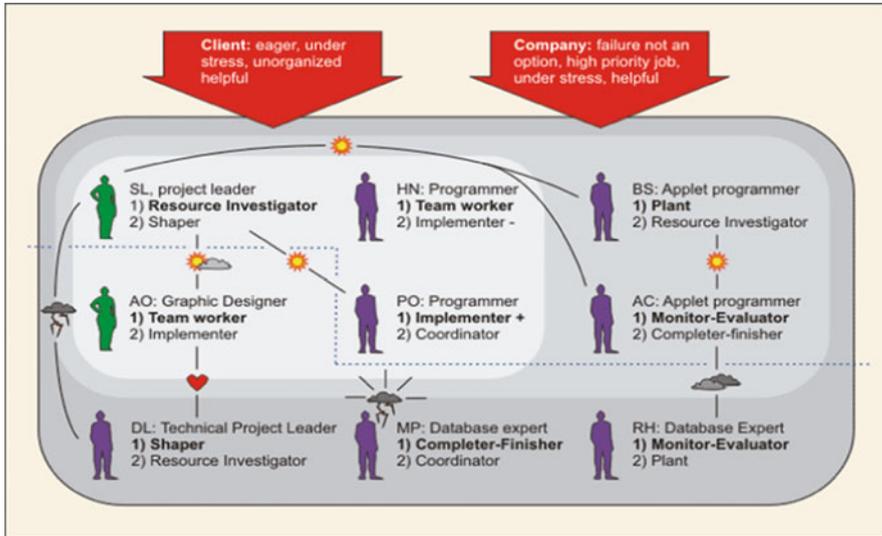
Fig. 17.7 Communication preferences in a team (Lundgren 2005)

02:25 Medium Channel Types

The attributes in Berlo model of medium channel refer to human senses. In addressing the Receiver, Sender may consciously use or unconsciously expose himself addressing one or more of the following senses:

- Visual Type (Eyesight) Visual presentation is the most efficient way. Preparing graphical presentations, work with the use of diagram, sheets, figures, models etc. we reach best perception.
- Auditive Type (Hearing) Auditive types register the heard information, reconstruct it and store it with a great ease. It is effective to present personal information in the form of personal conversation and discussion. Use music or other sounds associations to strengthen your message
- Kinesthetic Type (Feeling) It is very appealing to pass information most of all as an action. Putting an arm around kinesthetic type we most likely impel his acceptance, once we are accepted in his social – intimate sphere (see section "02:26 Medium Channel Environment, Cultural Impact").

The three above types of perception are most frequent. However, the Receiver can show the traits of further types of perception which requires a proper choice of other measures:

- Gustatory Type (tasting) Not coincidentally in many meetings sweets are on the table. In many cultures meal is the beginning of any business negotiations. We react to taste and pleasant associations promote our message.

02:26 Medium Channel Environment, Cultural Impact

Medium Channel Environment is an externalization of Sender and Receiver Cultures. The social aspects are considered in Team Culture Adjustment 22:25. An impact on communication is in:

- Context Dimension (what our message conveys). The meaning of the message is placed in personal, situational, cultural, contexts. Message may contain complete information as meant by e.g. Swiss-Germans (one extreme) or only hints to search in context as viewed by Japanese (Cardon 2008). The impact of gender determines the mutual perception of message (Bull 2002).
- Procedural Dimension(how we lead the conversation). Example from Morris and Peng (1994): Americans prefer to resolve disputes through procedures such as arbitration or adjudication in which a third party decides on the settlement. Chinese people, viewing the communication as infinite interpretation process, prefer procedures in which the two disputants reach the settlement through compromise, such as mediation or bargaining.
- Socio-technical Dimension (language, used means). Behind the obvious variation in linguistic groups much stronger impact has culture on interpretation of direct and indirect communication (there are 16 evasive maneuvers to avoid saying "no" in Japanese (Yum 1988). The e.g. contextual conditioning of Japanese over context preference of western cultures direct their interest to use joysticks and virtual reality interfaces instead of roman keyboard (beside obvious character limitations) (Ess 1999).
- Spatial Dimension (how we react on physical distance between sender and receiver). Hall (1966) created based on physiological reactions proximity theory, which gained particular relevance in analyzing spatial perception in intercultural communication. The personal spaces of Hall are:

1. Intimate (pericutaneous), reserved for closed friends and intimates
2. Personal (peropersonal), where we accept selected, acquainted persons
3. Social and Consultative (extrapersonal), most comfortable for interpersonal communication and new acquaintances.
4. Public, impersonal and anonymous distant communication

The original Hall perimeters are correspondingly 1.5, 4, 12 and 25 ft. Beaulieu (2006) places this distances in relativity to the cultural group. Anglo-Saxons need the largest personal space, followed by Asians, whereas the Mediterraneans and Latinos the smallest. Not surprisingly then, that American may perceive the Latino socialization as an invasion in the personal sphere.

02:27 Receiver Transition Model

Sender has to be aware, that Receiver who is not expecting our message, passes first through transient phases before he can focus on the merit of our message.

Fig. 17.8 The four-ear-model of Schulz von Thun (1981/2001)
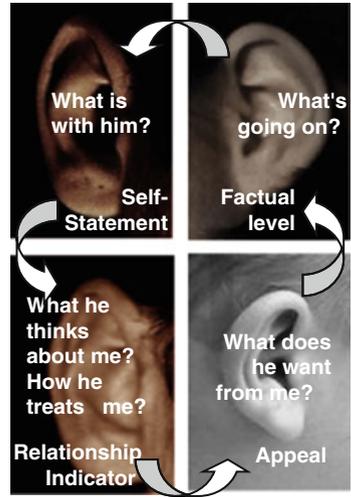
Following Schulz von Thun (1981/2001) the Receiver reacts on four levels, which once initiated, remain open for the time of communication.
- Factual level: focus on dates, facts, content
- Self-statement: hidden or direct reference to the Sender
- Relationship indicator: shows the relation between the author and recipient. It is reflected through e.g. the chosen form of utterances, intonation and other non-verbal accompanying signals.
- Appeal: through the appeal the author wants to evoke certain action performed by the recipient
The four-ear-model is shown in Fig. 17.8.

02:28 Receiver Information Distortions

If finally the message from Sender over medium and reaches the Receiver and even if the channel has been established, the perception by the Receiver may be distorted in the following ways:
- Reduction (denial)
- Misinterpretation (projection, displacement)
- Generalization (objectification)
The terms in brackets comes from Flannes and Levin (Flannes and Levin 2005)

Reduction (denial) occurs, when we deliberately or unconsciously reject e.g. a message or part of it with some unwanted news. When symptoms of rejections become perceptible, the countermeasures are necessary: message reverting, organizational changes, conflict solution.

Misinterpretation may be intentional or unconscious mainly depending on our management style. Being authoritarian we rather tend to suppose the team to share

our views without verifying that. In collaborative environment the fast and vivid feedback culture allow to keep under control this, what is called "projection" by Flannes and Levin. Other form of misinterpretation happens, when we interpret a message with some strong emotional bias caused by other not related with the message reasons. The "displaced" feelings may avert our sincerest intentions.

Generalization or Objectification is the common consequence of project manager hectic life. He tends to speed-up the process of message processing by classifying the source, or subject or Sender into his own classes, slipping may be most relevant nuances of the message.

02:29 Special Communication Procedure

Few cases may require direct communication by person in charge of this process: when more than interpersonal communication is involved e.g. broad stakeholder information about newest project problems or complicated changes in planned integration. The particular and presumably needed advanced method and techniques of communication beyond those presented in this book may be limited to one or few persons involved, allowing team to concentrate on merits.

02:30 Techniques and Tools

The techniques presented below are applicable both for the exchange of exact information as well as marketing purposes and are considered sufficient to manage the project.

The particular psychological and sociological techniques of marketing grip are unsuitable in team, where confidence and trust shall prevail. Therefore, they are not considered here.

02:31 Sender MBTI-Oriented Communication

In communication team members have to deal with each other personality differences. Table 17.1 gives an overview of suggested methods and techniques in dealing with specific types of MBTI dimensions (Chap. 14, 20:00 Human Resource Management: HRM, section "20:23 Recruitment and Evaluation") according to Flannes and Levin (Flannes and Levin 2005). The detailed description may be found in this source.

02:32 Visualization Techniques

Visualization is the visuospatial presentation of information targeted for processing by the visual sensor system (Scheiter et al. 2009). Visualization is parismonial as

Table 17.1 Communication recommended towards MBTI dimensions extremes acc. to Flannes and Levin (Flannes and Levin 2005)

Dimension's extreme	Recommended type of communication
Extraversion	Get together personally to think out loud
Introversion	Help draw out this person, and then give them some time to privately reflect on your message
Sensing	Present tangible facts, examples, data, and real-world experiences to make the point
Intuition	Offer a "big picture" overview, presenting concepts that are crucial for your discussion
Thinking	Present arguments that appeal to a rational analysis of the facts; appeal to the "head"
Feeling	Talk more from the "heart", using statements that address values and gut-level decision making
Judging	Be orderly in presenting your message, and keep the discussion moving towards resolution and closure
Perceiving	Allow for an open-ended discussion, staying flexible about the agenda

the spacial characteristics are included in picture (the famous and yet anonymous statement that "a picture may be sometimes worth 10,000 words"), expresses more information with less symbols, is more specific and less arbitrary, in conclusion, convey more efficiently and effectively the information (Scheiter et al. 2009; Gilbert 2005). Bagett in his bushiness hypothesis (Baggett 1984) arguments that the knowledge acquired from visual representations is better accessible in human memory as the brain nodes share more associations with other nodes in semantic network. These thesis supports Scheiter, Wiebe and Holsanova (Scheiter et al. 2009) stating that the visual information are processed in parallel, therefore accelerate the cognition process.

Successful Visualization:
1. **Choose purpose of the visualization:**
   Decorative, Affect, Replace and augment the real world, structure, represent, interpret or transform (different presentation of otherwise stated thesis)
   Scheiter, Wiebe and Holsanova (Scheiter et al. 2009)
2. **Choose structure:**
   Overview first, zoom and filter, then details on demand (Schneiderman 1996)
3. **Bear Receiver perception capability in mind:**
   3–4 Elements may be simultaneously kept in human short term memory (Farrington 2011)
4. **Choose means supporting your purpose:**
   Use real photos if associations are searched, use models to stipulate the imagination, use graphics, charts to illustrate the structure.   *(continued)*

5. **Consider the eye perception capability of the Receiver:**
   Design your visual presentation differently for the self-study (30–50 cm distance from a 20 in. 1728 × 2050 pixel screen) and for 500 audience lecture (20 m distance to 5 m diameter screen).
6. **Define the semantics of your visualization:**
   Develop and consequently apply the logic in the visualisation: green for remarks, red for conclusions, new chapters in headlines, etc.

For the last 55 years the learning pyramid attributed to National Training Laboratories, Bethel, Maine yet untraceable there (Magennis and Farrell 2005) placed visual message as superior to verbal (done with the help of words). Several derivates like e.g. that of Grimm (Grimm 2003) suggests higher retention rate of visual versus verbal communication. These intuitively expected results have not found confirmation in scientific researches. Visual senses demands higher cognitive capabilities to associate the meaning by engaging various brain areas (Scheiter et al. 2009). Kreger Silverman (Silverman 2002) suggests, that the thinking habits in population are distributed roughly as shown in Fig. 17.9 (both extremes visual/spacial and sequential(word) 25–30 %, rest – both ambivalent). We have visualizer-verbalizer dimensions of cognitive style, each of them performing better in specific tasks Scheiter et al. (Scheiter et al. 2009). Vessey formulated a hypothesis, that both capabilities are relevant and mutually complementary in problem solving performance (Vessey 1991).

We may conclude that although visualization is an important and in many cases helpful communication technique, the verbalization is not less relevant and both shall be mastered in efficient project management.

02:33 Verbalization Techniques

The efficiency of the verbalization may be attributed to two reasons, based on conclusion from Scheiter et al. (Scheiter et al. 2009):

- Word becomes meaning through conventional or cultural heritage, thus are considered in context of the environment and medium/channel impact by the Receiver, generating more information than purely transmitted verbalized thoughts. Yet, it demands higher capability of association in memory.
- Cognitive brain processes are simpler, as the words address directly the meanings associated with them as opposed to visual accentuations, where first the interpretation of the picture has to be involved.

In project communication verbalization allows for goal oriented optimization. In highly context sensitive information, e.g. in Knowledge Management, Change Management we may use abbreviations, references to some project occurrences, whereas in Documentation Management, Integration Management another broader context demands precise full descriptions.

Fig. 17.9 The cognitive style distribution in population acc. to Silverman (Silverman 2002)

Verbalization distinguishes:
- Written Communication (letters, emails, rapports, sms, chats). The expressiveness is limited due to missing voice impact (intonation, colour etc.)
- Oral (Spoken) Communication, spoken words, which allow for more expressiveness and easier mood transmission.

Written Contribution Metaplan
Written form is suited to activate passive team members (Grimm 2003). In e.g. Metaplan (Chap. 2, 07:00 Planning & Scheduling: P & S, section "07:32 Techniques of structuring"; Chap. 14, 20:00 Human Resource Management: HRM, section "20:32 Complete Demanded Profile Definition") an introvert, shy team member can express himself and possibly contribute significant solution in a project.

Oral (Spoken) communication is treated more in detail in the following chapters.

02:34 Oral (Spoken) Communication: Controlled Dialog

Dialog (Hellriegel and Slocum 2007) is a process whereby people suspend their defensiveness to enable a free flow of exploration in their own and others' assumptions and beliefs. Dialog includes:
- Asking questions to learn
- Seeking shared meaning
- Integrating multiple personal perspectives
- Uncovering and examining assumptions.

Assertive Expresson of Own Opinions
The assertive, confident expression of one owns views with simultaneous acceptance of different views of the others create trustful, common ground for mutual interpersonal relationship in a project.

Controlled Dialog
Controlled dialog (Pabst-Weinschenk 2004) is a technique, where Receiver first concludes what and how he understood the message of the Sender, before he continues with the subject.

Controlled Dialog allows for concentration on subject and reduction of personal remarks. It is very useful, when linguistic or cultural background differences

impose varying interpretation on messages and when personal or project related misunderstandings occur.

Constructive Dispute

None of the sides to make a looser is a cornerstone of successful controlled dialog. Therefore, it is a suitable technique to apply during the constructive disputes (Chap. 16, 00:00 Conflict Management: CFM, section "00:34 Constructive Dispute").

02:35 Oral (Spoken) Communication: Negotiations

We treated negotiations as a technique of successful conflict solution (Chap. 16, 00:00 Conflict Management: CFM, section "00:35 Negotiations"). From the point of view of communication it is an interactive process, which takes place between two or more interlocutors, whenever one want something from someone else and this person does not intended to give it unconditionally (Sethi and Adhikari 2010). By limiting the number of negotiated topics, we contribute to the successful goal reaching. Negotiations to certain degree can be pursued also in a written form. All other communication techniques may be applied simultaneously.

02:36 Oral (Spoken) Communication: Moderation

Project team has frequently to solve problems and various issues by discussing them. An efficient discussion determines directly the outcome and the atmosphere in a team. Therefore is this technique more profoundly presented here.

Moderation is guided by a third person communication of a systematic, structured and open procedure to prepare, manage and follow-up the communication process, decision taking, and problem solving in a way allowing for general acceptance and a project result with proper quality (Edmüller and Wilhelm 2009). It can be achieved when the moderator leads the discussion in accordance to the set meeting goal. However, the moderator should avoid to recommend any solutions; he enables the group to develop their ideas, to use financial assets, to support the brainstorming as well as common education. Moderator can use different techniques (Grimm 2003) which we quote here with our fullest support:

- Visualization (with the use of boards, diagrams),
- The technique of formulating and asking questions,
- The rule of 30 s (none of the participants speaks for longer than 30 s in order to avoid monologues which do not keep to the point of discussion),
- Fast reflection (each participant of the meeting provides a short assessment of the situation); the technique can be used e.g. at the end of discussion, in order to get reflection concerning the meeting.
  Moderator by using his own experience can guide the discussion with:
- Asking instead of saying,

Table 17.2 Moderator's duties during a meeting

Stage of a meeting	Moderator's tasks
Preparation of a meeting	Setting the goals of a meeting
	Setting the time structure necessary to achieve the set goal
	Coordination of goals and the plan of time
Meeting's commencement (initiation)	Getting to know one another and 'ice-breaking'
	Introduction of the subject, recapitulation of the goals of time plan, optionally, common preparation of the goals
	Setting the rules applicable during the meeting (see Chap. 16, 00.00 Conflict Management)
	Encouraging to take part in the discussion (presentation of a problem and analysis of a situation)
Directing discussion during the meeting	Leading conversation and giving the floor
	Sticking to the rules of the game, impartiality
	Listening to the discussion
	In case of controversial opinion, aiming to solve the conflict
	Speaking loudly about issues which have not been referred to for different reasons
	Discussing particular subjects one more time
	Constant summary of the discussion to enable quiet but tentative people to participate in the conversation
	Verbal emphasis of vital elements
	Moderation of examining potential causes of problems
	Explaining the meaning to the participants
	Moderation of acquiring possible undertakings or manners of conduct
	Moderation of evaluation of possible solutions
	Acquiring possible impact on the existing goals
Closing the meeting	Fast project's reflection
	Other forms of conduct
	Optionally, calming down the anxious minds and emotions
Preparing materials from the meeting	Preparing a matter-of-fact and prompt materials concerning the end of the meeting
	Assessment of one's own work: what was successful in the process of moderation? What was wrong?

- Moderation used in accordance with the group character, with flexibility and with reference to a particular situation,
- Directing the discussions, however allowing the group to assign the course of action,
- Taking into consideration non-verbal signals.

Table 17.2 summarizes tasks which have to be realized by the moderator during a meeting. The table clearly indicates that a moderator does not present any material issues but focuses on the process of work.

Very often we deal during a project with contra productive postures. Table 17.3 provides a view of the possible attitudes of the moderator or project manager.

Table 17.3 Tips of conduct with troublesome partners of a discussion

Quarrelsome team member	We should listen carefully and react accurately. We should not loose our temper when we have to answer provocative questions. Such questions should directed to a group or ignored
Team member with never-ending questions	A sly boost who wants to catch the moderator red handed when he/she does not know the answer. Do not loose your temper. Direct the question to the group for examination
Team member with 'No'attitude	We can get their help in case of their recognition and using their knowledge and experience
Knowing-all team member	We should aim at integrating the team member with the group by offering him/her some position
Shy team member	Directly request his/her opinion
Callous team member	Does not show any interest. We can try to contact him/her personally posing questions in accordance with his/her interests and the scope of professional duties
Haughty team member	Very sensitive to criticism. By no means we should pay attention to the rule of reaction
Talkative team member	Interrupt the speech for the purpose of the course of discussion and the goals (the rule of 30 s!). Apply short summary in order for the others not to loose the thread
Placid team member	It is worth to accept. We should request such team member directly, using short summary and asking for further opinion. This way we can check and use the strong points of conversation participants
Competitors	We should mediate between them. Basically a good method is to settle opposite points of view. We should mediate between them. Basically a good method is to settle openly the opposite points of view. However, we should simultaneously pay attention to the timetable and atmosphere within the group. It is advisable to include other members in the discussion in order to get other opinion. Usually it is also helpful for relaxation

02:37 Non-Verbal (Body Language) Communication

It became a common wisdom, what Schachner, Shaver and Mikulincer formulated, that non-verbal communication plays a vital role in the process of passing information (Schachner et al. 2005). However, both Birdwhistell (Crocett 2007; Milszus and Rohwedder 2003) as well as Mehrabian (Mehrabian 1972/2009) evaluated the spoken and non-spoken parts of communication:

1. Birdwhistell:
   - 35 % of the message in conversations is conveyed by the spoken word
   - 65 % "non-verbally"

2. Mehrabian:
   - 7 % of the message in conversations is conveyed by the spoken word
   - 38 % from paralinguistic channels, that is, tone of voice, loudness, and other aspects of how things are said
   - 55 % from facial expressions

Fig. 17.10 Open for our message and closed personalities

So correctly we shall talk about non-spoken, non-oral part of communication. But as conventional wisdom better understand this as "non-verbal" or "body language" communication we adopt this term to describe the major part of information conveyed by unspoken part of message. Both may be used consciously or elude to our unconscious behavior.

The non-verbal communication goes beyond the facial expressions and paralinguistic channels covering most of the traits referring to body and language, such as:

- Face expressions (we register within 1/15 s)
- Eye contact (shows interest in communication)
- Gesture (shows feelings, personal organization)
- Posture, body movement, body distance (relation)
- Appearance (shows value system)
- Type of voice (thimble, tone, loudness, tempo, rhythm and dialect, shows demographics).

Figure 17.10 shows same person in two positions: the left one – easy going – is open to accept our message, the right one – with crossed legs and arms – will most likely deny any acceptance of what we try to say.

02:38 Active Listening

Active listening allows both the Sender and Receiver to verify if the message send by Receiver in conscious and unconscious part, verbal and non-verbal, reached the Receiver exactly along the intentions of the Sender. Here the formal content of the message and the emotional side: conscious, unconscious, verbal and non-verbal are jointly perceived. Emotions and senses accompany the intended message.

To reach this both Sender and Receiver shall fully concentrate on the conversation, show mutual respect, attention and willingness to accept the position and reasoning of the counterpart. Active listening is the epitome of looking at world for

a short time period through the eyes of the interlocutor. We cannot present arguments against a certain point of view without understanding it. Therefore, it is vital to make an effort to listen actively (Schulz von Thun et al. 1981/2001; Cadle and Yeates 2008; Schachner et al. 2005).

Receiver confirms to the Sender how the message has reached him and what impression left. This way any misunderstanding may be cleared instantly and the conversation may focus on merits.

The feedback techniques used in active listening are presented in the following chapter.

02:39 Feedback

Feedback comes from design of automata, where output signals are looped back for control purposes. The history starts well before Christ, but we can not determine when first feedback loop has been deployed. Also unrecorded is first use of feedback in interpersonal communication, subject of this chapter. Barbour attributes this to Norbert Weiner and El-wood Murray around 1950 (Barbour 2003).

Feedback in the sense pursued further here is a conscious reaction on one's activity and conveys the intellectual and emotional message.

The perception of the emotional part of message depends on the current interrelation between Sender and Receiver. Positive feedback may target positive development of the current communication, in which both interlocutors are engaged, or changes (corrective feedback). To be constructive feedback shall be (Hellriegel and Slocum 2007; Barbour 2003):

- Rather specific than general
- Rather descriptive than evaluating
- Effective if needs of both Sender and Receiver are taken under considerations
- Given at a time, when Receiver appears to be ready to accept it (solicitation better than imposition)
- Concerns not all possible differences, but singular items, about which Receiver can do something instantly
- Is verified with Receiver if perceived as intended by Sender
- Build on trust and ethical (according to Sender internal Value System) approach

The self-esteem and self-protection of Feedback Receiver triggers several defense mechanisms (blockers), which may be triggered by the behavior of the Feedback giving person: Evaluating, attempt to control, implied superiority, certainty, hidden strategy, detachment (Barbour 2003). The chances, that feedback will be accepted by the Receiver increase substantially, when Sender uses the "I" form. It stresses the personal relation of Sender to the subject and personal perspective. One tends rather to do someone a favour than contribute for an anonymous society. In case of feedback blocker a simple "Have I missed something?" allow the interlocutor to share his fears. The basic techniques of feedback are given in the following sections.

Paraphrase

Praphrase (greek Para = close to, nearby, phraseïn = to speak, to talk) is a restatement of understood meaning of the received verbal message in another form, in most cases in own words.

Paraphrase serves the clarification and does contain neither interpretation nor conclusion of the Receiver. It is helpful, when we are uncertain, if the message is correctly understood, want to underline some items or focus the conversation.

Typical Paraphrases begin with:

- If I well understand you...
- Did you said, that....

Mirroring (Verifying own Perception)

In mirroring (Jarmakowski 2008) we subsume all conscious and unconscious messages received from the Sender and describe to him, how do we perceive his emotions and feelings. It is useful, when we have the feeling, that Sender is unaware that our perception of the unconsciously transmitted emotions and feelings deviate form his consciously expressed intentions. By mirroring we signal to the Sender, that his emotions are important to us.

Typical Mirroring begins with:

- Seems you are happy with that...
- Am I right, that you it is not your day today....

Verbalization of Emotions and Feelings

We verbalize the Receiver emotions when the problem is rather on Receiver emotional side. Verbalization as feedback allows to verify emotions of both Sender and Receiver (Diagonescu 2010). It contributes effectively to the recovery from emotions and return to the feedback ground principles (Zech et al. 2004).

Typical Verbalization of emotions begins with:

- I like this solution and don't understand why you do not...

02:40 Templates

02:41 Project Documents

The efficient communication depends on successful identification of Sender and Receiver most relevant to the analyzed person. In the example below the relationships of Project Manager (Level 0) to his direct Superior (Level +1 according to the project organization set in 08:00) and to his direct subordinates (Level −1) are thoroughly analyzed. All MBTI and Belbin primary and secondary roles are analyzed and the feasibility of cooperation between the Project Manager and the role owner is evaluated in column "Coo?". Preferred medium type (phone, mail, meeting) are extended with preferred time of interaction. Preferred phrases follows the MBTI/Belbin Types identification, Particularities in communication are noted in column "Special" Table 17.4.

Table 17.4 Example

					Date	
Communication network assessment					Project phase	
Level	Role	Owner name	MBTI	Belbin	Preferred medium	Preferred phrases		Specials
			Type	Coo?	Type	Coo?	Type	Time		
+1	Direct Superior						
0	Project Manager						
−1	Subordinate 1						
−1	Subordinate 2						
−1	Subordinate						

Table 17.5 Example

Communication concept
0. General information
1. Aim of the document
2. Communication approach vision and mission
3. Communication target receivers
4. Receiver
4.1. Responsible sender
4.2. Communication media, channel, receiver environment
4.3. Message content demanded
4.4. Time schedule
4.5. Budget
4.6. Control unit

02:42 Documentation of the Project Results

The resources in project are limited. The optimal allocation of financial and personal resources calls for conceptual approach. Possible result may be elaborated in the Table 17.5:

02:50 Activities and Deliverables of Particular Project Phases

02:51 Initiation Phase

Tasks
- Identification and optimization of communication in Core Team
- Communication trainings of core team

Results
- Core team trained in communication methods and techniques
- Preliminary Communication Channels in Core Team Set

02:52 Planning Phase

Tasks
- Evaluation and adjustment of all team members communication preferences along the project organization relations
- Elaboration of the communication concept
- Communication trainings suggestions to HRM
- Fulfillment of the communication needs according to the concept
- Setting up of the communication performance surveillance
- Evaluation and first conclusions of the project communication performance

Results
- Communication concept elaborated and verified
- Team organization optimized for best communication
- Team trained in communication method and techniques
- Communication surveillance operational

02:53 Implementation Phase

Tasks
- Communication in accordance to the concept
- Evaluation of the communication efficiency
- Evaluation of the communication performance
- Carrying out trainings in order to eliminate the weak points of communication
- Elaboration of organizational adjustment change requests
- Communication concept review and adaptation

Results
- All Recipient satisfied with project communication
- Actualized communication concept
- Team communication optimized
- Team members deficiencies in communication eliminated
- Communication evaluation conclusions available

02:54 Closing and Evaluation Phase

Tasks
- Communication focus on users, sponsors and relevant stakeholders optimized
- Communication performed best feasible way

- Closing evaluation of the communication efficiency
- Closing evaluation of the communication performance

Results
- The expectations of users, sponsors and relevant
- Stakeholders fully met
- Evaluation of the Communication in Project closedCommunication focus on users, sponsors and relevant stakeholders optimized

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04:00 Self Management (Work & Life Balance): SM

18

Quick Look

What Is It?

Project Manager has his own material and immaterial (cognitive and spiritual) resources. Their balanced deployment decides about the efficiency of his own actions and is conditioned by his intrinsic motivation, values and goals. Proper management impacts his and others actions.

Who Does It?

Project manager himself has to take care about his own process, as it tangles his personal inner values and motivation, crucial to the overall efficiency of his actions.

Why Is It Important?

Project manager stays in focus of stakeholders and team's attention. His values are scrutinized and decide about his actions. His motivation impacts his effectiveness and is infectious to his team. His balanced spiritual and intellectual personality as well as properly assigned deployment of material resources lends compulsory credibility to his decisions.

What Are the Steps?

Verify and close pending process improvements and tasks. Periodically or upon demand (from CM) review and adjust your values and goals. This along other factors may impact your intrinsic motivation: build it up. Evaluate your strengths/weaknesses, life attitude, emotional and cognitive perception and take corrective actions if needed. Verify your time management, stress conditions, physical abilities to do the job. Adjust where necessary. After verifying all roles check if Change Request or Knowledge Management shall be addressed.

What Is the Work?

The developments of coherent personality, which act upon own values in convincing way is a challenge. Manager tends to skip self-reflection and serious personal improvements – be honest on this issue. As our values evolve over the years it is difficult to change them – so can the goals, motivation, and personal resources balance be aligned with team and stakeholder expectations?

How Do I Ensure That I Have Done It Right?
Be honest with yourself and take time for self-reflection. Align your values with those
of your team and stakeholders. Be coherent. Act upon your personal conclusions.

Process

It makes sense also here first to revert to the outstanding issues. Change request, an
occurrence or periodical trigger (e.g. L-Timer® 4:00) initiate your review of your
personal values, goals, intrinsic motivation, your personal intellectual capital and
material resources, which trigger appropriate action. If you consider it suitable –
share your conclusions with others: through CM or KM Fig. 18.1.

04:10 The Goal of Self Management (Work & Life Balance)

The goal of self management is to increase satisfaction from work and daily life
through a skilled management of one's own personality and resources taking under
considerations own weak and strong points, their usage and steering their development.

04:20 Methods

Self Management is not considered by the ISO 21500:2012 (ISO 21500:2012 2012).
In contrast, a profound impact, the personality has on the project fate, remain the
vastly underestimated success factor. This Chapter is dedicated to this important issue.

04:21 Personality Entities Interrelation Chain

Definition of Personality
Following Ryckman, personality is a dynamic and organized set of characteristics
possessed by a person, that uniquely influences his or her cognitions, motivations and
behaviours in various situations (Ryckman 2008). We take the parsimonious
approach and build the hypothesis about the direct impact of personality entities as
shown in Fig. 18.2. The goal-action theory of Heckhausen and Kühl (Heckhausen and
Kühl 1985) considerations place goals in the center and sees values only through their
attachment to the goals (wishes) and not as absolute, original incentives. Wishes
translated into wants and intentions are enhanced by motivation in our model. The
abilities are split in immaterial resources deployment (cognitive and spiritual abilities
and attitudes) and physical resources: aptitudes and time. Support to this approach is
given by Bandura's innovative agentic view on human social behavior: human as an
agent intentionally makes things happen by one's actions (Bandura 2001). Bandura's
agencies comprise all personality entities presented bellow.

   Each of the impacted entities feedback to the impacting entity what may lead to
changes in the impacting entity (e.g. we adapt our goals depending on our motiva-
tion build-up process). Beside that direct impact, there is also certain indirect
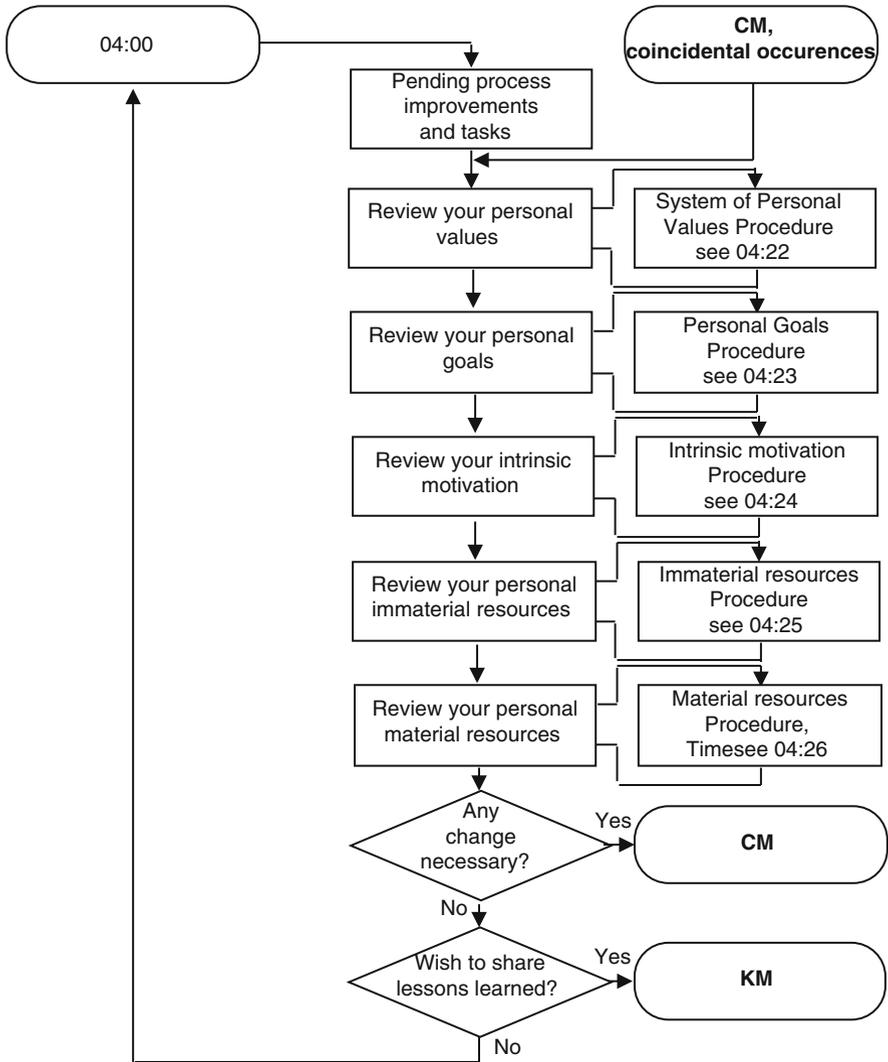
Fig. 18.1 Self-Management (Work&Life Balance) process

impact e.g. of value system on immaterial resources deployment or actions (Rokeach 1973). However, this may be included in the motivation build-up process, thus simplifying the interrelations. Author is aware about still outstanding proof of this hypothesis, yet for it's consistency it will be further evaluated in this chapter.

04:22 System of Personal Values

Personal Values

Values determine one's ethics; this if congruent with the environment, defines the moral of the individual (Chap. 14, 20:00 Human Resource Management: HRM,

Fig. 18.2 Personality
entities interrelation chain
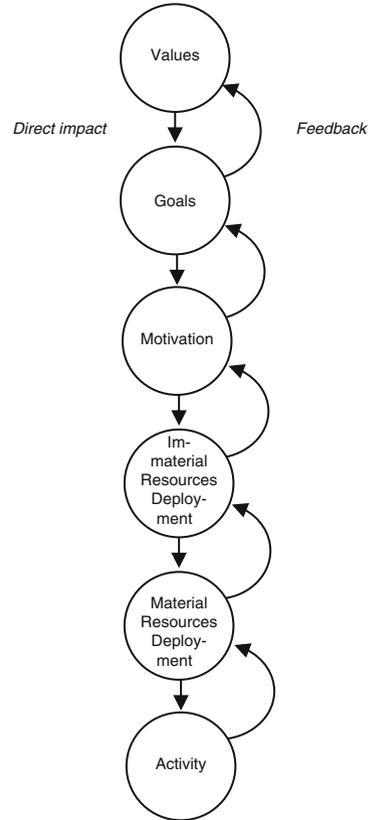
section "20:23 Recruitment and Evaluation"). A value in this book is viewed as an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence (Rokeach 1973).

Rokeach Value Survey

Rokeach Value Survey (RVS) distinguishes two types of values:

- 18+/−2 Terminal values are self-sufficient end-states of existence that a person strives to achieve (e.g. a comfortable life, wisdom). Pursued for their own sake.
- 36 Instrumental values, out of them 18 most important are modes of behavior. Examples are "ambitious (hard-working, aspiring)" or "honest (sincere, truthful)". Rokeach suggests that instrumental values help achieve terminal values.

Value System

This vast number of values calls for certain order, experimented also by Rokeach [ditto] and others (e.g. Schwartz (Schwartz 1992); Hofstede and Hofstede (Hofstede and Hofstede 2005) Rokeach defines this order as a value system, which is an

enduring organization of beliefs concerning preferable modes of conduct or end-states of existence along a continuum of relative importance.

A clearly structured personal value system helps to decide in the midst of uncertainty – an immanent feature of each project.

Integral Humanism

In choosing individual value system, the ideals of integral humanism initiated by Allport (Allport 1955) and Rogers (Rogers 1961/1995) appeal particularly relevant. Rogers prises the self-actuation: an individual acting freely, without external restrictions along his own ideals, beliefs, dreams, does his best. This attitude is the most desired in projects. Max Scheler (Scheler 1994) classified the Rokeach terminal and instrumental values into five hierarchical categories: hedonistic (lowest), utilitarian, vital, spiritual and absolute (highest). Hauser (Hauser 2004) and Batson (Batson et al. 1993) support the Allport concepts, that there is positive interrelationship between the intrinsic religiousness (absolute level of Scheler) and mental health – further positive contribution towards successful self-management.

Charta of Ethics

Most business ethics tangle level three: e.g. EU or PMI Charta of Ethics (EU 2013; PMI 2013), leaving the upper two categories to personal development of the individual. The highly diverging individual value systems calls for a fundamental reference point (Mariański 2007) allowing for team values integration, thus moral behavior of its members. Shared (common values) proves to lead to higher performance in organization, as compared to the organizations with differentiating, even better net margin (Kouzes and Posner 2008). The absolute category of Scheler (beliefs, supreme authorities) offers here an answer.

Integral humanism builds on three ethical principles, which again are beneficial in project management (Chap. 17, 02:00 Communication Management: COM, section "02:20 Methods"):

- Unconditional acceptance of second person: basic in successful team management and communication
- Unconditional and fully opened empathy
- Authenticity in Interpersonal relation

04:23 Personal Goals

Integral personality, with clear value system and elaborated set of own ethical principles, sets coherent and – in case own ethics matches the moral of the environment – widely accepted goals. Sheldon and Elliot (Sheldon and Elliot 1998) proved, that the goals, which an individual set himself are have higher predictability of being achieved as compared with inherited externally set targets. Therefore, it is relevant for the balanced personality and balanced work & life to set own well selected goals.

When the goals are well selected?

Personal Projects/Personal Goals Criteria

Few psychologists view our personality as cohesion of various personal projects (Little 2007). Thus the goals shall fulfill the same SMART criteria we apply to the project goals (Specific, Measurable, Attainable, Relevant and Time-bound, Chap. 2, 07:00 Planning & Scheduling: P & S, section "07:20 Methods"). Beyond they should be triple A:

- Ambitious – to lead your personal development
- Adaptable – the reality might demand changes
- Awarding – along a criterion chosen by the goal setting person.

Ambitious goals, according to Mone and Baker (Mone and Baker 1992), lead to higher performance, when compared with easy or do-your-best goals. Ambiguous is the adaptability of goals; on one hand they should be firm and with in certain perspective sustainable, on the other hand the particularity of projects and our personal life is a project, is the uncertainty, which may demand change of a course (when e.g. major change in private life occurs). So is the adaptability to be seen as conscious and well founded ability to adapt.

Awarding upon goal reaching is major factor contributing to the sustainable motivation. Rohweder and Milusz (Rohweder and Milusz 2003) see awarding as part of balanced happy life:

- Each day do something which makes you happy,
- Each day do something which significantly approaches you to the set goals,
- Each day do something which will counterbalance the work performed (sport, hobby, family, friends…).

The last is particularly relevant towards balanced life. The positive impact on our psychological well-being, attitude towards work and family rewards in increased performance and overall sense of harmony in life (Rantanen et al. 2011). That we shall balance our spiritual, emotional, intellectual life, based on our values, goals, personal immaterial and material resources deployment, agree meantime the psychology, business and science (e.g. Cobaugh and Schwerdtfeger 2005). The search of balance may lead us to the adverse, and not less ambitious goals in aesthetic perspective – feeling of beauty (Caproni 1997).

Ambitious goals, which mismatch own performance may lead to serious psychological problems (Ward and Eisler 1987). Therefore, good evaluation of one's own potential allows to place the goals in the right perspective.

The potential is given by strengths and opportunities, but is limited also by weaknesses and threats. With the SWOT Analysis (see section "04:31 Assessing Own Values" hereafter) we can well estimate our potential and set reasonable yet ambitious goals.

Coherence and Congruence of Goals

Sheldon and Kaiser (Sheldon and Kaiser 1995) proved that coherent and congruent goals are prospective predictors of health, well-being, vitality and engagement. They defined personal goals as coherent if they have mutual positive impact or contribute to higher level goals and as congruent, if pursued consequently by an individual.
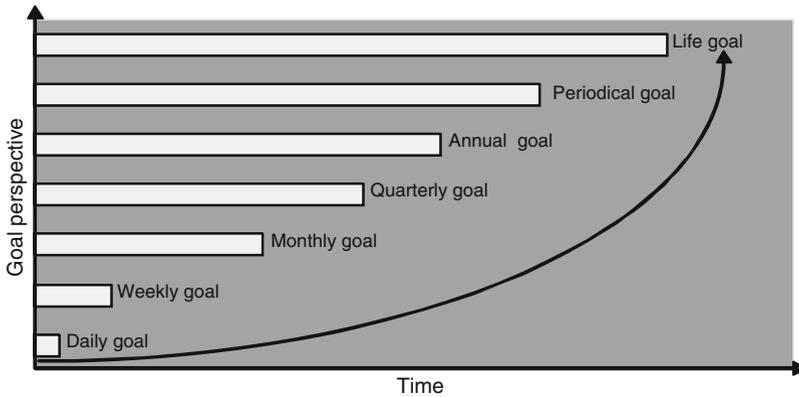
Fig. 18.3 Goal perspectives (Rohwedder and Milszus 2003)

Well Selected Intrinsic Goals

Proximal goals have higher valence, potency and thus attainability as their expectancy and instrumentality are higher (Snow and Jackson 1994). Thus well selected intrinsic goals are:

- Triple A SMART
- Set in a hierarchy of lower level goals contributing to higher level goals (e.g. attaining complex projects management some practice with simpler projects and trainings in peoples' management might be the intermediary lower level goals)
- Structured and appropriately to SWOT instrumentalized into proximal and distal goals (e.g. today's meeting success versus long term career plans, Fig. 18.3).

04:24 Intrinsic Motivation

Coherence and Congruence of Goals

Intrinsic motivation is an inner independent energy to engage in some actions with the expectation about future outcomes, rewarding to the organism. Intrinsic motivation is impacted positively by our wish to acquire competence and self-determination, thus relates to direct fulfillment of our inner needs combined theories, (Deci and Ryan 1985). The enjoyment and excitement, experienced at competent and autonomous acting are the rewards for the intrinsically motivated behavior. This brings upfront the choice theory of Glasser (1998) stating that all our behaviors are purposeful. Not necessary reasonable or appropriate as seen by others, but in one or other way rewarding to us.

Intrinsic Motivation Criteria

We build-up intrinsic motivation by evaluating our goals, attributed with our values, along the following five inner need (Erwin 2004) :

- Survival and security
- Love and belonging
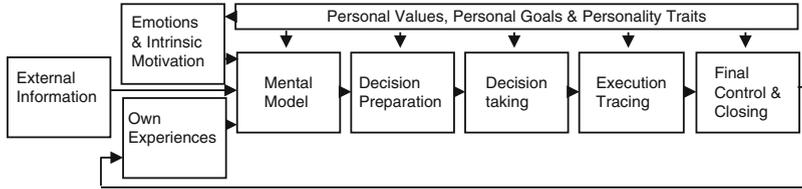
Fig. 18.4 Personal immaterial resources in decision process

- Power and purpose
- Freedom and novelty
- Fun

If we manage to align our distal and proximal goals fulfilling possibly all of the above needs with attainable results our intrinsic motivation increases.

Project managers enjoy usually higher degree of autonomy. This facilitates the self determination and positively influences the intrinsic motivation (Enzle et al. 1996).

There is widely proven extrinsic motivation impact on intrinsic one (a.o. Ryan and Deci 2000; Beswick 2013). The extrinsic project manager motivating factors inventory is presented further in Chap. 19, 06:00 Leadership: L, section "06:20 Methods".

In this chapter, dedicated to Self-Management, purposely only uncontrolled, personal motivation is considered as a facilitator of personal goals implementation. These start with the immaterial resources.

04:25 Personal Immaterial Resources

Decision Making Process

Personal immaterial resources are resources used in cognitive process of decision making (see Fig. 18.4) and in our social attitude. Key in decision making is mental model of various situations developed in our mind. This model bases on our own experiences, includes the external information and is conditioned by our emotions and intrinsic motivation.

Direct impacts on mental model take our value system, goals and personal traits, which also influence the following steps in decision making.

Mental Model

Mental model depicts situations learned or trained with certain similarity to the current situation of decision maker and has the following attributes:

- Relevance (given by similarity)
- Confidence
- Richness

The richer and more relevant the mental models are, the higher is our confidence in decision taking, lowering the risks and improving the quality of the decision.
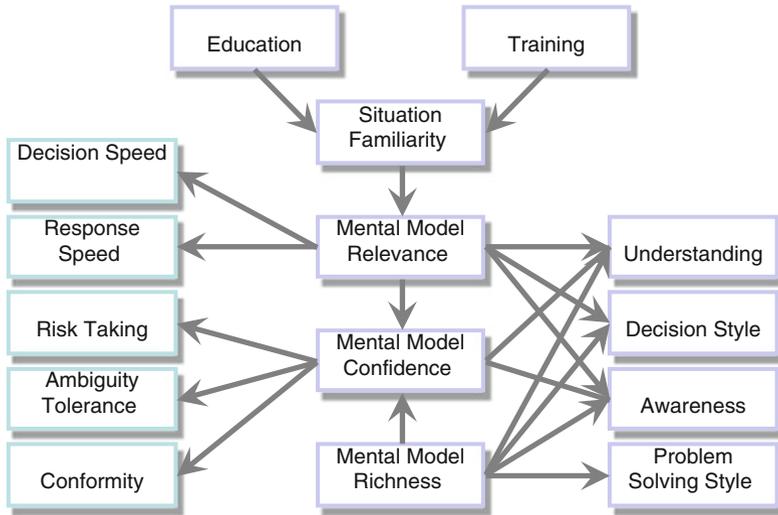
Fig. 18.5 Mental models interrelationships

The complete interrelationships are given in Fig. 18.5 (NATO RTO Technical Report TR-SAS-050 2007). As projects by definition vary from each other, there is possibility to develop perfectly matching mental model. We can develop rich and relevant partial models (e.g. earned values analysis) and enter with them the decision preparation.

The decision preparation features the Bandura's intentionality (result of values, goals and motivation) and forethought (mental model reference and expectancy) (Bandura 2001).

Decision Making Capabilities

Decision making demands our capabilities to:

- Analyse
- Synthesize
- Critically to evaluate

The development of those capabilities, often called critical thinking (a.o. King 2005/2013) is essential in project management. Due to the individual nature and unpredicted occurrences (Bandura's fortuity) right project decision demands thorough situation analysis, on the spot synthesis with the past, with the environment and with forethoughts and finally critical evaluation of possible outcome and risks.

Moral standards, based on personal values and ethics, exert here a regulatory influence (Bandura 2001).

The execution tracing (Bandura's self-reactiveness) and final control and closing (Bandura's self-reflectiveness) build up the utmost capability of project manager to reflect and critically review the results of the taken decision and shaping appropriately own experiences – feeding back to the mental model adaptations.
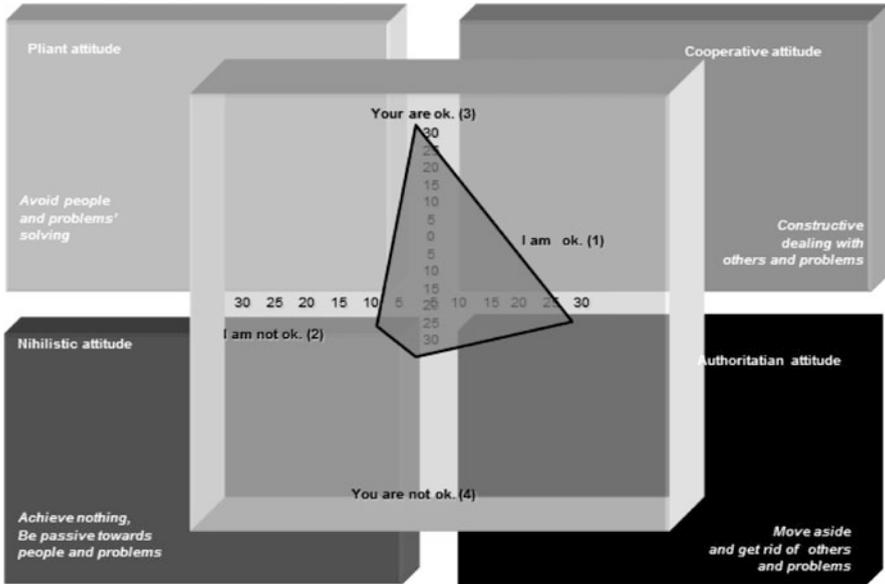
Fig. 18.6 Corralogram of 'I am ok – you are ok' attitude. (*) Life positions (Psyquo 2013)

The feed-backing is also a part of NLP: Neuro-Linguistic Programming (Tossey and Mathison 2003). The cognitive associations in our mind are expressed as linguistic chains. We are encouraged to adapt our behavior (feedback) until we obtain the expected results (intentionality predicate). In NLP mental model is immediately deployed and so long modified until final results are reached. Although it sounds simple, it's application and practical deployment proved difficult and subject to some criticism (Einspruch and Formann 1985). Therefore, this concept is not further pursued in this book.

Our attitude exerts influence on the development of our personality as well as on the effectiveness of the decision taken.

Thomas Harris (Harris 1967) formulated Eric Berne four types of attitudes, based on combination of positive/negative attitude towards self and others. Most desired for the project manager is the attitude "+/+": I am ok. – You are ok. This constructive and indulgent attitude:

- Gives up comparisons,
- Treats others openly and with respect,
- Consider others as important as we are,
- Criticizes in a constructive, not humiliating way,
- Is the attitude of a winner.

Franklin Ernst expressed Berne's attitudes into the so called OK Corral. Ernst arguments, that in our daily behavior we move between all attitudes (Ernst 1971). By scaling the dimensions we may express our personal energy distribution in form of corralograms (see Fig. 18.6).

On the Ernst Corralogram we superseded the life positions (Psyquo 2013). The lines express our orientation toward specific position. The dark quadrate is the average life position we take. The individual in the example in Fig. 18.6 behave in a positive, well-balanced way, with a positive attitude towards others and good impact on the environment, is problem solving oriented, accept common rules, is tempered in face of emotions busts with a good sense of humour. Life position most welcome for project managers, who care about success in their professional and private life.

The OKness/Not-OKness can not be explored under the idiographic (specific cases and unique traits or functioning of individuals (Turvey 2008)) and phenomenological (private way of thinking, not necessary related to objective reality (Lazarus and Folkman 1984)) aspects (Boholst 2002). Boholst identified the two factors "I" and "You" as dominating over the underlying OK/Not OK. The scale, used as in the example in Fig. 18.6 is relative and has to be calibrated with a possibly vast sample. Therefore, taking the tests of one's own life position it is advisable to learn the calibration base of the test itself.

We summarize this chapter as follows:

- Balanced self management in immaterial resources focuses on improvements in mental models, critical thinking, moral standards and cooperative "I am OK, you are OK" attitude.

04:26 Personal Material Resources, Time

Decision Making Process

The personal material resources at our disposal include our physical constitution and condition, deployed over time.

The material resources are as individual as personal immaterial ones (Forsyth 2007; Brügge 2011). Good balanced physical condition is relevant to the overall balanced work & life. Tired (overworked) team member is rather prone to errors; stressed manager will more likely react adversely to reasonable proposals. With SWOT analysis we can identify if our physical abilities and skills match current job demand and take suitable individual action.

Special attention is given here to the time. Although time is needed while considering the values, goals or in the cognition processes, we view it as bound with material resources. In each activity, including the intellectual one, the human's material resources are engaged. If we consider e.g. project organization than at least part of our brain is occupied. When we temporarily focused on our spiritual merits, we might not be able to do anything else. Therefore, time is bound with our material resources and it's use impacts our balance.

Time is the most invariable of all of our resources; time can not be stopped and it's pace is constant (Rohwedder and Milszus 2003).

Human life amounts to about 700'000 h. Most of us have 200'000 h behind, few even more. The question arises: do we use our time efficiently...? The team looks

up at the project manager – his own time management is an indicator of his capabilities in project management.

Numerous authors provide recipes for successful time management, just to name the few newest only (Brügge 2011; Alexander and Dobson 2009; Forsyth 2007; Mancini 2007). Common in all approach of all authors, including the non-conformist Ralph Brugge are two aspects:

- The analysis of the current time management and
- Person oriented approach.
  Varying are the proposed measures.

The synthesis, practiced since several years in several cultures by the author, comprises:

1. Analysis of current time use
   - Analysis of the daily practice
   - Identification of the time thieves
   - Evaluation of the stress potential
2. Identification of improvement potential
   - Classification of the activities according to own priorities
   - Identification of the distribution of the own physiological performance over the 24 h
   - Personal work and life balance definition
   - Selection and adjustment of the activity/time slot
   - Drop-out of selected activities
3. Personal optimization contract
   - Fixing of own goals and priorities
   - Fixing of necessary actions and deadlines
   - Optimal time/activity allocation during the day
   - Setting control points

The analysis of our daily practice let us to identify the potential in time deployment optimization. There are three dimensions of the analysis:

(a) What are our current priorities?
(b) Where do we have social obligations, which are not easy to change?
(c) The "10 %" deficiencies (Rohwedder and Milszus 2003)
   Suitable techniques are presented in section "04:36 Unsatisfactory 10% Rule".

Time thieves are imposed activities, which do not contribute to our goals, yet steal our time: drops for a chat by superior, sales phone calls, irrelevant urgencies.

The last not least analysis item is stress potential. Stress is a non-specific reaction of our body to internal or external conditions which mobilize our body to additional effort: Heart rate, breathing rate, muscle tension, metabolism and blood pressure all increase (Davis 2008). Stress is subjective, i.e. each of us reacts differently to different stressors. Stress appraisal distinguishes three phases: Challenge – Threat – Harm/Loss (Lazarus and Folkman 1984). Figure 18.7 shows stress appraisal in terms of our performance versus load relationship.

Slightly increased stress, mostly from higher load, under normal circumstances influences positively our efficiency up to the point, where tiredness takes upper hand. We reach our highest performance. The Exhaustion which starts with each
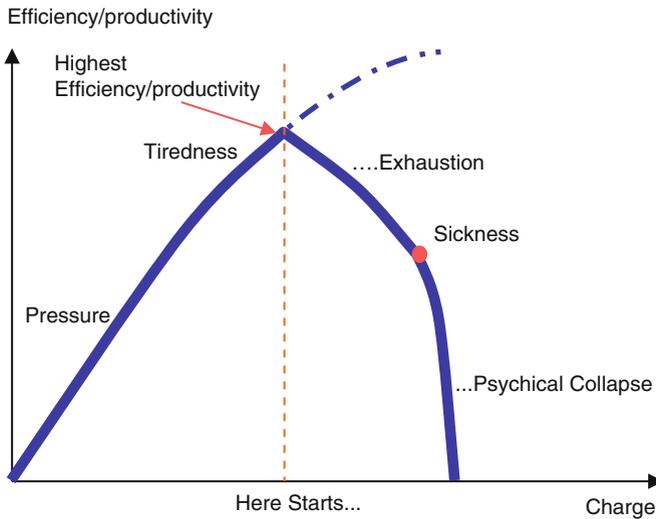
Fig. 18.7 Stress effect on our efficiency and productivity (Knoblauch 1991)

additional load stressors decreases our performance down to the point of sickness – point of no return. Burn-out, psychical collapse and several months in therapy are the consequences. Certain resistance provides here a clear value system. Creswell et al. (Creswell et al. 2005) proved that self-affirmation of values has positive impact on stress resistance.

Stress symptoms and sources are described in section "04:39 Stress Syndromes and Stressors".

04:30 Techniques and Tools

04:31 Assessing Own Values

The Rokeach Value Survey
In the evaluation of personal value systems majority of inventories base on Rokeach Value Survey (RVS), introduced above in section "04:22 System of Personal Values". By setting the exact sequence, which are the most relevant values and which are less, we achieve guidance for evaluating our goals. Examples of RVS terminal and instrumental values are given in Tables 18.1 and 18.2 respectively.

04:32 Evaluating Own Goals

Goal Evaluation Criteria
The goals, in trace of Emmons and Kaiser (Emmons and Kaiser 1996), can be evaluated in four perspectives:
- Financial benefits:
  Indicates direct incomes from reaching this goal

Table 18.1 Rokeach value survey terminal values (Rokeach 1973)

Terminal values		
No	Criterion	Description
1	A comfortable life	A prosperous life
2	Equality	Brotherhood and equal opportunity for all
3	An exciting life	A stimulating, active life
4	Family security	Taking care of loved ones
5	Freedom	Independence and free choice
6	Health	Physical and mental well-being
7	Inner harmony	Freedom from inner conflict
8	Mature love	Sexual and spiritual intimacy
9	National security	Protection from attack
10	Pleasure	An enjoyable, leisurely life
11	Salvation	Saved; eternal life
12	Self-respect	Self-esteem
13	A sense of accomplishment	A lasting contribution
14	Social recognition	Respect and admiration
15	True friendship	Close companionship
16	Wisdom	A mature understanding of life
17	A world at peace	A world free of war and conflict
18	A world of beauty	Beauty of nature and the arts

- Emotions/feelings:
  Indicates how exciting is to reach this goal
- Impact:
  Indicates to which extend is this goal instrumental, supporting to reach the other goals
- Attainability:
  Indicates the chances to reach the goal and it's unique or permanent opportunity character.
  The resulting exemplary evaluations are depicted in Fig. 18.8.

Goal 1 provides high emotions and is attainable; goal 2 is purely financially oriented with certain probability of attainability. Goal 3, highly attainable, is supportive to other goals.

04:33 Assessment of Own Intrinsic Motivation

Intrinsic Motivation Inventory

Ryan and his colleagues from the University of Rochester developed the Intrinsic Motivation Inventory (IMI) to measure subjective experience related to target activity (Ryan 2013).

All questions are to be answered with values RV between 1 (not at all) to 7 (very much). The questions marked with (R) are reverse: the score value is the difference

Table 18.2 Rokeach value survey instrumental values (Rokeach 1973)

Instrumental values		
No	Criterion	Description
1	Ambitious	Hardworking and aspiring
2	Broad-minded	Open-minded
3	Capable	Competent; effective
4	Clean	Neat and tidy
5	Courageous	Standing up for your beliefs
6	Forgiving	Willing to pardon others
7	Helpful	Working for the welfare of others
8	Honest	Sincere and truthful
9	Imaginative	Daring and creative
10	Independent	Self-reliant; self-sufficient
11	Intellectual	Intelligent and reflective
12	Logical	Consistent; rational
13	Loving	Affectionate and tender
14	Loyal	Faithful to friends or the group
15	Obedient	Dutiful; respectful
16	Polite	Courteous and well-mannered
17	Responsible	Dependable and reliable
18	Self-controlled	Restrained; self-disciplined
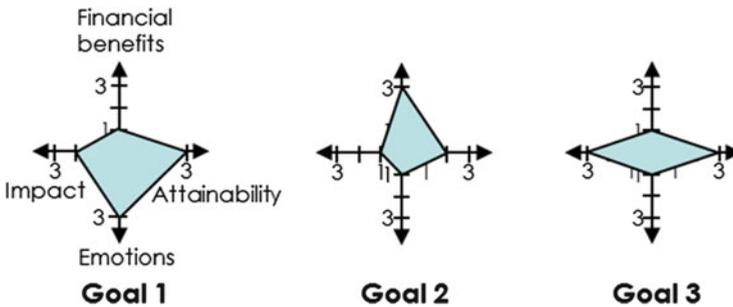
Fig. 18.8 Goal evaluation

between the answer RV deduced from value 8. The total score is relative – you may set the threshold level to assess the level of intrinsic motivation. Tables 18.3 through 18.9 contain the variables (factors) of Ryan's IMI.

04:34 Assessment of Personal Psychical Energy Focus

There are three best known assessments instruments to assess the focus of personal energy, determining our attitude towards life and towards others.

Table 18.3 Ryan IMI: interest/enjoyment (Ryan 2013)

No	Interest/Enjoyment variables (factor)	Response value RV 1–7	Score
1	I enjoyed doing this activity very much	RV_1	$= RV_1$
2	This activity was fun to do	RV_2	$= RV_2$
3	I thought this was a boring activity (R)	RV_3	$= 8 - RV_3$
4	This activity did not hold my attention at al (R)	RV_4	$= 8 - RV_4$
5	I would describe this activity as very interesting	RV_5	$= RV_5$
6	I thought this activity was quite enjoyable	RV_6	$= RV_6$
7	While I was doing this activity, I was thinking about how much I enjoyed it	RV_7	$= RV_7$
	Total Score Interest/Enjoyment		$= \Sigma RV_{1\text{-}7}$

Table 18.4 Ryan IMI: perceived competence (Ryan 2013)

No	Perceived competence variables (factor)	Response value RV 1–7	Score
1	I think I am pretty good at this activity	RV_1	$= RV_1$
2	I think I did pretty well at this activity, compared to others	RV_2	$= RV_2$
3	After working at this activity for awhile, I felt pretty competent	RV_3	$= RV_3$
4	I am satisfied with my performance at this task	RV_4	$= RV_4$
5	I was pretty skilled at this activity	RV_5	$= RV_5$
6	This was an activity that I couldn't do very well (R)	RV_6	$= 8 - RV_6$
	Total score perceived competence		$= \Sigma RV_{1-6}$

Table 18.5 Ryan IMI: effort/importance (Ryan 2013)

No	Effort/Importance variables (factor)	Response value RV 1–7	Score
1	I put a lot of effort into this	RV_1	$= RV_1$
2	I didn't try very hard to do well at this activity (R)	RV_2	$= 8 - RV_2$
3	I tried very hard on this activity	RV_3	$= RV_3$
4	It was important to me to do well at this task	RV_4	$= RV_4$
5	I didn't put much energy into this (R)	RV_5	$= 8 - RV_5$
	Total score effort/importance		$= \Sigma RV_{1-5}$

Life Position Test

Positions our psychical energy within the two dimensions: I am OK/I am not OK and you are OK/you are not OK and may be depicted on corralogram as shown in section "04:25 Personal Immaterial Resources" above. Fig. 18.9 shows an example result of test taken with Psyquo (Psyquo 2013). Blue pointer is the relative orientation, purple star the mean life positioning.

Table 18.6 Ryan IMI: pressure/tension (Ryan 2013)

No	Pressure/Tension variables (factor)	Response value RV 1–7	Score
1	I did not feel nervous at all while doing this (R)	RV_1	$= 8 - RV_1$
2	I felt very tense while doing this activity	RV_2	$= RV_2$
3	I was very relaxed in doing these (R)	RV_3	$= 8 - RV_3$
4	I was anxious while working on this task	RV_4	$= RV_4$
5	I felt pressured while doing these	RV_5	$= RV_5$
	Total Score Pressure/Tension		$= \Sigma RV_{1-5}$

Table 18.7 Value/usefulness (Ryan 2013)

No	Perceived choice variables (factor)	Response value RV 1–7	Score
1	I believe I had some choice about doing this activity	RV_1	$= RV_1$
2	I felt like it was not my own choice to do this task (R)	RV_2	$= 8 - RV_2$
3	I didn't really have a choice about doing this task (R)	RV_3	$= 8 - RV_3$
4	I felt like I had to do this (R)	RV_4	$= 8 - RV_4$
5	I did this activity because I had no choice (R)	RV_5	$= 8 - RV_5$
6	I did this activity because I wanted to	RV_6	$= RV_6$
7	I did this activity because I had to (R)	RV_7	$= 8 - RV_7$
	Total Score Perceived Choice		$= \Sigma RV_{1-7}$

Table 18.8 Ryan IMI: relatedness (Ryan 2013)

No	Relatedness variables (factor)	Response value RV 1–7	Score
1	I felt really distant to this person (R)	RV_1	$= 8 - RV_1$
2	I really doubt that this person and I would ever be friends (R)	RV_2	$= 8 - RV_2$
3	I felt like I could really trust this person	RV_3	$= RV_3$
4	I'd like a chance to interact with this person more often	RV_4	$= RV_4$
5	I'd really prefer not to interact with this person in the future (R)	RV_5	$= 8 - RV_5$
6	I don't feel like I could really trust this person (R)	RV_6	$= 8 - RV_6$
7	It is likely that this person and I could become friends if we interacted a lot	RV_7	$= RV_7$
8	I feel close to this person	RV_8	$= RV_8$
	Total Score Relatedness		$= \Sigma RV_{1-8}$

Egogram

According to Dusey an individual allocate his time and psychical energy in varying grade to the "Ego" states in Berne's model of Transactional Analysis(see Chap. 17, 02:00 Communication Management: COM, section "02:22 Dynamic Model of Transaction Analysis") (Dusay 1977). The Adult State is spilt in two: Critical Parent (CP) and Supportive Parent (SP) and the Child state into Natural Child (NC) and Adaptive Child (AC). A questionnaire of 143 questions helps to position our energy and time focus.

Table 18.9 SWOT success/failure balance (Rohwedder and Milszus 2003)

My most important successes, achievements	How have I achieved them? Which abilities were necessary to achieve them?	
1.		
2.		
3.		
4.		
....		
My biggest failures	**Which abilities were missing in this case**	**How have I coped with the failure?**
1.		
2.		
3.		
4.		
. . .		

Fig. 18.9 Example life position test results (Psyquo 2013)

Figure 18.10 (transparent frontline yellow pillars) shows an exemplary test taken with Patrick Wagner tests (Wagner 2013).

Heinzel analysed 4,000 German managers. The median is shown in Figure 04:00–10 in lined columns (Heinzel 2007). The highest pillar depicts the state, along which an individual will most likely act in stress situations. Deviation of +/−15 from standard area shows extremes, which may have dominant negative impact on a interpersonal transaction.
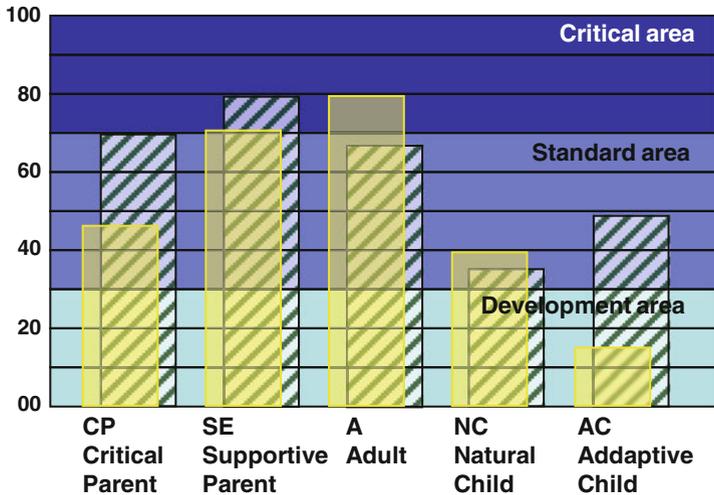
Fig. 18.10 Example egogram test results

Energogram amplifies the different positive and negative characteristics of the five "Ego" states. Example of test results taken with Psyquo (Psyquo 2013) are given in Fig. 18.11 below.

04:35 SWOT Analysis

Our chances to set the right goals increases if we deploy our strengths ("S") and take advantage of the opportunities ("O"), The weaknesses ("W") rise the risk whereas the threats ("T") are the goal prohibiting factors. Figure 18.12 depicts the SWOT example (Furugori 2013).

The analysis of the strengths and weaknesses shall be performed periodically. Honest and firm answers to the questions, which refer to the particular profiles in SWOT helps to position an individual. Positive and negative polarization easies the positioning (Rohwedder and Milszus 2003):

- What am I willing to do?
- What do I perform well?
- What do other people appreciate in me?
    Questions concerning negative options can also be helpful:
- What am I not particularly willing to do?
- What am I bad at?
- Where did the conflicts appear?

SWOT in Form of a Success and Failure Balance

Critical in SWOT is the choice of criteria: different in the example above and different in the questions of Rohwedder and Milnusz. They should be formulated in alignment to the selected personal goals.
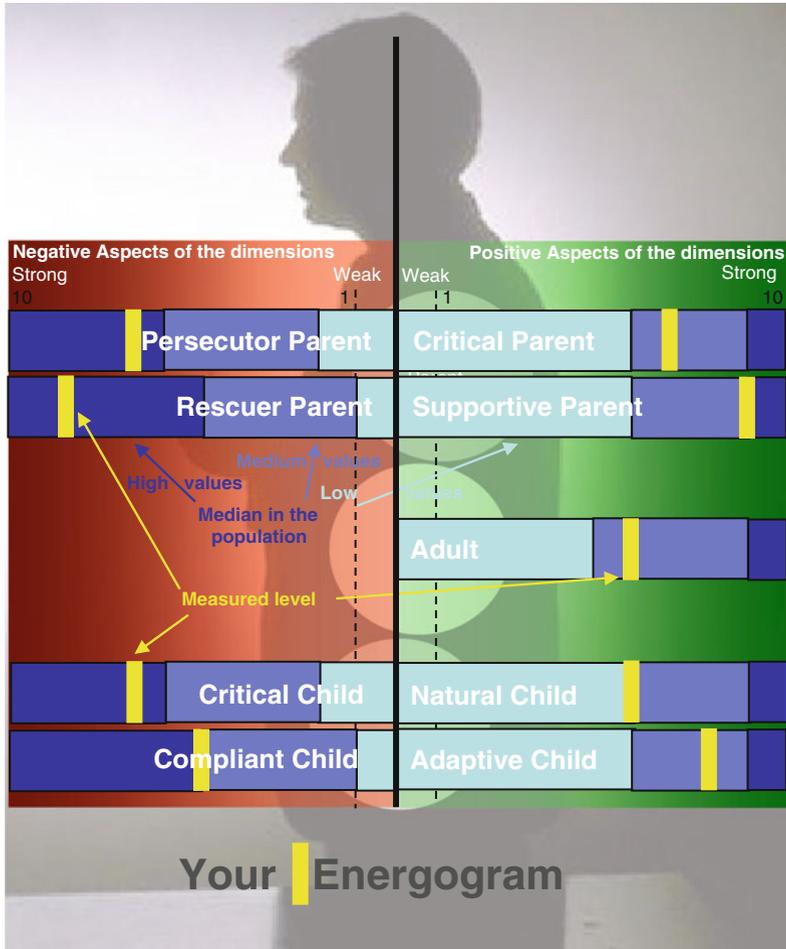
Fig. 18.11 Example energogram test results (Psyquo 2013)

SWOT may by also performed by a balance of one's successes and failures as shown in Table 18.9 (Rohwedder and Milszus 2003):

Feedback Opinion

The third form of SWOT Analysis is the honest and comprehensive feedback by someone we trust and who knows sufficiently our values, goals and daily life. It may be coach, may be a friend or relative. The rules of PACTAR (00:32) and feedback (00:33), presented in Chap. 16, 00:00 Conflict Management: CFM, might be helpful here, too.

Strengths	Weaknesses	
Personality strengths ■ Creative ■ Objective thinker ■ Realistic ■ Charismatic ■ Persuasive	**Personality weaknesses** ■ Sceptical ■ Stubborn ■ Unfocused ■ Apprehensive in new situations ■ Difficulty seeing the „big picture"	**Intern**
Experience ■ Being a leader ■ Social awareness 3rd world	**Lack of Experience** ■ Work experience (1 summer job) ■ Life experience – 18 years old	
Application of certain skills ■ Visual arts (e.g. film, models) ■ Working with people	**Application of certain skills** ■ Applying the scientific methods ■ Working with numbers ■ Computer technology	
Opportunities	**Threats**	
Personal ■ Getting involved with teams and clubs (e.g. theatre, improv, film, ball hockey, track&field)	**Personal** ■ Myself–Allowing me to convince myself that I cannot do something, or that I cannot learn what i would need to in order to do it	**Extern**
Education ■ Degree from post - sec institution ■ Leaving School with A - grades	**Education** ■ Distruction from studies–being overly involved-not putting school first	
Career ■ At current employment room for expansion of responsibilities, skill set and salary	**Work** ■ Competition–the market for young and educated individuals is very competitive	
To take an advantage	**To circumvent**	

Fig. 18.12 SWOT analysis

04:36 Unsatisfactory 10 % Rule

Analysis of Activities and Time

Interesting technique of the evaluation, whether we use the time in the best way, comes from Rohweder and Milnusz (Rohwedder and Milszus 2003):

Firstly the typical activities during the day shall be meticulously noted down, the time of their beginning, their end and duration (see Table 18.10).

Next each activity shall be evaluated:

• Was the given activity necessary?
  If more than 10 % of activities turn out to be unnecessary, it means that the tasks were badly assigned or their priority was wrongly set.
• Was the time used to perform this activity appropriate?
  If the time spent on activities exceeded 10 % of what we would estimate to be appropriate, we should find the reasons and react properly. The causes can

Table 18.10 Social readjustment rating scale (Holmes and Rahe 1967)

Nr	Event (Stressor)	Value	Your score
1	Death of spouse	100	
2	Divorce	73	
3	Marital separation	65	
4	Detention in jail or other institution	63	
5	Death of a close family member	63	
6	Major personal injury or illness	53	
7	Getting married	50	
8	Being fired at work	47	
9	Marital reconciliation with mate	45	
10	Retirement from work	45	
11	Major change in health of a family member	44	
12	Pregnancy	40	
13	Sexual difficulties	39	
14	Gaining a new family member	39	
15	Major business readjustment	39	
16	Major change in financial state	38	
17	Death of a close friend	37	
18	Changing to a different line fo work	36	
19	Major change in number of arguments with spouse	35	
20	Taking out a loan or mortgage for a major purchase	31	
21	Foreclosure of mortgage or loan	30	
22	Major change in work responsibilities	29	
23	A son or daughter leaving home for	29	
24	Trouble with in-laws	29	
25	Outstanding personal achievement	28	
26	Spouse beginning or stopping work	26	
27	Beginning or ceasing normal schooling	26	
28	Major change in living conditions	25	
29	Revision of personal habits (manners)	24	
30	Trouble with boss	23	
31	Major change in working conditions	20	
32	Change in residence	20	
33	Change to a new school	20	
34	Major change in the type/amount of recreation	19	
35	Major change in church activities	19	
36	Major change in social activities	18	
37	Taking out a loan for major appliance	17	
38	Major change in sleeping habits	16	
39	Major change in the no of family get-togethers	15	
40	Major change in eating habits	15	
41	Holiday	13	
42	Christmas	12	
43	Minor violation of the law (traffic ticket etc.)	11	

include e.g. wrong assessment of time needed, the technique of working or self-discipline.

- Was the performance purposeful (goal oriented)?
  If more than 10 % of performance was not in line with with our goals, we should correct the planning process and organization.
- Was the choice of deadline appropriate?
  If the choice of the deadlines is in more than 10 % of cases wrong, we should analyze again our planning and time assignment.

  We extend this Unsatisfactory 10 % Rule with two other items which may occur over the longer period: a week or a month:
- Are there breaks in your planned schedule with negative impact?
  If more than 10 % of overall time was lost due to the unscheduled and not contributing to your goals events (Your superior drops for a chat, financial department demands urgent clarification etc.) you should be more assertive in declining them.
- Are there time thieves in your planned schedule?
  Time thieves are activities which do not contribute to our goals. If more than 10 % of overall time was devoted to those activities a change in behavior might be advisable: decline, postpone, reduce the frequency of occurrence, stop it or disappear.

  Knoblach (Knoblauch 1991) attributes up to 28 % time losses due to breaks and time thieves.

04:37 Setting the Priorities

The following approaches to priority setting are feasible:
1. Deciding upon the urgency and importance
2. Deciding upon the earned benefits
3. Deciding upon benefit/effort ratio
4. Deciding upon relevance/time availability

The first approach is attributed to president Dwight D. Eisenhower. He is frequently quoted to have having said: "What is important is seldom urgent and what is urgent is seldom important", yet author could not identify the original source (Badiru 2009; Rohwedder and Milszus 2003; Seiwert 2002). Due to the popular identification of this approach as Eisenhower principle, it will be denominated as such further in this book.

Eisenhower Principle

Eisenhower divided empty page into four areas (see Fig. 18.13) and allocated the tasks depending on their urgency and importance:
- Area A: Here are urgent and important tasks, which must be performed immediately.
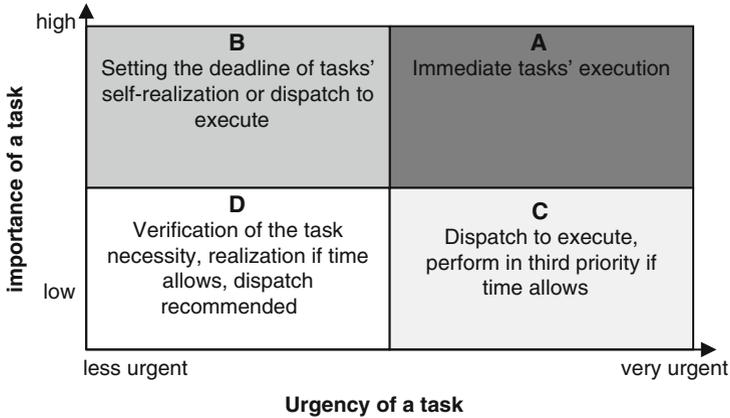
Fig. 18.13 Eisenhower task priority assignment principle

- Area B: Here are important but not urgent tasks. A deadline for their performance is set, and the tasks are duly executed or dispatched for the timely execution.
- Area C: Comprises the tasks of minor importance as compared to the tasks in areas A and B, however urgent. These tasks shall be dispatched for execution by someone else, sparing our time for the execution of important tasks in areas A and B.
- Area D: These are the tasks, which are neither important nor urgent. Their execution shall be questioned. If they prove to have to be done, they should be dispatched to somebody else. If it is possible to abandon them, we should give them up and initialize the organizational provisions for the future to reduce the occurrence of these area tasks.

  The time allocated to perform the tasks in each area, bearing the individual goals in mind, shall follow the priorities: the largest portion shall be dedicated to tasks in area A, followed by the time allocated to area B and C. As less as possible time shall be spent on tasks in area D.

Pareto Principle

The second approach is attributed to Vilfredo Pareto, who 1906 evaluated the wealth distribution in Italy and concluded that 80 % of wealth in Italy belongs to 20 % of the people. It was however, pioneered around 1940 by American business theorist Joseph Juran as the 80:20 rule of quality manufacturing (Tracy 2010). In the automotive industry 20 % of car furnishing options deliver 80 % of turnover, while the remaining options jointly secure 20 % only. So the criterion of setting the priorities is the expected benefit. We start with the activity bringing the biggest win and continue until the 20 % effort is reached. Anything beyond this value will most likely contribute less, than the activities in the first group.

Benefits

| 65% - 80% | 20% - 40% | 5% - 15% |

A   B   C

| 15% - 20% | 20% - 40% | 40% - 65% |
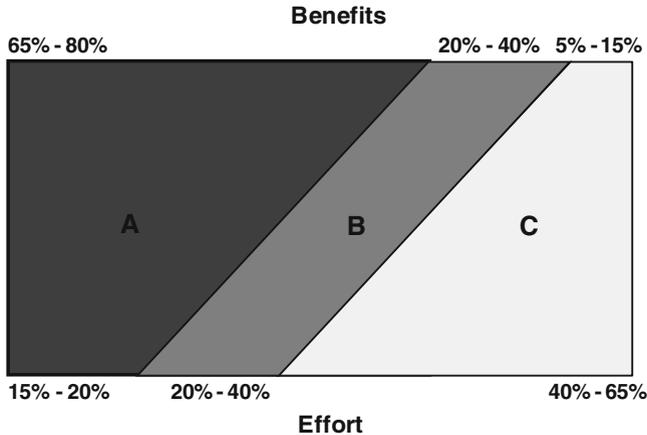
Effort

Fig. 18.14 ABC priority assignment principle

ABC Principle

A derivate from the 80:20 Pareto principle is the ABC categorization. Here 15–20 % efforts results in 70–80 % gains (A-class). The remaining 80 % of efforts is further split into two classes B and C. Class B efforts between 20 and 40 % generates in most cases linear 20–40 % win, whereas class C efforts of up to 65 % may bring as less as 5 % (Oakland 2008). Figure 18.14 illustrates this case.

Relevance/Time Availability

Whichever way we choose to assign the priorities, thus determining the relevance of an activity, the question remains, which absolute time effort we allocate to each area, each class.

Project manager is frequently facing unexpected and has to cope with unplanned, yet important or beneficial activities.

Based on present practice the following heuristics proved to be effective:

- Plan first not more than 60 % of your time along the chosen priorities
- Allow 20 % of reserve for unpredictable activities (buffer time)
- Admin up to 20 % time for relevant yet unplanned activities.

04:38 Individual Diurnal Physiological Performance

Diurnal Physiological Performance

Human being diurnal physiological performance is controlled by two clocks: sleep and wakefulness clock and physiological clock which regulates among others our body temperature (Kroemer et al. 2010). Usually our routine circadian rhythm matches both: increasing the temperature during the day time wakefulness and reducing it during sleep. Confusion arises when we take e.g. night shift or night flight into a different time zone – the physiological performance varies. Those, who
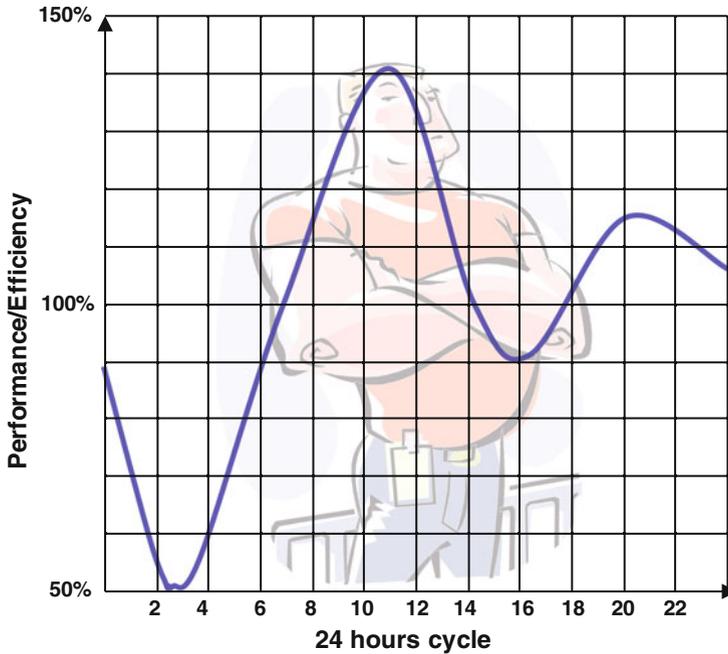
Fig. 18.15 Individual diurnal physiological performance

sleep 8–9 h perform the remaining 15–16 h, while those with a 5–6 h sleep may enjoy a nap in-between.

Our individual physiological performance varies; few of us has a monotonic physiological performance, most of us has twin circadian performance peaks. Knoblauch (1991) suggests to assess own daily physiological curve as a capability to perform between 50 % of own average performance and 150 % in peak times (see Fig. 18.15).

04:39 Stress Symptoms and Stressors

Social Readjustment Rating Scale SRRS

Based on profound research, Holmes and Rahe developed a scala of 43 stressful events, given in Table 18.10, impacting the probability of illness (Holmes and Rahe 1967, quoted in Shumaker 2010). You may mark and copy the value of the corresponding event into your score, if it occurred within the last 12 months. Table 18.11 shows the probability of illness within the forthcoming 24 months according to the statistics of Holmes and Rahe.

The results and relevance of the SRRS scale after 50 years of the civilization development; new psychology and neuropsychiatry developments as well as new technologies might demand some adjustment in SRRS. Kälin and Küng developed

Table 18.11 Probability of illness within the forthcoming 24 months (Holmes & Rahe)

Stress value	=	Illness probability within the next 24 months
150–199	=	37 % Chance
200–299	=	51 % Chance
300 and higher	=	79 % Chance

their stress scala and pursued research in Switzerland in 2006–2007 (Kälin and Küng 2008). Yet there is none of the tools as widely used and accepted as SRRS so far. Therefore it is included here.

Smith (2008, page 13) considers the range of 40–70 scored stress value points as the optimal range to work.

They concede that reaching the range of 80–100 points already may lead to major repercussions, impacting our normal daily life and health.

04:40 Templates

04:41 Project Documents

- Analysis of daily activities and time spent

In the exemplary template Table 18.12 (Rohwedder and Milszus 2003) the Activity No. 1 is evaluated as unnecessary and at the wrong time done. So in the columns "Was it necessary?" and "Was it done at the right time?" under "No" the Duration of Activity No. 1 is noted. Activity No. 3 is considered as unnecessary and with unjustified duration. Activity No. 2 was not done right. Consequently under "No" in these two columns the Duration of Activity No. 3 is noted. For each necessary activity done the right way at the right time and with justified duration put "Y" in the corresponding column.

After all activities are evaluated, the Total in the columns "Duration" and "No" is to be calculated. The relationships of "No"s to the Total Duration time multiplied by 100 % gives the value above or below the 10 % threshold.

- Analysis of work breaks and time thefts

Another view on the time used gives the Table 18.13. An assessment helps to identify the optimization potential (Rohwedder and Milszus 2003).

- Analysis of own work attitude

The Table 18.14 with few examples of working styles might be helpful to assess the consequences of our working style and the optimization potential there (Rohwedder and Milszus 2003).

04:42 Documentation of the Project Results

Project manager, who intend to improve his own performance through conscious deployment of transactional analysis concept, value system definition and activities/time analysis write a contract with himself.

The contract (see Table 18.15) shall include:

Table 18.12 Analysis of daily activities and time spent

No	Activity	Start	End	Duration	Was it necessary?		Was the duration justified?		Was it done the right way?		Was it done at the right time?	
					Y	No	Y	No	Y	No	Y	No
1		t_{1Start}	t_{1End}	$t_{D1} = t_{1End}-t_{1Start}$		$TN_1 = t_{D1}$						$TS_1 = t_{D1}$
2		t_{2Start}	t_{2End}	$t_{D2} = t_{2End}-t_{2Start}$	Y					$TR_2 = t_{D2}$		
3		t_{3Start}	t_{3End}	$t_{D3} = t_{1End}-t_{1Start}$		$TN_3 = t_{D3}$		$TD_3 = t_{D3}$				
…	…	…	…	…								
i		t_{iStart}	t_{iEnd}	$t_{Di} = t_{iEnd}-t_{1Start}$								
…	…	…	…	…								
Total				$\Sigma_v\, t_{Dv}$		$\Sigma_v\, TN_v$		$\Sigma_v\, TD_v$		$\Sigma_v\, TR_v$		$\Sigma_v\, TS_v$
10 % threshold						$\dfrac{\Sigma_v\, TN_v}{\Sigma_v\, t_{Dv}}*100\%$		$\dfrac{\Sigma_v\, TD_v}{\Sigma_v\, t_{Dv}}*100\%$		$\dfrac{\Sigma_v\, TR_v}{\Sigma_v\, t_{Dv}}*100\%$		$\dfrac{\Sigma_v\, TS_v}{\Sigma_v\, t_{Dv}}*100\%$

Table 18.13 Analysis of the causes of breaks at work

Break caused by:	Person causing the break or time theft	Conclusion avoidance of a break minimalization of a break No possibility of break avoidance
	Break/time theft caused by other people	Break/time theft caused by ourselves
Unplanned phone conversation		
Mail work-through		
Accidental conversation		
Visitor		
Co-worker		
Superior		
Unpredictable deadline		
Inquiry		
Deadlines collision		
Unscheduled meeting		
Unpredictable work		
. . .		

Table 18.14 Analysis of one's own attitude to work

I	Yes	No	Negative impact		
			Often	Never	Rarely
. . .prefer diversity of tasks					
. . .set short deadlines					
. . .can manage with the unexpected demands					
. . .also deal with secondary issues					
. . .subordinate the task to the goal					
. . .tolerate deviation from the plan					
. . .yield under the influence of priorities					
. . .					

04:50 Activities and Deliverables of Particular Project Phases

04:51 Initiation Phase

Tasks
- Identification of own values, goals, motivation, immaterial and material resources

Table 18.15 My personal contract

My personal contract	
No.	Content
1	General information, Date of actualization, Version
2	Aim of the document...
3	My 3 most important values...
4	My 3 key Triple-A SMART goals...
5	I would like to improve in my life...
6	To reach my goals and improve my life I can do...
7	Strengths and Opportunities supporting my intended activities...
8	My weaknesses, threats, prejudices, customs, patterns which are counterproductive in my intended activities...
9	My Child-Ego personality characteristics, which are counterproductive in my intended activities... (interesting activities, but not supporting my goals)
10	I may count on support of the following persons...
11	In pursuing my goals along the intended activities I might change. The changes which may be noticed by others, are...
12	In case I encounter some obstacles, in particular by someone, I will...
13	In case I need help from others, I may do...
14	In case I will not manage to pursue this contract, I will...
15	The worst scenario, when I will not reach my goals, is...
16	In view of the above, reviewing my threats again, I feel, that...
17	In conclusion I decide to...
18	Finally, taking all above under considerations, I review and adapt my Triple-A SMART goals (No. 4) as follows...
....	....
Date	Signature

Results
- Own values, goals set, motivation and immaterial and material resources identified

04:52 Planning Phase

Tasks

- Reevaluation of own Values and Goals
- Reassessment of own motivation, immaterial and material resources
- First approach to the identification of the needed activities
- Elaboration of the Personal Contract
- Setting of the verification points
- Defining inputs for Change and Knowledge Management, where suitable

Results
- Own values, goals set, motivation and immaterial and material resources verified
- First list of needed activities

- Personal Contract elaborated and signed
- Input, if any, for Change and Knowledge Management submitted

04:53 Implementation Phase

Tasks
- Time management
- Evaluation of the results of the planned activities
- Reassessment of own motivation, immaterial and material resources
- Review and adaptation (if needed) of Personal Contract
- Defining inputs for Change and Knowledge Management, where suitable

Results
- Al least few periodical analyses of own time management
- At least one evaluation of the results of the planned activities
- Reassessment of own motivation, immaterial and material resources done
- Personal Contract reviewed and adapted if needed
- Input, if any, for Change and Knowledge Management submitted

04:54 Closing & Evaluation Phase

Tasks
- Same as in the Implementation Phase and additionally
- Concluding evaluation of the purposefulness of undertaken actions
- Evaluation of time management results
- Concluding evaluation of the Personal Contract
- Formulation of lessons learned for future personal peruse

Results
- Same as in the Implementation Phase and additionally
- Final conclusions on purposefulness of undertaken actions
- Results of the evaluation of time management
- Results of the evaluation of the Personal Contract realization
- Personal lessons learned formulated

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06:00 Leadership: L

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19

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Quick Look

What Is It?

Project Manager is the one to deliver – and he needs his team as he needs the support of other stake-holders to reach it. Leadership is the way to get all on board to pursue convincingly the common project goals.

Who Does It?

Project manager is the man in charge, yet in many cases other team members may take lead, too.

Why Is It Important?

Projects are unique and thus predestined for risk and uncertainty. All stake holders and team members expect from project manager the competence and guidance towards successful project termination and delivery. Project manager is an amplifier of teams productivity: with positive, but in less successful cases – negative impact.

What Are the Steps?

Resolve pending issues first. Then proceed along LEAD: "L" for Launching the Leadership: evaluating where is the project and who are the team members. Elaborate the right leadership strategy; "E" for empowerment of the team; "A" for acting – by applying the right leadership style; and "D" for delivering: dealing with the uncertainties and right decision taking. Check if Change Request or Knowledge Management shall be addressed.

What Is the Work?

In holistic cybernetic view of leadership the relationship with team and stakeholders determines the fate of the project and project leader. So major effort is to identify the initial state and continuously to adapt the leadership style to the current team member's behaviour. Project manager has to be androgynously manager and leader; he balances between linear and non-linear systems. Challenge is to find the balance and despite all obstacles to deliver the results. Social responsibility demands you to care about the leader qualities development of your team members.

How Do I Ensure That I Have Done It Right?
Be competent, profound and authentic. Do good job in creating the Big Picture and successful leadership strategies. Be sensitive to people to win and engage them; adjust your leadership style to their dynamic behaviour; develop your sense making intelligence and take risk of intuitive decisions.

Process

The outstanding issues shall be treated first; at least periodically (e.g. L-Timer[®] 6:00). Otherwise, your leadership process, which may be triggered by few other processes, too, begins with launching activities, followed by team engagement, active acting and warranting of the delivery. If you consider it suitable – share your experience with others: through CM or KM Fig. 19.1.

06:10 The Goal of Leadership

The goal of leadership is to create and mould the mutual relationship process with all project stakeholders, team members in particular, towards project goals accomplishment.

06:20 Methods

Leadership is not considered in the ISO 21500:2012 standard at all. Anonymously: "Someone should" is in the process 4.3.18 stated as follows: "This process should enhance team motivation and performance" (ISO 21500:2012 2012). Other issues like aligning the team, taking care to deliver, leading through personality are not treated at all. In view of the impact this issues have on the project fate, once again the leading thought of the book an of this part from DeMarco and Listener is nothing less than perfectly pinpointing the situation: the light is better there". . . . (DeMarco and Listener 1999). Author takes care to move the search to where the key had had been lost – and summarize the suitable instruments for the project manager in this chapter.

06:21 The Leadership Model

Most leadership theories view leadership as a unidirectional process of leaders influencing socially their team members (e.g. Verma 1996; Fielder 2005; Avolio 2004).

Few recognize that it is rather a mutual dynamically evolving relationship and leader has first to create the way to perform for the team, than win the team (dyadic theories). Leader shall continuously adapt his behavior to the team development and steer the project fate towards successful delivery of project results.
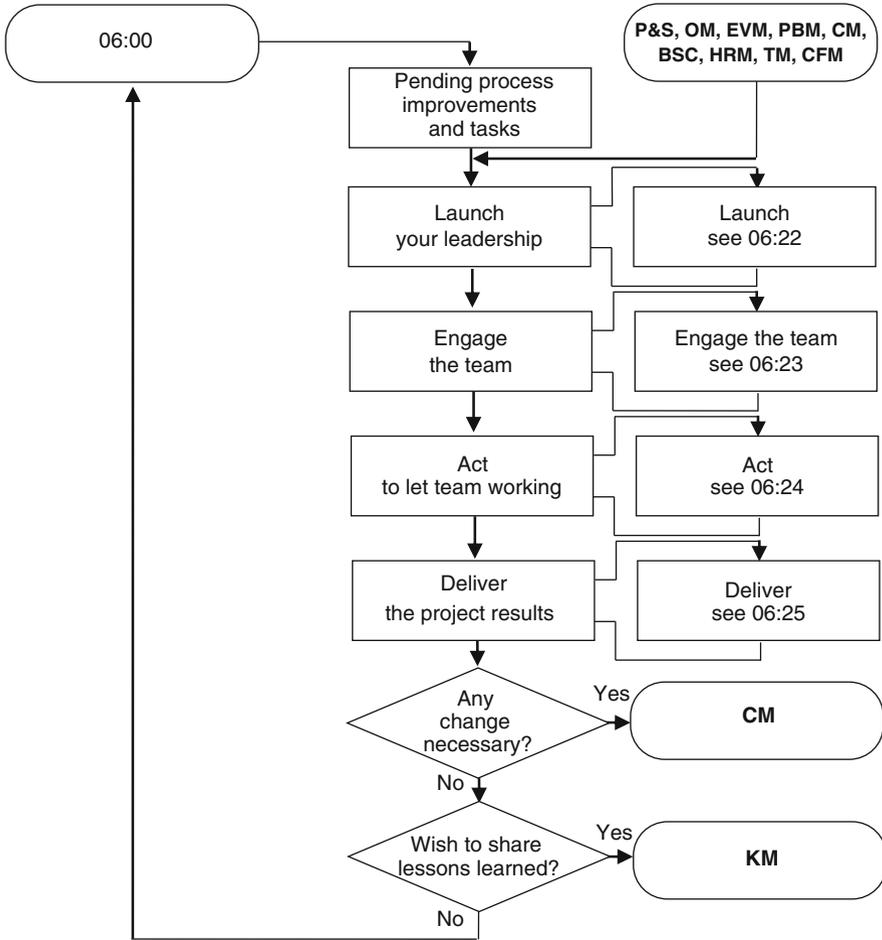
Fig. 19.1 Leadership process

The situational/contingency theory of Fiedler positions the classical Task/Relationship behavioral combinations into the context of the situation (Fielder 2005; Cragan et al. 2009). The situational leadership model of Hersey and Blanchard sets (statically) the leadership style in relation to the team members "development level" (Hersey et al. 2007). Few theories consider the dynamics of arising leaders (role emergence theory) and the dynamical interrelationship between the leader and the followers (Adair 2010); Implicit Leadership Theory (Hogg 2001).

Several behavioral theories demonstrate static perception of occurrences: Bass transformational and transactional theories (Egan et al. 1995), functional theory of Hackman & Walton, stylistic theory of White and Lippet, social style theory of Blake & Mouton, X, Y later also Z theory of McGregor, power theory of French and Raven (Cragan et al. 2009).

Fig. 19.2 Where Do We Come From? What Are We? Where Are We Going?, 1897–98. Paul Gauguin. Museum of Fine Arts, Boston, Tompkins Collection—Arthur Gordon Tompkins Fund. Photograph © 2012 Museum of Fine Arts Boston

Functional theorists (Hackman and Walton 1986) view leader as servant to the needs of team – missing a notion of the purposefulness of the wholeness.

Promising, yet punctual, as in the case of functional theorists, is the Vroom-Yetton Jago Normative Decision Model. Here several dynamic factors of team are taken under considerations in developing the behavioral recommendations for the leader (Vroom and Jago 1988).

Closest to contemporary leadership perception seems to be path-goal theory of Robert House (House 1996). In this approach effective leader engage in behaviors that are complimentary to the environmental and abilities conditions to compensate for the deficiencies.

The cybernetic model developed further in this book bases on the holistic theory (Best KC 2011/2013) which integrates the above theories with procedural (dynamic) development stages of leadership, which in part, related to the communication, are introduced by Cragan et al. (2009). In specific issues further theories like e.g. holistic or power theories are further introduced.

The proposed four stages model of leadership LEAD resembles the four phases of Rubicon project realization model (Chap. 2, 07:00 Planning & Scheduling: P & S, section "07:20 Methods"). We distinguish:

- L = Launch (Initialization of the project Leadership)
- E = Engage (Motivate and empower the project team)
- A = Act (Handle the daily leadership)
- D = Deliver (Assure the BSC – balanced score results)

06:22 Launch

Leadership and Paul Gaugin

Methodical leadership is a prepared, conscious behavior. Inspired by Paul Gauguin (see Fig. 19.2) canvas we shall answer the following questions:

- Where do We Come From?
- What Are We?
- Where Are We Going?

"Where do We Come From?" comprises two areas:

Project goals and the context, in which project was set up. The correctness of future, often instantly to be taken decisions, depends strongly on the profound, correct knowledge about the project. The wholeness is mission critical (Redcliff 2009). Project manager has to engage himself in a profound intelligence gathering to obtain the right data (Verma 1996).

Big Picture

The so called Big Picture, which comprises both the task content as well as an organisational, technical, human and environmental context of the project, leads to better understanding of the background of the project (Cragan et al. 2009). In particular, project manager shall evaluate his team members (followers' characteristics) (House 1996; Cragan et al. 2009).

Five Base Powers

Next question is "What Are We?" Power theory of French and Raven distinguishes five bases for power, which social agent (leader) can exercise towards individual team members (French and Raven 2001):

- Reward power (leader can mediate the rewards)
- Coercive power (leader can mediate punishments)
- Legitimate power (legitimacy to prescribe the behavior)
- Referent power (social impact on team member)
- Expert power (perception of leaders expertness)

Project manager, in most cases designated, enjoys a priori an authority of legitimacy (Cragan et al. 2009). Team will expect his rewarding or coercive power in the course of project life. A profound analysis of followers allows to differentiate and to prepare both instruments individualized for optimal impact.

Project managers assigned by superiors are supposed to have a proven track of records and sufficient knowledge to demonstrate also expert power in the project area. The emerging leaders gain their expertise perception by relative knowledge assessment by the followers (Cragan et al. 2009). Frequently these are ordinary people, which placed in extraordinary situations enable their personal potential, convincing others to follow (Munroe 1999).

Referent Power

Key to success is the referent power, preferred perception of leader by project team members (Cragan et al. 2009).

Authenticity

Leadership is the social interaction between the leader and the followers. Lee call it co-created space, relationship between the egos of those, who are involved (Lee and Roberts 2010). To get engaged successfully leader has to be confident, dependable, keep promises (Verma 1996) and authentic, i.e. represent intensions and commitments with emotional genuity (Peterson and Seligman 2004). Authenticity is unfortunately neither static, nor a final state: as it is subjective to social

Table 19.1 The roles of project manager and leader according to Verma (Verma 1996)

Project management	Project leadership
Planning and budgeting	Setting vision and direction
Organizing team	Inspiring team work
Staffing the roles	Aligning the team members
Controlling the results	Motivating and supporting

Table 19.2 Focus of the project manager versus leader's focus adapted from Verma contribution (Verma 1996)

Manager focuses on:	Leader focuses on:
Objectives	Vision
Choosing predefined way	Searching the right way
Doing the things right	Doing the right things
Shorter range	Longer range
Procedures	Policy
Administration	Goal driven handling
Rules conforming	Rules challenging
Maintaining and restoring	Developing
Organization and structure	People
Autocracy	Democracy
Telling how and when	Selling what and why
Controlling	Directing
Restricting	Enabling
Restraining, foreseeing	Creativity and Innovation
Imitating	Originating
Consistency	Flexibility
Risks to avoid	Risks as opportunity
Bottom line	Top line

interaction it is a continuous and dynamic pursuit – challenging the leader to recognize the changes. This leads to the social authenticity: behavior true to the needs of the situation, attuned to others, to the context and impact, project manager is likely to make on his team members (Lee and Roberts 2010). Positive impact of the authenticity on the team members' work behaviour and engagement has been proved by Walumbwa et al. (2010).

The authentic leader is dedicated to the project goals and fulfills his mission with passion (Nash 2004). Therefore, more prevalent transformational leadership offers more opportunity to develop this attitude, that rather transactional in nature management profile of project manager (Egan et al. 1995). In Wong taxonomy managers are guardians, leaders are idealists and artisans (Wong 2007).

Project manager, Wong rational type, has to be androgynously manager and leader. Each of these profiles has different role (see Table 19.1) and thus different focus (see Table 19.2).

As the personal traits influence our behaviour (Chap. 18, 04:00 Self-Management: SM, section "04:20 Methods") project manager can only to

certain degree control his perceived authenticity, dedication and passion. The responsibility for his appearance lays with the role owner designators: choosing the right personality for the given project type. The innovative exploring projects might rather need leader type management, whilst building construction might be advisable to entrust the management type person. This may occur also during project lifecycle: leadership is prevailing in the initialisation and planning, whilst manager is sought in the realisation and finalizing (Verma 1996).

Bennis aptly pointed: The manager does things right; the leader does the right things. (Bennis 2009).

Two-Leaders Approach

The dichotomy of leader and manager may be elegantly solved by splitting the tasks into two complimentary roles: person strongly oriented towards leadership and other one focused on management excellence. Miller and Watkins argue, that this "two-leaders" approach is not only effective, but also meets the social needs in company structure (Miller and Watkins 2007.). The experience gained by the author of this book supports this thesis. Thomas et al. brought it to the point: brilliant leadership is no substitute for strong management; it is a compliment to it (Thomas et al. 2006).

Last (and not least) question to be answered in launching one's own leadership is "Where Are We Going?"

The orientation on the future and visioning are cornerstones of the project leadership (Radcliff 2010; Flannes and Levin 2005; Verma 1996). Big Picture acquired at the beginning of the launching serves leader to develop and articulate the right project vision (Flannes and Levin 2005). Right project vision is directed towards goal achievement and takes the intelligence of Big Picture into account. The resulting strategy is optimized not only with respect to the project goals and acquired recognitions, but take into account individual preferences regarding the leadership style, abilities and life experience of the project manager (Verma 1996).

It is the task of the leader to set the goals and to cascade them within the project team, once the strategy is set (Kinicki et al. 2011/2013; Nash 2004). Even the most contagious goals will be followed only if compelling reasons for team members will be formulated by the leader (Verma 1996).

With Big Picture, Intelligence, Vision, Strategy and Goals formulation the next stage of Leadership process may be approached.

06:23 Engage

Engagement

Project team members occupy roles and bring varying degree of their selves, physically, cognitively and emotionally, remaining within integral borders of who they are and the role (Kahn 1990). The term "engagement" was coined by the Gallup Organization following their research in workforce behaviour (Buckingham and Coffman 1999) and only later extended with emotional component. The research of Shondrick at al. (Shondrick et al. 2010) indicates, that the last, with root in short episodic memory, is more meaningful to the leader perception and
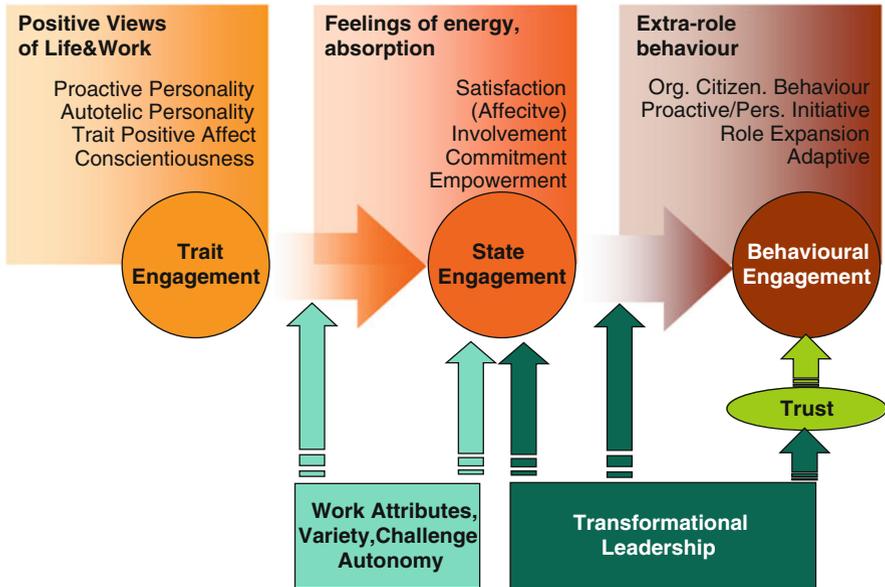
Fig. 19.3 Engagement process in a project (Macey and Schneider 2008)

engagement than the reasoning elaborated in the semantic human memory. That means, that leader, by awaking the positive emotions has better chances to engage team member than working towards the logical argumentation of the engagement. This emotional part, yet not loosing the grip of reasoning passes from the traits engagement to personal state engagement to be catalyzed by the leader as final behavioral engagement, where team member fully contributes towards project goals. Figure 19.3 shows these relations following Macey and Schneider (2008).

The state and then the behavioral engagements are best achieved, if the holistic leadership, which bases on the interaction between the leader, team members and the environment, is applied (Best KC 2011/2013).

Holistic Leadership Assumptions
Holistic leadership bases on the following seven assumptions (Best KC 2011/2013):
• Successful outcomes result from an orientation toward development.
• The healthiest and most productive development is done collaboratively.
• The leadership unit shapes the context of collaboration.
• The core leadership unit is the individual, which makes every participant a leader within his or her own sphere of influence.
• The intrinsic desire for meaningful purpose suggests that every individual wants to realize his or her best potential.
• Holistically led collaboration requires that the participant's right to self-determination be respected.
• The exercise of self-determination in a way that realizes the individual's best potential, results from an iterative process that must be supported.

This holistic approach is partially implemented also in dyadic and team oriented concepts (team or shared leadership (Pearce and Conger 2003; Carson et al. 2007)).

The leader, who is furnished with the legitimate power, is facilitator, proactively securing the necessary resources (Flannes and Levin 2005; Verma 1996) and the social architect of the environmental climate in a project (Verma 1996).

He inspires the team and evokes the team confidence and trust (Nash 2004). In this capacity leader empowers his team. Team members, who participate in the decision making develop higher performance (Avolio et al. 2004).

Omoto et al. view motivation as an antecedent of the personal engagement (Omoto et al. 2010) Project manager can and shall influence the motivation of team members in his role as a leader (Flannes and Levin 2005).

Leader's Motivation

The research of Seiler et al. conducted in Switzerland, and currently extended to other countries identified the following key extrinsic project managers and project team members motivating factors (Seiler et al. 2012):

1. Clear understanding of what to do
2. Working in a trustful environment
3. Working with individuals who have a will to achieve results
4. Having clear project goals
5. Producing identifiable pieces of work
6. Having access to all needed information
7. Having the opportunity to contribute to decisions
8. Having the opportunity to use own skills and abilities
9. Seeing progress in current projects
10. Being part of a cohesive, supportive team.

The above results confirm the considerations in this chapter. Leader can influence positively the psychological engagement by focusing on emotions, building up the cohesive, supportive team, by creating the outright, trustful atmosphere, challenging tasks and by the empowerment of the team members. He can turn on the management engagement by securing the organisational provisions for effective work contribution and necessary resources to perform the job.

06:24 Act

Leadership is action not position; quote attributed to Donald H. McGannon, who ran the Westinghouse Broadcasting Corporation and served as President of the National Urban League, pointedly render the merit of leadership. (among others Adair 2007).

The five base powers (section "06:22 Launch" above) may make someone a good manager, but only through acting he may become a leader.

To act means to get engaged in continuous exchange with the project team environment and with the team members.
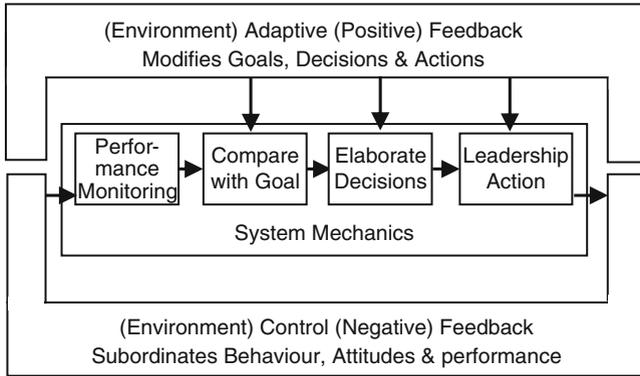
Fig. 19.4 Cybernetic model of leadership (Kinicki et al. 2011/2013)

Cybernetic Model of Leadership

The spirit of the holistic leadership is best reflected by a cybernetic model of leadership (Kinicki et al. 2011/2013)

In this model the team member (subordinate) behaviors are feedbacks to the leadership action. The reflecting awareness (Lee and Roberts 2010) allows for analysis and interpretation leading to the corrective actions which close the cybernetic loop (see Fig. 19.4). The situational (environmental) variables impact the goals and expectations as well as the feedbacks of the team members. Recalling the values as the origin of goals and expectations we obtain the model of self management of the leader, shown in Fig. 19.2 section "04:22 System of Personal Values" above.

The particular interrelationship, which emerge between the leader and team member (LMX : Leader-Member-Exchange, (Gruaen and Uhl-Bien 1995)) is related to individual leaders' style orientation, preferences, his abilities and life experience.

Blake and Mouton Managerial Grid

An impact of leaders' orientation towards people, primarily the team, and towards project objectives has been analysed by Blake and Mouton (1968). They conceived a two-dimensional matrix scaled between 1 (lowest) and 9 (highest), named managerial grid as shown in Fig. 19.5. Blake and Mouton evaluated 716 managers of one organization and demonstrated that the career accomplishment is related to managerial concern: Most successful were managers with high concern for production (corresponds to project objectives) and for people (9,9); eventually production first (9,1), (Kälin and Küng 2008; Bock 2007). The predictive value of this Instrument points at the desired androgynous leaders approach as shown in Fig. 19.5.

Egograms of Personalities in Managerial Grid

The individual management concerns can be only in part consciously controlled. The individual attitude, expressed in egograms of transactional analysis (section "04:34 Assessment of Personal Psychical Energy Focus") predetermines our most likely concern (Fig. 19.6) (Bock 2007).

maximum concern for friendly working conditions and minimum production emphasis

adequate production and satisfactory morale

encourages teamwork and mutual respect, learns from mistakes, has a sense of directed commitment, and does not use facades

High

1,9

9,9

desired approach

Concern for people

5,5

major production emphasis and minimum human considerations

1,1

9,1

Low

Concern for production   High

minimum concern for production and people

Fig. 19.5 Blake and Mouton managerial grid with desired approach (Bock 2007; Kälin and Küng 2008)

High   1,9   9,9

Concern for people

5,5

CP SP A NC AC
1,1   9,1

Low

Concern for production   High

CP, SP,A, NC, AC: see Chapter 04:34
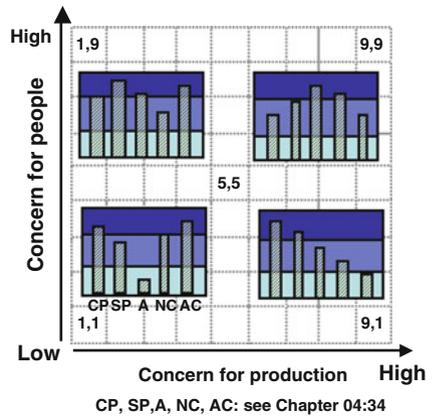
Fig. 19.6 Egograms of personalities in managerial grid (Bock 2007)

Hersey and Blanchard (Hersey et al. 2007) developed a three dimensional leader effectiveness model, in which behavior of a leader is determined the task and by the team members attitude. Originally both authors defined the team member attitude as the follower maturity, given by the ability to set ambitious yet achievable goals, ability and willingness to take the responsibility and the necessary knowledge and
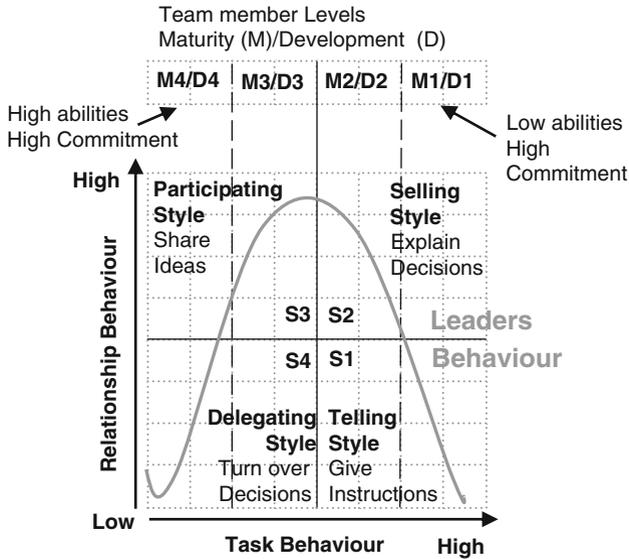
Fig. 19.7 Situational leadership styles of Hersey and Blanchard (Hersey and Blanchard 1977, 1982)

experience (Hersey and Blanchard 1977, 1982). In the later concepts the maturity gave place to the development levels.

Depending on the team development stage leader migrates between the task and relationship orientation (see Fig. 19.7).

The Leader in a new team with less commitment and abilities shall start with authoritarian style S1: defining the roles of telling who, what, how, when, and where.

With the team abilities development (and according to Hersey and Blanchard – willingness drop down) we can proceed to integrative style S2: in a two-way communication trying to explain the decisions. Positive further team development allows team to decide how the task is going to be done, while the leader focuses on relationship (Style S3). Finally with high competences and high motivation to perform team can decide without the leader. The last do some monitoring only (Delegating Style S4).

Blake and Mouton Versus Hersey and Blanchard Models

As in the Blake and Mouton model the best leader is ambiguously task and people oriented, in Hersey and Blanchard model leader exercise situational style, which varies depending on the team members maturity (development) level.

Lewin, Lippitt and White Behavioural Model

Lewin, Lippitt and White developed the behavioral model of three approaches of leader towards his team members: authoritarian approach (which corresponds with Hersey and Blanchard S1), democratic (combines both S2 and S3) and the Laissez-faire behavior (let do) which corresponds to S4 (Lewin et al. 1939) The relevance of

the Lewin, Lippitt and White research is their proof of mutual impact of team an aggressive behavior of the individual (reaction to the authoritarian style).

US Army Leaderhsips Models

We distinguish few other leadership styles. US Army Leadership Field Manual bounds the leader centred leadership to the directing (authoritarian style) as opposite to the team-oriented leadership, where team empowerment leads to great satisfaction but lower perception of a leader as a competent worker (US Army, The Center for Army Leadership 2004). Whereas the army follows the Hersey and Blanchard model, they introduce also the two other styles: transformational (focuses on inspiration and change) and transactional (rewards and punishment) arguing that good leader shall migrate between these two as the situation demands, too. The notion of change is base for the change culture (N3) considered by Nash as one of the key success factors in projects (NASH 2004). As changes are immanent to the projects it is crucial for the project team to anticipate the changes and handle them efficiently. Leader shall make it happens.

06:25 Deliver

Project manager most of all is doomed to deliver. He is responsible for the results and he is equipped with powers needed to achieve the results. Three aspects dominate this stage:
- Sense making in problem and risk management
- Stakeholder management
- Social responsibility for replicating himself, coaching and mentoring of team members

We recall that project management is considered in the book as being composed of several processes (see Chapter Introduction above). Management according to Kaplan is the optimization of the processes and their effectiveness (Kaplan and Norton 1996). This is relatively predictable and well known procedure. Projects themselves by definition are unique, at least partially unpredictable, creating various unexpected problems. The problem solving comprising the idea search and evaluation obliges leader (Cragan et al. 2009; Shondrick et al. 2010).

Unique character of a project causes the discontinuity and natural changes. Project managers have to work at the edge of chaos. Within the shortest time they are expected to handle complex issues with high degree of uncertainty (see Fig. 19.8).

Linear and Non-linear Systems

As projects are driven by humans even the simplest tasks become complex management issues. Add time constrains to these and stress situation is inevitable. In cybernetic model of leadership presented above (section "06:24 Act" above) the relationships are depicted in part by linear and non-linear systems. Singh and Singh (Singh and Singh 2002) view project managers as permanently balancing between linear (management) systems and non-linear systems, effective in chaos and complexity management.
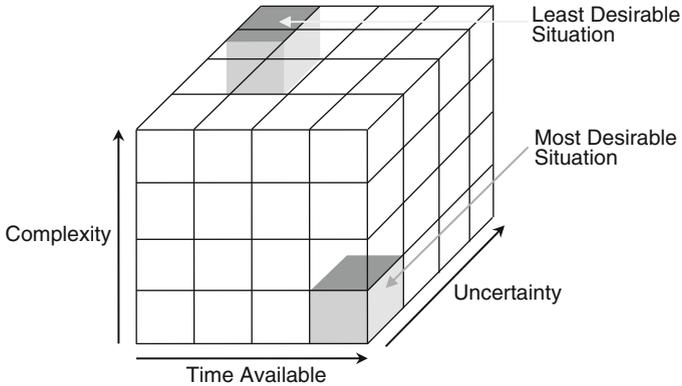
Fig. 19.8 Leader decision making drivers (NATO RTO Technical Report TR-081 2004)
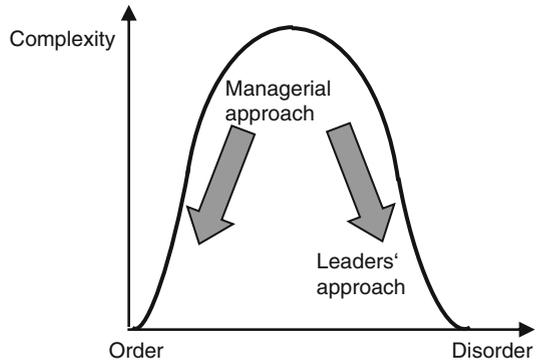
Fig. 19.9 Complexity adapted from (Gell-Mann 1994)

Managers see the system as linear one and try to master the negative feedback loop (e.g. by increasing the frequency of project progress control) imposing order. (see Fig. 19.9).

The leaders, oriented towards dealing with the uncertainty of nonlinear systems, focus on positive feedback. They let the system to certain degree freely floating or even intentionally destabilizing, to learn the equilibriums and the resistance to change around those points. The adaptive learning let leaders to develop the cognitive intuition (Bousquet 2009). This operation on the verge of chaos is viewed by several authors as the most successful strategy to deal with the non-linear systems (Bousquet 2009; Kaufmann 1955; Singh and Singh 2002).

To handle the last, an awareness of context and relations, even anticipation of their possibility, may be crucial to project success. Linear systems focus on quantitative analysis and project controls limiting the capability of the perception of deviations or stochastic occurrences with impact on the project fate, what may also explain, why today's project are not better managed than 10 and 20 years ago.

Also stress situations, typical in any project day life, focus our approach on problem solving rather than on systematic development of understanding,

Fig. 19.10 Sense making intelligence SQ Thomas and Mengel (Thomas and Mengel 2008)
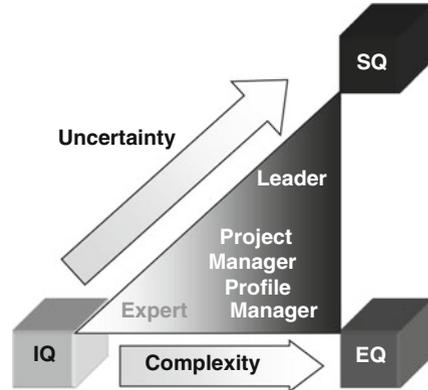
alternatives evaluations, and risk analysis. We handle mostly instantly and spontaneously, without questioning assumptions or implications of our action.

This reaction comes from our sense making capability in view of non-linear system encounter.

Sense Making Intelligence

Thomas and Mengel (Thomas and Mengel 2008) introduce the concept of Sence making Intelligence SQ demanded in systemic solution of what appears to be chaos (leading to uncertainty) creating non-linear systems there. SQ can not be reached without both Intellectual intelligence IQ defining someone as an expert and Emotional intelligence EQ which makes the manager out of an expert (Fig. 19.10). The cognitive capabilities (IQ) support the self-awareness. Goleman (1997) sees the self-awareness as a cornerstone of the emotional intelligence (EQ). EQ is responsible for self-compassion and compassion and empathy for others. Both self-awareness and self-compassion are necessary for self-regulation (Silverthorne 2010).

It is finally the sense making intelligence SQ which builds on both IQ and EQ and which in author's view is a necessary condition for leader – the ability demanded in project management.

The second part of delivering is handling the stakeholders of immediate (upper management) and indirect (politics) impact on the project (Verma 1996; Leatherman 2008). It is the decision making and steering of all other project management processes, most of all communication, towards successful influencing of these target groups.

Team Coaching and Mentoring

Final responsibility of project manager in his deliver leadership is coaching of team members. By replicating himself, coaching others towards personal development, mentoring, where support is needed, securing stewardship through personal values, project leader shows his excepted maturity and social orientation (Leatherman 2008; Flannes and Levin 2005).

Leadership BSC

In conclusion we have the four perspectives of Balanced Scorecard approach in Leadership: The customer perspective (team members and stakeholders), financial perspective (project limitations), process perspective (optimal leadership processes) and development perspective (personal self-reflection).

06:30 Techniques and Tools

Statistics Solutions quote ten various instruments which may be applied to evaluate someone's Leadership qualities. Few selected, most widely used, are presented in this chapter (Statistic Solutions 2013).

06:31 Leadership Practices Inventory

LPI Leaderhip Practices Inventory

Kouzes and Posner developed comprehensive Leadership Practices Inventory LPI (Kouzes and Posner 2008). The LPI 360 is composed of two parts:

- LPI self: an individual self-assessment of a leader along 30 questions with the results indicated on the 10-points frequency scale (1 = almost never, 10 = almost always).
- LPI Observer: also 30 items assessment of five to ten subordinates and superiors of the leader, providing an experience shared by them in relation to the leader under evaluation.

  The 30 items covers five practices:
- Model the way
- Inspire a Shared Vision
- Challenge the Process
- Enable Others to Act
- Encourage the Heart.

  The Criteria allow to evaluate the leadership process in a project. They are listed in section "06:42 Documentation of the Project Results" as an example of the project results.

06:32 Multifactor Leadership Questionnaire

Bass and Avolio Multifactor Leadership Questionnaire

Bass and Avolio developed a 45 item short and 63 items long instrument based on transformational/transactional leadership framework (Bass BM, Avolio BJ 2013). Their tool assesses the capabilities of the leader and the effectiveness of the behavior related to the individual success and the success of the organization.

The survey contains nine factors revised from the original six factor model and five points Likert type scale.

- Contingent Reward
- Intellectual Stimulation
- Management-by-exception (passive)
- Management-by-exception (active)
- Laissez-faire leadership
- Idealized Influence (behavior)
- Idealized Influence (attributed)
- Inspirational Motivation
- Individual consideration

Much to the regret of the author the full questionnaire can not be published. It may be individually purchased only; therefore no reference is further given here.

06:33 Motivational Factor Inventory

MFI, Seiler, Lent, Pinkowska, Pinazza

The Seiler, Lent, Pinkowska and Pinazza Motivational Factor Inventory (MFI) of 47 items distinguishes six dimensions:

- Interpersonal Interaction
- Task
- General Working Conditions
- Empowerment
- Personal Development
- Compensation

Tables 19.3, 19.4, 19.5, 19.6, 19.7, and 19.8 give the factors according to Seiler et al. (Seiler et al. 2012). The evaluation follows along the six levels Likert type scale both for the personal perception as well as presently encountered experience in the company.

The survey conducted by the authors in Switzerland among the ICT project managers and project team members indicated, that an interesting task, a cohesive, goal oriented team, receiving the necessary resources, and the possibility to influence important decisions are the most important motivators (Seiler et al. 2012).

06:34 ACE Self-Reflection

Lee and Roberts Leader ACE Record

Lee and Roberts see authentic leadership in the quality of consciousness and the level of reflective and integrative awareness, which shape the sense making intelligence of a leader (Lee and Roberts 2010). Leader self-reflection is supported by ACE: Action-Cognition-Emotion recognition. An example of ACE record is given in Table 19.9 (Lee and Roberts 2010).

Table 19.3 The interpersonal interaction factors, dimension interpersonal interactions, (Seiler et al. 2012)

No.	Dimension interpersonal interactions	Motivational factor
1	Interpersonal interaction with team	Working with enthusiastic people
2		Working with individuals who have a will to achieve results
3		Being part of a cohesive and supportive team
4		Working in a team capable to handle also difficult situations
5		Sharing common project goals within the team
6	Interpersonal interaction with superior	Having a good relationship with my superior
7		Having superiors who are open towards changes
8		Being free from destructive/disruptive supervision
9		Being hold accountable for my work in a fair way
10		Experiencing support and encouragement in professional aspects
11	Interpersonal interaction, general aspects	Experiencing mutual support between project managers and line managers in my organization
12		Experiencing good communication flow
13		Experiencing loyalty (in all relations)
14		Working in an trustful environment
15		Obtaining recognition for my work efforts
16		Having direct client contact
17		Being respected as a professional

Table 19.4 The interpersonal interaction factors dimension task (Seiler et al. 2012)

No.	Dimension task	Motivational factor
1	Congruence of the task with occupational aptitude and disposition	Working on important tasks
2		Having the opportunity to use own skills and abilities
3		Having a variety of work
4		Contributing to society at large
5	Clear tasks, goals and results	Seeing progress in current project
6		Producing identifiable pieces of work
7		Clear understanding of what to do
8		Having clear project goals

06:35 Mindfulness

Mindfulness

Kabat-Zinn, the pioneer of Mindfulness, defines mindfulness as "paying attention in a particular way: on purpose, in the present moment and non-judgmentally" (Kabat-Zinn 1994). William W. George port it to leadership as a state of being fully present, aware of oneself and other people, and sensitive to one's reactions to stressful situations.

Table 19.5 The interpersonal interaction factors dimension general working conditions (Seiler et al. 2012)

No.	Dimension general working conditions	Motivational factor
1	Resources	Getting the necessary financial resources to complete the task
2		Getting the necessary personnel resources
3		Having access to all needed information
4		Having the companies support for the right balance between workload and private life
5	Working environment	Having a state of the art working environment
6		Having an adequate working place (office, space)
7	Job security	Having a secure job
8		Having stable, long-term employment
9	Processes	Having adequate administrative processes
10		Having adequate organizational rules and policies

Table 19.6 The interpersonal interaction factors dimension empowerment (Seiler et al. 2012)

No.	Dimension empowerment	Motivational factor
1		Having the opportunity to contribute to decisions
2		Having the authority to make important decisions
3		Having the opportunity to influence the departments or organizations actions
4		Having the opportunity to influence roles and staffing of my project team

Table 19.7 The interpersonal interaction factors dimension personal development (Seiler et al. 2012)

No.	Dimension personal development	Motivational factor
1	Congruence of the task with occupational aptitude and disposition	Having the opportunity for further education
2		Having the opportunity for promotion and career in the organization
3		Having the opportunity to acquire experience
4		Having the opportunity for personal growth

Mindfulness Based Interventions

The mindfulness based interventions (MBI) originally used in stress reduction (MBSR) offers tools and techniques of waking up an awareness to phenomena related to the four foundations of mindfulness (Mahā Sattipaṭṭhāna Sutta: Contemplation of the Body, Contemplation of the Feelings, the Contemplation of the Consciousness and the Contemplation of the dhammas – mental condition of sense evaluation and desire (Cullen 2013; Silananda 2002/2012)). This reflective

Table 19.8 The interpersonal interaction factors dimension compensation (Seiler et al. 2012)

No.	Dimension compensation	Motivational factor
1		Having a performance-based total compensation
2		Getting materialistic rewards above expectations
3		Having an adequate total compensation
4		Getting non-materialistic rewards

Table 19.9 ACE record example (Lee and Roberts 2010)

ACE record example		
Intension:	**Result:**	
What do you wish to achieve?	What is the current outcome?	
To develop a more productive working relationship with Charles	Confrontations and then distance	
	Limiting	Enabling
Actions:	Cool, steady, logical	Choosing when to talk to others
What behaviours do you use in relation to this intention?	Dismissive statements	Finding common ground
	Point scoring	Inquiring rather than solving
	Rapid, cursory, "rifle-fire" speech	Lighter, more spacious and nuanced speech
Cognitions:	"They don't respect me" (anticipating rejection)	"They value my knowledge"
What thoughts, attitudes and beliefs about yourself or others do you have in relation to this intension?	"I'll show them"	"I am good at finding solutions"
	Black-and-white thinking	"It's interesting to notice my impulses and reactions and to wonder about those of others"
Emotions:	Anger and resentment	Desire to have an impact
What feelings about yourself or others do you have in relation to this intention?	Longing to be valued	Enjoying a sense of perspective
Effectiveness:		
To what extent is this ACE pattern successful? (What is the gap between intentions and results?)		
The "Limiting" ACE approach is causing a rift with Charles, and undermining the interdepartmental relationship		
Changes:		
What changes do you need to make to achieve your intended results more effectively? Consider changes in actions, cognitions, and emotions		
Make time for mindfulness practice to get more perspective on cognitions and emotions in self and others		
Enact the "Enabling" actions		

dimension can not be developed with a single action; rather a series of mindfulness trainings, focusing, meditation techniques, mental trainings and imagination techniques are needed. An example of reflective meta-model of Leadership, named Azonic Leadership, has been published by Liska, Ster and Schulte (Liska et al. 2011).

06:40 Templates

06:41 Project Documents

One of the challenges of current project management is leadership in virtual teams. An assessment scheme is given in Table 19.10.

Pauleen suggested preparation of the collaboration in three steps (Pauleen 2004):
- Assessing the current situation
- Defining the target Level of Relationship
- Creating the (implementation) strategy.

The extended approach comprising the issues relevant in the Launch Stage of Leadership is given in Tables: Table 19.10 (Assessment), Table 19.11 (Target Level) and Table 19.12 (Strategy).

06:42 Documentation of the Project Results

The evaluation along the Leadership Practices Inventory LPI (section "06:31 Leadership Practices Inventory" above) allows for the evaluation of the leader's performance in each practice and a comparison to average. Table 19.13 shows the items and their practice allocation.

06:50 Activities and Deliverables of Particular Project Phases

06:51 Initiation Phase

Tasks
- Launch the leadership
- Develop holistic leadership approach
- Engage the team members

Results
- The Big Picture and powers identified
- Leadership strategy elaborated
- Team members aligned

Table 19.10 Assessment in virtual team leadership launching stage

Launch leadership team member	
Hub (in-between leader)	
1. Assessment of current situation	
No	Criterion	Fulfilment
	Big picture	
1	**Project goal/his goal**	
2	**Team member characteristics**	
2.1	MBTI personality	
2.2	Belbin personality	
2.3	Relevant experience	
2.4	Skills	
2.5	Background	
2.6	Values	
2.7	Personal motivators	
3	**Organizational boundary Xing**	
3.1	Organizational and diplomacy difficulties	
3.2	HR policy difficulties	
3.3	Economical barriers	
3.4	ICT Policy difficulties	
3.5	Security policy difficulties	
3.6	KM policy difficulties	
4	**Human boundary Xing**	
4.1	Cultural boundaries	
4.2	Trust & credibility	
4.3	Time zone differences	
4.4	Preferred contact time	
4.5	Preferred communication style	
4.6	Preferred technology in communication	
5	**Technological boundary Xing**	
5.1	Available communication technology	
5.2.	Comm technology policy difficulties	
	Powers	
6	Available Powers (R/C/L/R/E)	

06:52 Planning Phase

Tasks
- Strategy revision
- Positioning of Manager and Leader activities
- Cybernetic model of leadership developed
- Leadership style consciously selected
- First ACE self-reflection mindfulness exercises
- Defining inputs for Change and Knowledge Management, where suitable

Table 19.11 Target level in virtual team leadership launching stage

Launch leadership team member . . . . cont.		
Hub (in-between leader)		
2. Target level of relationship		
No	Criterion	Fulfilment
	High	
7	**Task**	
7.1	Is the project task complex?	
8	Boundaries	
8.1	Are several boundaries crossed?	
9	**Trust**	
9.1	Is there potential to develop trust?	
	Medium	
10	**Effective understanding**	
10.1	Is there potential to share private infos?	
10.2	Can individual needs of both be met?	
	Low	
11	**Minimum understanding**	
11.1	Are all contact data known?	
11.2	Does the bidirectional comm work?	

Table 19.12 Strategy in virtual team leadership launching stage

Launch leadership team member . . . . cont.		
Hub (in-between leader)		
3. Strategy creation		
No.	Criterion	Fulfilment
	Developing vision	
12	**My vision of collaboration**	
12.1.	Which vision suits my targets?	
	Developing virtual relationships	
13	**Communication channels:**	
	Purposefulness/when/results	
13.1	Face-to-face	
13.2	Written paper communication	
13.3	Telephone	
13.4	E-mails	
13.5	Social platforms	
14	**Messages**	
14.1	Which messages face-to-face?	
14.2	Which messages through other forms?	
	Feedback	
15	**Collecting and evaluating feedbacks**	
15.1	My feedback to the team member?	
15.2	Team member feedback to me?	

Table 19.13 The LPI reconstructed from sample profile copyright 2004 by James M. Kouzes and Barry Z.Posner. (Kouzes and Posner 2013)

Nr	Item	Practice	Self 1–10	Others 1–10
1	SLets a personal example of what is expected	Model		
2	Talks about future trends influencing our work	Inspire		
3	Seeks challenging opportunities to test skills	Challenge		
4	Develops cooperative relationships	Enable		
5	Praises people for a job well done	Encourage		
6	Makes certain that people adhere to agreed-on standards	Model		
7	Describes a compelling image of the future	Inspire		
8	Challenges people to try new approaches	Challenge		
9	Actively listens to diverse points of view	Enable		
10	Expresses confidence in people's abilities	Encourage		
11	Follows through on promises and commitments	Model		
12	Appeals to others to share dream of the future	Inspire		
13	Searches outside organization for innovative ways to impr.	Challenge		
14	Treats people with dignity and respect	Enable		
15	Creatively rewards people for their contributions	Encourage		
16	Asks for feedback on how his actions affect people's perf.	Model		
17	Shows others how their interests can be realized	Inspire		
18	Asks "What can we learn?"	Challenge		
19	Supports decisions other people make	Enable		
20	Recognizes people for commitment to shared values	Encourage		
21	Builds consensus around organization's values	Model		
22	Paints "big picture" of group aspirations	Inspire		
23	Makes certain that goals, plans, and milestones are set	Challenge		
24	Gives people choice about how to do their work	Enable		
25	Finds ways to celebrate accomplishments	Encourage		
26	Is clear about his/her philosophy of leadership	Model		
27	Speaks with conviction about meaning of work	Inspire		
28	Experiments and takes risks	Challenge		
29	Ensures that people grow in their jobs	Enable		
30	Gives team members appreciation and support	Encourage		

Results
- Leadership strategy revised
- Manager and Leader activities identified
- Leadership style selected
- First ACE Rapport elaborated
- Cybernetic model of leadership elaborated
- Input, if any, for Change and Knowledge Management submitted

06:53 Implementation Phase

Tasks
- Acting along selected strategy, actions, leadership style
- Closed loop control of cybernetic leadership loop
- At least one ACE self-reflection performed
- Defining inputs for Change and Knowledge Management, where suitable

Results
- Team performing fully motivated
- At least one ACE Rapport elaborated
- Input, if any, for Change and Knowledge Management submitted

06:54 Closing and Evaluation Phase

Tasks
- Same as in the Implementation Phase and additionally
- Sense Making Intelligence developed
- Least desired decisions taken in due time
- Final delivery of project results secured
- Team member oriented development
- Formulation of lessons learned for future personal peruse

Results
- Same as in the Implementation Phase and additionally
- All necessary decision and actions taken to deliver
- Final conclusions on purposefulness of undertaken actions
- Results of the BSC evaluation of own leadership
- Personal lessons learned formulated

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