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Process Improvement Defence Solutions

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Graz, April 2017

Affidavit

I declare that I have authored this thesis independently, that I have not used other than the declared sources / resources, and that I have explicitly marked all material which has been quoted either literally or by content from the used sources. The text document uploaded to TUGRAZonline is identical to the present master's thesis.

Date	Signature

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Abstract

This scientific work has been carried out in cooperation with the company Palfinger. Palfinger is the leading manufacturer of innovative lifting solutions. Palfinger represents the global market leader in loader cranes, timber and recycling cranes, hook lifts, marine cranes and wind cranes. In addition Palfinger is the leading specialist in tail lifts, truck mounted forklifts and high-tech railway systems. From these products, individual elements are also developed and adapted on a project basis for military use. In the case of this project-related product transformation, delays in the execution of the order and the delivery, which also have an impact on the income situation, have resulted due to incomplete procedures, non-targeted communication and the lack of organizational structures. With this master thesis, a company-internal process was developed for the project management in the Palfinger Defence Solutions department, with the scientific support of the Graz University of Technology, Institute of General Management and Organisation. A written survey carried out by the departments, who were involved in the project business of the Palfinger Defence Solutions, showed the weaknesses of the project management and an organisational need for action. Within the framework of three expert workshops, the necessary fields of action were elaborated and individual structural solutions were proposed:

- Restructuring the department and implementing a project coordinator
- Creation of a standardized project process
- Description of interfaces and definition of responsibilities

After completing the expert workshops, the existing basic structures and proposed solutions were transferred into a stage gate model according to Cooper (2002). Thus, it is now possible to adapt flexibly to individual customer requirements. The core process of project management was thus efficiently redesigned and optimised. Additionally, an individually adapted process was proposed for smaller projects. This can help to eliminate the weaknesses that have been raised and to increase efficiency in the Palfinger Defense Solutions division.

Kurzfassung

Diese wissenschaftliche Arbeit, wurde in Kooperation mit der Firma Palfinger durchgeführt. Palfinger ist der führende Hersteller innovativer Hebelösungen. Palfinger steht weltweit als Marktführer für Ladekräne, Holz- und Recyclingkräne, Containerwechselsysteme, Marinekräne und Windkräne. Darüber hinaus ist Palfinger der führende Spezialist für Hubladebühnen, LKW-Mitnahmestapler und Hightech-Eisenbahnsysteme. Aus diesen Produkten werden auch für militärische Verwendung einzelne Elemente auf Projektbasis entwickelt und angepasst. Bei dieser projektbezogenen Produktumformung haben sich aufgrund von unvollständigen Abläufen, nicht zielgerichteter Kommunikation sowie fehlender organisatorischer Strukturen zeitliche Verzögerungen bei der Auftragsabwicklung und Auslieferung ergeben, welche sich auch auf die Ertragssituation auswirken. Mit dieser Masterthesis wurde mit wissenschaftlicher Betreuung der TU Graz, Institut für Unternehmungsführung und Organisation, ein firmeninterner Prozess für die Projektabwicklung in der Abteilung Palfinger Defence Solutions erstellt. Eine durchgeführte schriftliche Befragung der an den Projekten teilnehmenden Mitarbeiter zeigte bisherige Schwachpunkte der Projektabwicklung und einen organisatorischen Handlungsbedarf auf. Im Rahmen von drei Experten-Workshops wurden gemeinsam notwendige Handlungsfelder erarbeitet und individuelle strukturelle Lösungswege vorgeschlagen:

- Umstrukturierung der Abteilung und Implementierung eines Projektkoordinators
- Erstellung eines standardisierten Projektprozess
- Beschreibung der Schnittstellen und Definition der Zuständigkeiten

Nach Abschluss der Experten-Workshops wurden die vorhanden Basisstrukturen und vorgeschlagenen Lösungswege in ein Stage-Gate-Model nach Cooper (2002) transferiert. Dadurch ist es nun möglich auf individuelle Kundenwünsche flexibel einzugehen. Der Kernprozess der Projektabwicklung wurde somit effizient neugestaltet und optimiert. Zusätzlich wurde für kleinere Projekte ein individuell angepasster Prozess vorgeschlagen. Damit kann es gelingen die erhoben Schwachstellen zu beseitigen und die Effizienz in der Abteilung Palfinger Defence Solutions zu steigern.

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IV. Abbreviations

PDS	Palfinger Defence Solutions
EMEA	Europe Middle East Afirca
HoD	Head of Department
PRINCE2®	Projects in Controlled Environments 2
PMBOK®	Project Management Body of Knowledge
RACI	Responsible, Accountable, Consulted and Informed
R & D	Research & Development
RFI	Request for Information
RFQ	Request for Quotation

1 Introduction

Palfinger is the leading manufacturer of innovative lifting solutions and has developed into a global company in recent years. Palfinger is organised in business areas which each have adjusted business models and therefore different processes throughout the group. These different processes are caused by the product life cycle of each product and also by the national laws which the products are developed for. International company growth is now making adjustments to international organisational structures necessary.

1.1 Problem description

In order to consolidate this steady growth of Palfinger, one has to create new and stable structures in the various divisions. Therefore also in the Palfinger Defence Solutions, which handles the military operations of the entire Palfinger Group. The Palfinger Defence Solutions (PDS) is found in the business area EMEA (Europe – Middle East - Asia) with worldwide activities. This department operates through calls for departments of national defence and direct customer requests for military projects worldwide.

The department has been able to record steady success and growth over recent years and is now facing a new direction. At the moment the Palfinger defence Solutions has no specific process regarding the product life cycle and the product sequences. Therefore, project management in the PDS department is to be expanded in order to obtain inter alia a standardised process. This process should enable the company to synchronise itself with different business units and generate a regulated procedure in the Palfinger Defence Solutions.

1.2 Goals

The aim of this master thesis is to create a new and flexible process, which is similar to a project plan, in order to control the blurring of the order definition as well as possible individual customer wishes. This is to be collected by data collection and analysis of ongoing projects in the PDS. In the course of this, possible process steps, which are similar in project development, are filtered out and combined into a control process. The individual process stages are then to be identified and described. Possible criteria for the stages should also be collected and assigned. This should be done under consideration and understanding of MIL STD requirements and NATO STANAG.

Due to the fact that in project management one should always work with defined milestones from the beginning, such an approach cannot take into account sporadic customer wishes. At this point the master thesis also would now like to start.

In order to ensure more flexibility and to counteract the degree of blurring in the initial phase of the order acquisition, an attempt is made to combine a stage gate process with milestones. There have been two different philosophies assumed:

- First, project management based on phase and milestone according to Meyer & Reher (2016)
- Second, the process management of the product development according to Cooper (2002) based on gates and stages.

The goal of my work is to create a process adapted to the needs of the Palfinger Defense Solutions. The advantages of the milestones and gates are to be combined and a process adapted to the system should be created. Furthermore, the stages are to be transferred to a third-generation

process in accordance with Cooper (2002) philosophy. There is thus the possibility of an increase in the throughput speed which results in a reduction of the project running time.

On the process management side, the goal is a well-structured process and a procedure for the PDS, which should be characterised by a solid departmental structure. The main outcome for Palfinger should be a focus on the customer‘s needs and therefore a better customer service.

1.3 Methods

In order to achieve these objectives, chapter 2 provides a basic understanding of proess reengineering according to Hammer & Champy (2003), process management according to Jochem et al. (2010), project management according to Meyer & Reher (2016) and refined by claim and change management to Mohapatra (2013) and Felkai & Beiderwieden (2015). Classifications of projects according to Jakoby (2015), the control and possible interfaces in processes are further methods that are used. Methods for measurability and control according to Cooper (2002) and Shenhar & Dvir (2007) of projects are presented in order to generate a clear understanding.

For this purpose, it is important to define terms such as the definition of a process and an explanation of stage gate according to Cooper (2002). In the same way, the difference between milestones versus gates and the advantages of this process representation should be explained.

In view of the conventional methods in project management, where milestones are defined and fixed in time at the beginning of the order specification, this temporal window is defined by the merging of gates with a milestone character and a connection to process management methods.

Methods for the early initial phase of business start-up in the PDS area must be set up and re-modified in order to achieve the desired impact. Various approaches to project and process management as well as different philosophies in these areas are analysed and combined.

This is necessary in order to sharpen the reader’s understanding of this particular problem and to understand necessary steps. The advantages of the process should not only be at the technical level, but also at an organisational level. This makes it possible, to take Palfinger Defence Solutions a major step towards the future.

1.4 Structure of the master thesis

The master work is structured in such a way that in the first chapter the problem presentation and the objectives and methods of problem solving are presented. There are innumerable routes to Jochem et al. (2010), Becker et al. (2012), Osterloh & Frost (2000), Hirzel et al. (2008), to design and re-define the processes. The topics discussed in chapter two serve the purpose of finding ideas and reflect the approach of processes. Ideas from the process reengineering, from the pure process management or the project management are searched, in order finally to establish a connection to the Stage Gate Process by the help of the claim and change management.

According to the different aspects of the literature, the case studies are now described in chapter three with the main events. The chapter four presents the questionnaire built up on the case studies and the expert workshops connected to them.

As the title of the master thesis "Process Improvement Defence Solutions" already announced, a final comparison between existing literature, actually manifested problems and process handling should be drawn by means of the method of the Stage-Gate-Process. These and other topics will be presented and discussed at the end of the thesis and finally a future outlook will be given.

2 Theoretical principles

To adapt an economic change in a company caused by strict experienced structures and working forms, it is necessary to become a dynamic organisation. (Hirzel et al., 2008, p. 12)

A clear defined strategic organisation is an important base for a possible economic change. Scholz (1997) discusses the principles for vitalisation and virtualisation of different types of organisations. How to use business reengineering in a strategic way is written down in Osterloh & Frost (2000), who describe process management as a core competence. Suter et al. (2015) discuss the effective implementation of process management when they are looking for ways to anchor strategy operational and therefore to achieve “Operational-Excellence”. The principles for a strategic proved organisational design and process design are described as a base for sustainable performance improvement. (Suter et al., 2015) This chapter has the goal to combine and explain these approaches and to give a basic understanding of processes for product development projects.

2.1 Business process reengineering

The term “Business Process Reengineering” (BPR) was published in 1990 from Hammer and Champy. They defined it as followed.

Hammer & Champy (2003) describe it as*: “Reengineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed.*”

A further definition for business process reengineering according to Mohapatra (2013, p. 4) is: “*Business process reengineering is the fundamental analysis and radical re-design of every process and activity pertaining to a business — business practices, management systems, job definitions, organisational structures and beliefs and behaviours. The goal is dramatic performance improvements to meet contemporary requirements — and IT is seen as a key enabler in this process.”*

As the definitions show, the following key elements have been identified from Mohapatra (2013) as important for business process reengineering.

- Change in orientation
- Technological improvements
- Change organisation structure
- Radical change
- Redesign business process
- The objective is the improvement of customer service and reduction of costs

In order to improve entrepreneurial performance, business reengineering tries to adapt basic redesign construction of business processes as core processes. The idea of business reengineering is not a theoretical concept, it´s more a running documentation of known approaches, amount of observations and practical studies. (Osterloh & Frost, 2000, p. 18)

2.2 Working of process reengineering

To change the process organisation of a company in a suitable way, it is necessary to radically restructure the business process. BPR assumes the current process is irrelevant, which results in a completely rethinking and new design of the process. How does the process look like? What is the main goal of the process? What are the employees think about it? How to handle it? How do other companies solve the process layout? All these questions are clarified with a “breakthrough reengineering model”. First of all, as figure 2.1 shows, it begins with defining the scope and objectives of the reengineering project and determines the actual conditions. This results in a learning process which externalised current lacks and conflict points. The next step is to create a vision for the future and to consider that in the new design of the business processes. Given this knowledge base, the gap between the current processes, structures and the vision should be filled by defining fields of action. It is then a matter of implementing a field of action. (Mohapatra, 2013, p.6)

Figure 2.1: Breakthrough Reengineering Model (Mohapatra, 2013, p.30)

To find a single approach exactly matched to a particular organisation´s needs, leads to the question, are there typical characteristics of a reengineering companies. Business reengineering solutions always differ from each other because there are no prescribe rules on how to structure the business. (Mohapatra, 2013, p.7)

“The main goal is to find the best possible solution for a business, to know what method to use when and how to pull it off successfully such that bottom-line business results are achieved.” (Mohapatra, 2013, p.7)

In many cases a single person is not able to manage the whole workscope of a process or a process variant. (Osterloh & Frost, 2000, p. 111)

According to Hammer & Champy (1993), there are some common steps how to reach the best solution for a business and to restructure the work process. A couple of them are shown below.

- **Processes replace individual departments and tasks**
  This is a solution to change the way how department operate between each other by dividing the company into processes instead of individual task and departments. Field of applications are where complex skills are required. Examples are IT support functions and financial functions.

- **Process-team**
  Another concept to the restructuring of business is to divide the employees into different teams. Every team member should understand the whole process and ensure that the customer needs are satisfied. Those complex processes are often split up in several parts and then assigned to different teams. These teams can work in parallel with each other to

support the completion of their task. Finally, the tasks are integrated with each other. The aim of the concept is to create “small self-managed teams”.

- **A process owner replaces the manager**
  The Methodology of the process owner, who is responsible to guide the team through the tasks and ensures that the customer needs are satisfied, could be also applied in restructuring of business. This person should replace the manager himself and should act as a link between the customer and the company. Therefore the process owner is the only contact person of the customer which is a big advantage because he is responsible for every aspect of their business, can react easier on errors in the process and improve the customer relationship.

2.3 Change management conflicts

“Any single change in the existing system affects all parts of the system; a complex change such as may be needed to meet competitive challenges, has virtually unlimited ramifications. Any program that seeks to introduce change into an organisation will fail if it is not grounded in this system wide view of the organisation.” (Mohapatra, 2013, p.18)

For the successful management of extensive change processes, employees were earlier faced with accomplished facts through the approach of Hammer and Champy. Kubicek (1992) and Staehle (1994) hold the view, by turning of the middle management and therefore driven by a powerful guidance from above, were employees forced to a change. This approach named “bomb-drop-strategy” was extensively criticised in the literature on organisational change.

The neglect of the structural change aspect according to Osterloh & Frost (2000), is a decisive reason that 60-70% of reengineering projects collapse. For example the CNC Index study (1994). Hammer (1997) describes, that in the meanwhile it has been recognized that process management is not a one off quantum leap more a continuous step by step improvement.

Champy (1995) takes up in his book ”Management reengineering 1995” the problem of the management of process change, that includes the value proposition of the employees.

In order to prepare departments for changed tasks and functional reorganisation of business units or to achieve integration in other business areas are major tasks that requires management and employees in the same way.

According to Mohapatra (2013), the creation of willingness to change and the overcoming resistance in the company against planned changes of the management requires special attention. This is the basis for timely implementation. *“Change management focuses on these two tasks by proposing, designing, and subsequently executing effective interventions at individual, group, organizational, and environmental levels. It should not be overlooked, though, that the environment often is more powerful than the organization itself, while the psyche, the most personal category, is too deep-seated to external change initiatives.”* (Mohapatra, 2013, p.18)

Furthermore, Mohapatra (2013) argues that interventions are relate to a set of planned change activities, that are carried out by internal or external persons and which should help an organization to increase its effectiveness. Following three features contribute to improve productivity and quaility of work: First characteristic, they are based on valid information about the organisation´s functioning. Second, they provide organisational members with opportunities to make free and informed choices and third, they gain member´s internal commitment to these choices.

In the following curve figure 2.2 of Fratzer (1995) is the reaction of the employees during a transition phase shown. In a graphical way the transition phase is similar to a cosinus curve with lots of mental ups and downs which infect the velocity of the transition phase. This curve shows the adaption of every employee who is affected of the adjustment.

Figure 2.2: Individual shock curve (Fratzer, 1995, p. 9)

The shock is the first reaction of the confrontation with a radical change. The information for the employees which should help them forward in this situation is to let them know the new urgency. The next behaviour in this transformation phase is denial. The denial can be transformed into a co-operation by explaining the aims of the adjustment. If it is possible to implement the sobering into the process by accepting the necessary change, this avoids any start-up losses. The faster you reach the acceptance phase, the less emotional resistance must be overcome and this results in a much faster transition to a new sequence. The sooner the trying out phase is reached with the employees, the faster the new process can be positively integrated in the work unit. During the trying out phase it is important to consider the problem-solving competence of the employees in a constructive way in order to solve the inevitably emerging problems of transformation together.

Depending on the hierarchical information, an organisation unit with different hierarchical stages (employee qualifications) shows a time delayed course (see figure 2.3), of the employee's adaption to new circumstances. This means that the organisation loses a certain period of productivity until the new activity within the understanding of the employees is resumed.

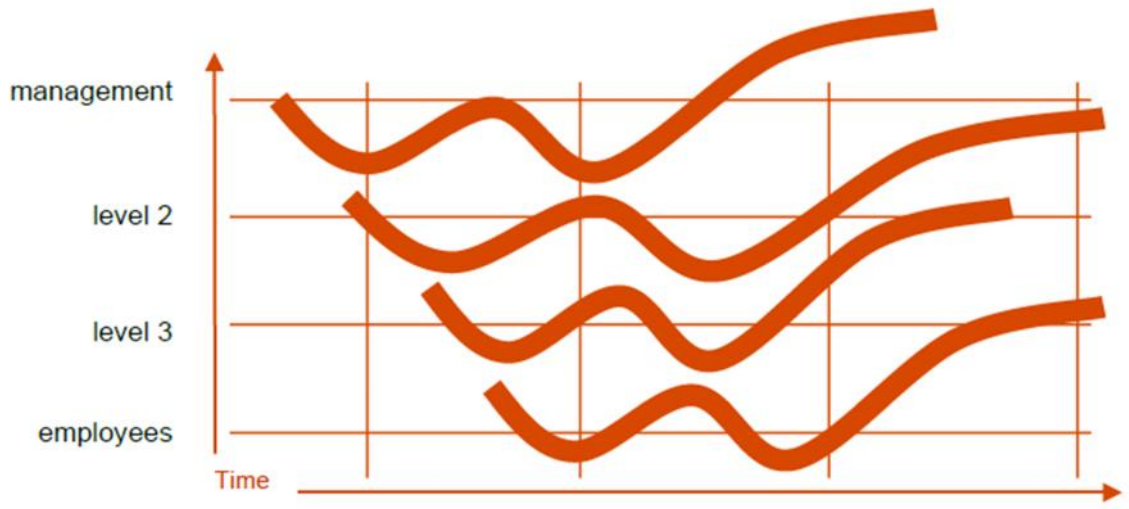


Figure 2.3: Hierarchical shock curve (Doblhofer, 2016, p. 3)

The main task of the management would be to keep the adjustment curves flat and to adapt the time delay to the management curve as far as possible to the lowest level. Finally, the goal is to reach that with a lowest possible mutual friction between the individual stages.

2.4 Change management process

The change management process aims to ensure that a change management team or project leader is able to apply with a step by step instruction the change management to a project or change. Starting from the research Prosci´s of the most frequently used and most effective change, the following three phases shown in figure 2.4, are identified in most change management processes. (Mohapatra, 2013, p.23)

- First Phase → Preparing, strategy development and preparation for change
- Second Phase → Managing, planning and implementation
- Third Phase → Reinforcing, data collecting, gap solutions

In addition, the project manager must recognize that the levels of adjustment in the various levels are approaching approximately one time to achieve a single short overall adjustment period for the unit.

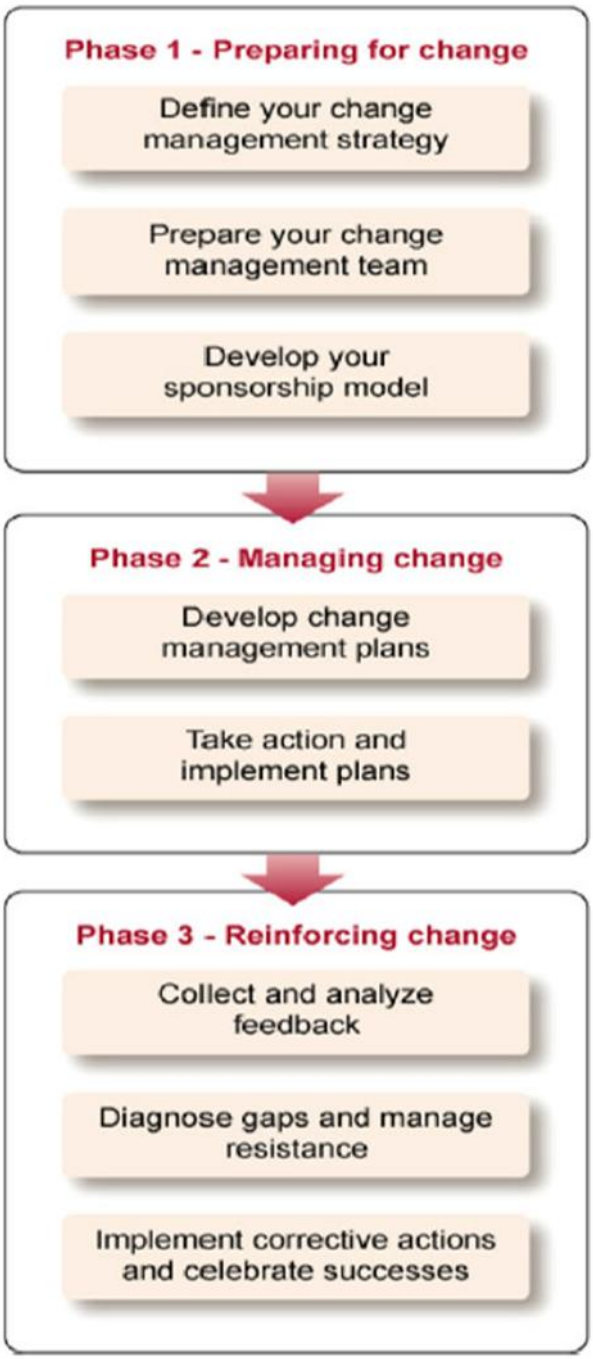


Figure 2.4: Change management process (Mohapatra, 2013, p. 24)

2.5 Process management competence

The significance of process management increases by achieving strategic and internal targets in a company. In order to improve the company´s overall value, it is necessary to increase the effectiveness on the one hand and the efficiency of the company on the other hand. Therefore processes and process management have the goal to ensure efficiency and effectiveness in the company. First of all, the corporate strategy is the base of the process-identification and -direction. For this purpose, required processes are determined and analysed for their strategic direction. That means, a change in the company´s strategy implies a change in the process structure. Secondly, the customer orientation determines which requirements and acceptance are fulfilled by the processes. The orientation extends from the customer demand to the delivery of the process results. In context of the process management it is important to coordinate the processes in relation to corporate strategy and customer. This means that success of process management accrues on the alignment of the processes on corporate strategy which results in profound changes and restructuring of the company. (Jochem et al., 2010, p. 15)

2.5.1 The way towards process management

"Process management means thinking and behaviour, methods and tools, organisation and control for an effective offer and an efficient, cross-organizational service delivery to meet permanent customer requirements!" (Hirzel et al., 2008, p. 16)

In the course of time, larger corporations up to medium size companies are increasingly interested in systematic process management with the aim of better customer orientation and shorter lead times. The success to enhance the process orientation is up to 50% - 70%. In the following figure 2.5 of the "egip Software AG" are these values to the success rate of process management documented and they are justified with long realisation time, limit resources and acceptance problems as the three main difficulties with the implementation. The reason is due to an inadequate systematic approach. (Jochem et al., 2010, p. 195ff)

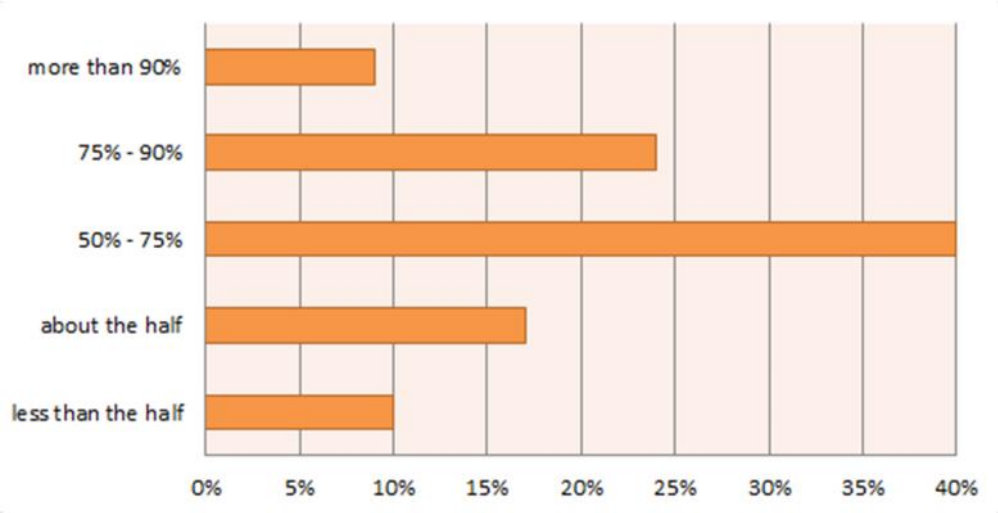


Figure 2.5: Success rate process management n= 417 companies (ATHENA-IP, 2006, A1.4.1)

Becker et al. (2013) describe, that due to the continuous optimization and perfection of functional areas of companies over the last few decades, such as accounting, logistic and production and relating thereto application of communication and information technologies, led to a significant increase in productivity and quality. However, as an effect of operational cooperation, the cost for coordination und communication rose in individual divisions of the company. "*In order to strengthen*

*a company in its entirety and to reduce existing interfaces, it is important to focus on the processes of the company." (*Becker et al., 2012, p.4) According to Hammer & Champy (2003), a process oriented enterprise configuration is the way towards a clear process configuration.

For the realisation of process orientation, strategic, organisational and technical requirements are created by implementing process management. The Implementation of the introduction of process management has several tasks that can only be transformed progressively by companies. Take for instance the documentation and identification of core processes and the accountability for each process step and additionally the determination, definition and understanding of interfaces and how to steer these actions. Another aspect is to accumulate the process performance in order to the planning of redesign and improvement of processes. This should result in controlled processes with permanent reform. (Jochem et al., 2010, p. 195ff)

After extensive research of Jochem et al. (2010) and Becker et al. (2012), there have been three main aspects of implementing process management, core processes, support processes, control and information management, extracted which are shown in the following figure 2.6.

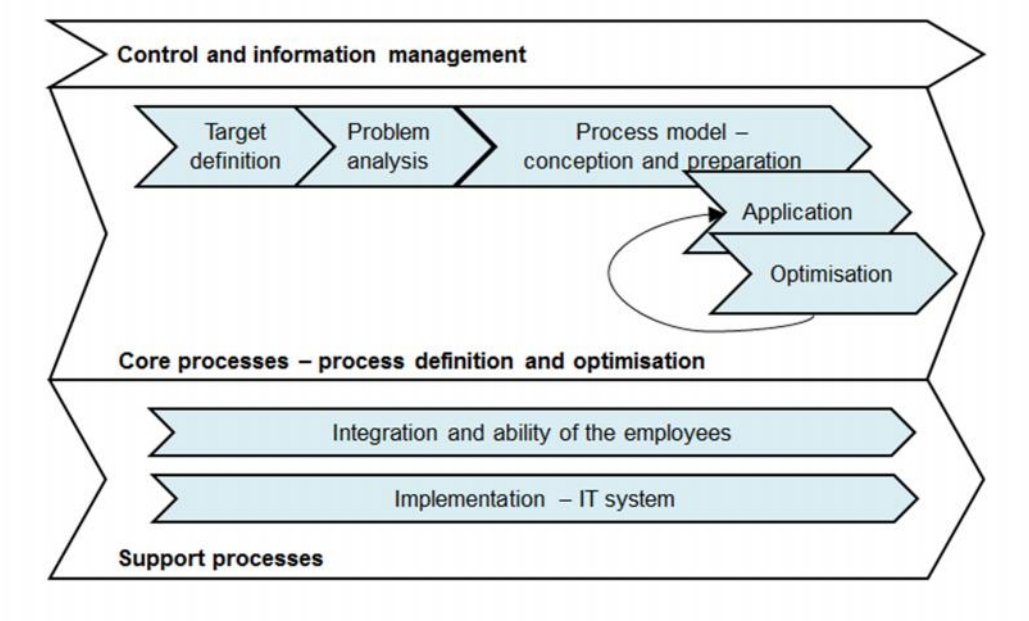


Figure 2.6: Approach of process management (Jochem et al., 2010, p. 202)

Jochem et al. (2010) pointed out, that the control and information management observe the performance of the tasks of modelling and provide information of the process to the employees and management. Therefor the control concept must clarify milestone criteria and the decision making power for the implementation of process management. In addition, conflict points and non-fulfilments in relation to the process targets have to be defined in the way of interface agreements. Depending on the size of the project and the difference between starting position and desired status, a strict compliance and a detail elaboration of the control concept are necessary. Some of the control topics of process management are shown below:

- Definition and overview of the process landscape
- Target definition, cost and time management of the processes
- Demand oriented strategic process optimisation
- New process areas of responsibility and determination of new defined processes
- Implementation of an independent function for process management and controlling

Regarding process optimisation and notification of process targets periodical meetings are useful. They contribute to a global process understanding of the company. With the help of the information concept an efficient and effective communication should be regulated. Therefore the use of the provided tools and mechanism should ensure the communication of the process management in general and in single projects.

As to Jochem et al. (2010), the **core processes** of process management represent the heart of this approach (figure 2.6), which is related to control and optimization of business processes. Concerning this, the objectives and the impeding hurdles of the core processes have to be defined and analysed. After this, the conception phase and preparation of the process models start, which are subsequent transferred into the reality, examined in the course of their development and if necessary optimized.

What is more, Jochem et al. (2010) argue as a **target definition**, a directional process formulation has to be created that is based on the quality and structural objectives of company management. Due to the strategic organisation structure of the core- and the business competence area, are there is already a preliminary confinement of core process objectives. Becker et al. (2012) pointed out, that the definition of the targets can also be limited by staking the process boundaries. For this purpose, the process is viewed at an abstract level and delimited with the help of three criteria.

- The objectives of the processes are defined by the performance requirement
- The starts of the processes are defined by triggering events
- The process scope is specified by the break limit

This phase is intended to have a clear and complete definition of the target as well as a coordination of individual project objectives with reference to the company strategy. Based on the target definition, the **problem analysis** should determine improvement specifications and make assumptions about analysis of causes. Through this the demand and the necessary requirements are derived for modelling. (Jochem et al., 2010, p. 202f)

Process modelling differs between the phase of conception and creation. The phase of conception follows the phase of creation. First of all, rules of modelling have to be implemented. Take for instance, the definition of the methodical principles with the goal of requirements to illustrate reality and to express the characteristics of the model. Therefore a problem analysis can be determined. As a result, a definition of specifications that describe business processes can be found. Based on these rules and the method of modelling, the practical process can be transferred into a theoretical model. The different concepts of modelling differ in the way of approaches and involvement of the concerned person. (Jochem et al., 2010, p. 204)

Approaches to model formation (Mertins et al., 1994):

- Top-Down: to go more into detail the supreme process stage is defined (e.g. used in the case of clear process boundaries and clear defined responsibilities)
- Bottom-Up: starts with the identification of the smallest process steps in order to generate an overall concept
- Middle-Out: known process steps are identified and then sequenced; based on the same target definition the processes are summarized and worked out in detail (e.g. used in the case of non-defined process boundaries and steps)

To sum up Feldbrügge & Brecht-Hadrashek (2008) remain, that the best answer to process model is the question: “Why has this taken so long?” As soon as a person is searching in detail about a specific function or process step, which is or is not mentioned in the model, then the model isn´t

quite good enough. A good model is transparent, simple and still complete. The **application** is the successful transition of process models into reality. Also the analysis of the models plays an important role in this phase. Mertins et al. (1994) mentioned that with the help of experiments it is possible to examine the actual- and target-concepts by using the variation of statistic and dynamic model parameters. For an effective application of the process model it is necessary to start with the implementation as soon as possible. Therefore the different views have to be generated to support the changing process and the employees. Take for instance the model based process assistants, who should guide the employees through the process, support them with information regarding responsibility of the process steps, documents or guide them through IT systems. If the assistant is implemented in the IT-architecture of the company, roles, functions and documents can be easily adapted and retrieved. Furthermore, workflow management-systems and IT specifications should simplify and support the process understanding. These two systems focus on the automation of the process flow. (Jochem et al. 2010, p. 205f) In the core process the last step is the **optimisation**. Jochem (2001) holds the view, that on the one hand the optimisation secures the sustainability of the process model bases on a regulation of the quality in ongoing projects, on the other hand it concerns the improvement of model based company structure. On top of that, Jorgensen (2004) remains the importance of the monitoring´s realisation of the process models. This ensures validity of experiments as well as the closed loop between application and optimisation, in order to transfer the outcomes into a continuous optimisation of the company structure. Beside the structural change, the optimisation describes the actualisation of the company's documents and data too.

The **support processes** are split up two parallel running procedures. One of them, the integration and ability of employees, deals with two main topics which play a critical role in successfully implementing process management. Therefore the transformation of the qualification concept as well as the role and participation concept is necessary. Fristly, the qualification concept serves the assurance of project specific skills of employees with regard to intended tasks of process management. For the design of the qualification concept the allocated skills of the role models have an important meaning. Take for instance the application of chosen modelling methods, voting and optimisation methods, interview techniques or project management for bigger modelling scopes. Due to the complexity of process management, chronologically staggered qualifications are important from the beginning of the project, because they minimize the risk of overloading. An advantage of the staggered qualification is gathering of own experience in early stages. Furthermore, permanent training lessons combined with actual project targets are important to prepare the employees for the next steps towards implementing process management. In addition to that, employees can exchange their experience with tools, methods and other partners in the company.
Secondly, tasks of the role and participation concept are the assignment of the duties according to the process management and additionally the participation of employees at the working and decision-making realisation of the processes. For a successful implementation in all areas of process management, different types of participation are necessary. First of all, there is the basic participation which focuses on the workplace and workgroup in a direct way. Application areas are qualification project. Secondly, the management participation is triggered through the management of different organisation areas and thereby it´s possible to include the total organisation. Typical areas are cost cutting projects. Finally, the lateral participation takes place in different project groups as well as in the committees. It´s a type of cross-hierarchical participation because in project groups or committees there are more often mixtures of different departments and employees with different hierarchical levels. Those Teams are decision makers for certain topics. Concerning this, process management concentrates on strategy, reorganisation and technical project, that´s why the lateral participation is the most appropriated type. In addition to the participation concept, different types of roles have been extracted by the implementation of process management. The most

common ones are the promoter for the definition of strategic targets, the project leader for the controlling of time and cost, the moderator for methodical support of modelling and the system administrator concerning the integration of the process model in the IT architecture of the company. In special cases can these roles be mastered by one person depending on the size of the project. The other procedure is introduction of IT systems. According to Spur & Krause (1997), typical IT systems for the realisation of process management are modelling, control of the workflow, calculation, simulation, management of documents and project management. Furthermore, the systems can also be connected with their functions to each other (e.g. modelling and simulation). The selection and configuration of the modelling software are main topics that have to include function of model design, distribution and evaluation of the model information matched to the company´s needs. The goal is to implement functionality and to show the utilisation of the model for the purposes it has been made for. (Jochem et al., 2010, p. 210ff)

2.5.2 Use of process management

Feldbrügge & Brecht-Hadrashek (2008) hold the view that the meaningfulness of a company working on their processes is located in productivity and quality. Therefore process management is the benchmark to improve quality. In the long term it is important to anchor sustainable quality improvement in the company. Process management also leads to a reduction of driver performance, commission and delays. This results in a lower error rate and increases the reliability of the production. The consequences are lower costs bases on reduction of commission, rework, corrections and the customer's satisfaction. Additionally, liquidity gaps, resulting from rectification of the products and unsatisfied customers who are not willing to pay, can be closed. To sum up, the advantages to improve quality with process management are:

- waste of resources
- committee production
- reduction of idle time
- lower capital commitment based on shorter throughput time
- reduction of stock
- more flexibility and customer orientation
- better communication
- positive side effects of long term customer relation

Hirzel et al. (2008) are of the opinion that only with the knowledge of the involved parties about the advantages of process management, the implementation will succeed. Therefore it takes time and patience to realise process management in the company. Process management can only develop with the understanding of the usage in the company and for each person. In this approach the use of process management separates between company and employees specific tasks.

For the company:

- reduction of costs per power unit: process management gives a closer look on the economic results of the value chain that leads to a reduction of cost drivers
- increase of throughput speed: matching and streamlining of necessary working steps
- accuracy of the offer increases: reduction of useless services through customer orientation and analysis of market research
- customer satisfaction: based on the process, building up a relationship with the customer to involve the wishes and notions
- higher quality: showing the value proposition follows a strong obligation for the fulfilment
- reduction of reaction time: concurrent management of the whole value chain

For the employees:

- objective performance measures: determining clear definition of capacity size of the process
- delegation of decision making power: scope of action increases with defined roles
- binding tasks: periodical target definitions with the process coordinator and interface descriptions with involved departments
- improve of self-guidance: orientation for improvement measures to be independent of higher hierarchical levels
- bigger sense of achievement: the performance in the value chain is more evident and transparent; the result of the process tangible

"Process management creates an additional use by linking independent organisation units along the value chain in one performance community!" (Hirzel et al., 2008, p. 22)

2.6 Definition of a Process

This chapter describes the common used definitions of a process with explanation of individual characteristics and thinking methods. Katzmaier (2006) has the consideration to break down the definitions of processes into different characteristics. With this background information and additional literature research the following features have been resulted:

Crosslinking of departments

Crosten (1997) has the opinion that the process should work overall and across the department and should not be limited by boundaries of the organisation unit as shown in figure 2.7. With the processes the structural breakdown of the process chains in organisations can be avoid (Schmelzer & Sesselmann, 2008, p. 45).

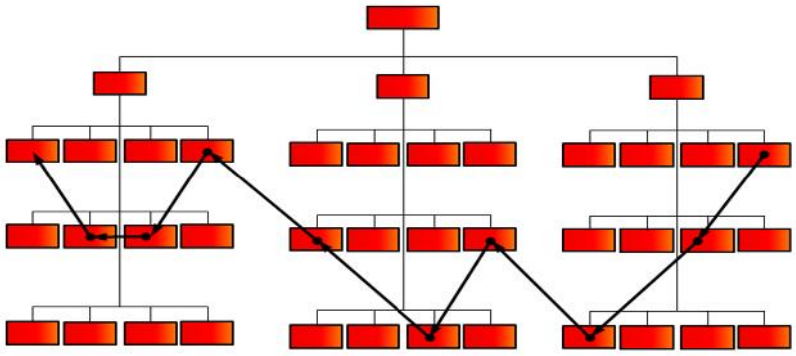


Figure 2.7: Crosslinking process

Repeatable

A process is a repetition of common sequences and routines. Stöger (2005) claims, that processes are not individual cases, they have to be reproducible and must show a specific standardisation. Arguments against routine and repletion based on changing surroundings and new challenges are not exceptions, that´s why it is essential to think about standardisation. The standardisation involves routine and in this way efficient production sequences. Therefore the standardisation should not be questioned, but new tasks and production sequences should be integrated into the standardized process sequence.

Input and output

In the early years, Davenport (1993) has the opinion that*: "*A process describes a sequence as a flow and transformation of material, information, operation and decisions. A business process can be seen as the structured order of cross functional activities with a start and an end. Furthermore, it is characterized with clear defined inputs and outputs." (Davenport, 1993, p. 4) The result of a process is the so called output. Every customer receives an output in shape of information, material or an assembled product. To gather results a process input is needed. Depending on the features of the process, the input consists of information, raw material, technical illustrations or other measurable features. Otherwise the process itself is a service recipient based on the output of a previous process. Furthermore the received performance must be checked and transformed into another output. Expected inputs can also come from external suppliers. Therefore it´s important to focus on the quality of the input otherwise this can lead to costs and an error rates in the next process steps. The better and more comprehensive the input the more efficient is the processual implementation. (Feldbrügge & Brecht-Hadrashek, 2008, p. 18f)

Chain of activities and **Customer orientation**

Another description of Feldbrügge & Brecht-Hadrashek (2008) is: "A process is a chain of coherent activities which create customer benefits together." This means, that every process has a number of duties and a number of persons who are involved to ensure the customer's needs. Therefore processes always focus on the completion of customer requests. In addition to that, the outcomes of the processes are dependet on the customer requirements, demands and expectations as a consequence there is no process without a customer. Katzmaier (2006) says, the hole thinking and acting of a process focus on the customer and results in dependence of the customer. The sooner the process reaches the exact customer requirements the better is the business success. Schmelzer & Sesselmann (2008) hold the view, the effectiveness of a process measures on fulfilment of the customer needs. In other words, if you can´t summarise and formulate the customer benefit then it´s not useful to create a process. Given this consideration, it is very important in a profit-dependent company that every process with customer orientation is also oriented on earnings. For these considerations, it is essential in a profit-dependent company that every customer orientated process is also focussed on earnings.

Responsibility

According to Stöger (2005), generally a process is separated from concrete persons. Stöger (2005) goes on to point out, that precisely from this a sequence of activities becomes a process when the dependency on concrete persons is no longer given and each or many can work in a process or control it. However a personal responsibility for the process must be given. For this to happen, a process must be transferred to accountability. It must be transferred as a whole as well as in parts. Especially the result orientation implies the principles. The process management must ensure that there is a single person responsible for each process. This regards to the control, the transaction, the results and the feedback to the customer. Within this process a single person is responsible to the outside and the top, but further responsible task can be delegated. (Stöger, 2005, p. 3)

2.7 Project management

The origin of project management is located in the in the early years after the Second World War. At that time project management was implemented through technical military projects and aerospace projects in Germany and USA. Major projects of successful performance were the moon landing in July 1969 and the start of the ARIANE rocket on the 24th December 1979. This leads to the question what is project management about? The basic idea of project management is to achieve benefits or values through systematically planning and controlling. In addition, customer proximity and satisfaction are also play major roles. This leaves the impression of a good working organisation with structured processes in the company. (Meyer & Reher, 2016, p. 32) The DIN69901-5 (2009-01) describes project management as the total of management tasks, organisation, techniques and resources of the initiation, definition planning, controlling and completion of projects. Given these explanations, Meyer & Reher (2016) describe the management of the project as the decisive aspect and identified some important system components how to manage a project. The next chapters should give an overall understanding of how to manage projects, what is a project, how to ensure project targets and how to measure the success of a project.

2.7.1 Definition of projects

In many areas of daily life, short term problem solutions are found which correspond to the small projects of the organisational. As well as in public authorities, schools, science and research, in technology and in many other areas, modern project management plays an important role for the problem solving and the organisation of the work even though the necessity is not immediately recognized. Big and small projects are omnipresent and challenge us every day. Different authors, institutions, associations and types of norms are writing on the one hand the same and on the other hand different definitions of a project. They are not talking about one coherent definition rather about characteristics which designate a project. Some of these definitions are shown below and summarized to identify the most common characteristics.

According to the DIN a project is defined as an intention, which is essentially characterized by uniqueness of conditions in its entirety. The uniqueness of conditions can refer to the target, temporal, financial and personal or other limitations, project specific organisation. (DIN 69901-5:2009-01, p. 11) Schelle et al. (2005) holds the view, that the definition of the DIN norm is not complete. He added the aspect of the involvement of several persons, working groups or institution. This means that inter divisional working in teams and collaborative processes are necessary to develop a solution and ensure a successful project. The Project Management Institute (2013) describes the definition as a limitation of time and fundamental uniqueness of a project with a start and an ending. What is more, Bea et al. (2011) sum the literature up and emphasize four categories, unique, temporary, interdisciplinary approach and progressive to identify projects. PRINCE2® adds another aspect of the characteristics that prioritise the temporary project organisation. The following attributes consider the various definitions and should generate a clear picture.

Uniqueness: A project separates from other intentions in the way of uniqueness for those who are working at the project and it is unrepeatable.

Temporary: The duration of projects is limited and defined with a beginning and an ending. The project team is dispersed after reaching the target.

Outcome: A project has a clear purpose and output.

Interdisciplinary approach: Institutions, associations, working groups and other departments share their experience and knowledge to develop a solution. Necessary processes and areas of responsibility are allocated. The project team members are rooted in their original organisation and are working out of these structures on the project. Additionally, the validity is referenced until the achievement of project targets.

Progressive elaboration: With the ongoing project, more and more information can be collected which leads to better understanding of the problem. A step by step approach and permanent review of the project targets avoid uncertainty in early stages of the project. With the running project the fuzzy rate gets reduced.

As to Meyer & Reher (2016), the reason to gather these attributes for identifying a project is to clarify whether project management methods are used or not. These characteristics are the most common definitions and indicators for determining a project. In order to that, companies should generate their own criteria for determining a project. This should simplify the decision when to use the methods of project management.

2.7.2 Measurability of projects

Measuring and evaluating are two completely different procedures. The measurement is based on measured quantities, which specify an exact value or a clear measureable variable. These values can be retested and evaluated at any time. However, it is possible to evaluate a project without concrete parameters, but this only gives a vague statement about success and quality. Therefore this chapter clarifies the necessary measured quantities in the form of project characteristics of success and quality. Both of them are measurable. Take for instance the success, which is measured through the sale figures, market shares and quality criteria. What you cannot measure, you cannot improve. (Geyer & Ronzal, 2002, p. 245)

Success and quality are the major components on the way towards measurability. Meyer & Reher (2016) describe the success and quality as results of valuations. Cooper (2002) has the opinion, that success has a sample and therefore it´s possible to separate between top or flop. He holds the view that eight key success factors are influencing a project. The following list gives an overview of these eight success factors.

1. A superior output or product, which persuades the customer in every concerns. The outcome needs a high differentiation to other products. It should solve the customer problems with other competing products, reduce the overall cost of the customer and give a higher the product quality. This results in a higher success rate, more market shares and customer satisfaction.
2. Clear definition of the outcome or product at the beginning of the project. Statistically, project with clear targets have 3 times higher chance of success and gain higher market shares. Binding agreements are the fundament of the clear defined strategy. The characteristics are satisfying the customer´s preferences and needs, a clear product concept and the performance requirements. The stricter the pre definition the better the project success.
3. Quality oriented performance of technical activities leads to significant higher success rate. Therefore success is depending on how the performance of the technological tasks and the quality performance are implemented in the process.
4. Technological teamwork aims at the interaction between project needs, R&D, technical competences, resources and the production sector. The technological interaction has a high meaning for the assignment of projects. Focus on technical strengths!

5. High quality of the development run-up is based on the early screening, valuation of market and technical aspects, accurate market research, business and financial analysis. These aspects have to be implemented in the start-up phase of the process to ensure the clear definition of the outcome. Otherwise the definitions are based on wrong information or assumptions instead of secure data.
6. Interaction of marketing is the sign of successful products. The teamwork of sales and distribution system, information procurement and market research, the interaction of the skills in the advertising range and the service capacity reduce the deficiencies in marketing and support the early screening for high quality of development run-up.
7. In many cases quality oriented performance of marketing activities is the weakness of companies. Therefore it´s important to implement the customer´s opinion into early stages of the process. Essential marketing activities are market research, market assessment at the beginning of the project and customer trials with the prototype. The implementation of these activities in the process is a fundamental element which results in higher success rate.
8. The orientation of the market attractiveness plays significant role. Projects with the right orientation of the market are characterised by high growth rate, strong desire of the customer for the product and high importance of the acquisition. As a result the value of the products increases and the profit is appreciably higher.

These eight key success factors of Cooper (2002) represent measurement characteristics, which are measured on the success rate, the market share and the classified profitability. These values are broken down in tabular form and valued after top or flop. Furthermore, the execution quality of innovations at products is evaluated. The focus is located at the measurement of key tasks, which serve for the evaluation of the failures and successes. The higher the execution quality is measured the better the success is evaluated. Some Key tasks are start-up screening, temporary market assessment, temporary technical estimation, market research, organisational and financial analyse, product testing in house, customer trails, product development, test market, business analysis before market entry and market launch. (Cooper, 2002, p. 61ff)

Meyer & Reher (2016) describe two similar factors to cooper´s approach about determination of success, but they separate between settlement success and application success. Settlement success is measured with the efficiency of a project related to the compliance of appointments, costs based on contract and on time delivery. The application success describes the long term benefit of the project for the customer or other involved stakeholders. Depending on the contract agreements and on the life cycle of the system it is important to measure during the project and beyond the completion of the project. Another point is the project quality which can be measured in an objective way or perceived in a subjective way. This should involve the customer satisfaction and consider the internal project view through the course of the project. In order to that project quality is related to the projects targets regarding project procedure and project articles to make it measureable and thereby evaluable.

How can you summarize, how to measure process success and project quality? The approaches of Cooper (2002) and Meyer & Reher (2016) pointed out, that it is necessary to define the measurability including measurement criteria in a clear way from the beginning of the project. On this base success factors and quality can be measured and subsequently evaluated. This decision should be determined form the next hierarchical level above the project leader. In order to promote a continuous learning process in the project management segment, a uniform internal project evaluation with clearly defined measurement criteria would be appropriated.

From this extensive subject, two more interesting approaches from the literature are presented. On the one hand the Project Excellence Model of GPM and on the other hand the multi-dimensional strategic concept according to Shenhar and Dvir (2007), which were inspired by the concept of Kaplan and Norten´s balanced scorecard. Both concepts include the efficiency and customer satisfaction of the product.

The Project Excellence Model of the GPM (Deutsche Gesellschaft für Projektmanagement) evaluates projects on the base of nine criteria as shown in figure 2.8. After the completion of the project the GPM model can be used to evaluate project processes, project results, customer, employees and objective measured as well as subjective perceived target fulfilment. (Meyer & Reher, 2016, p. 10)

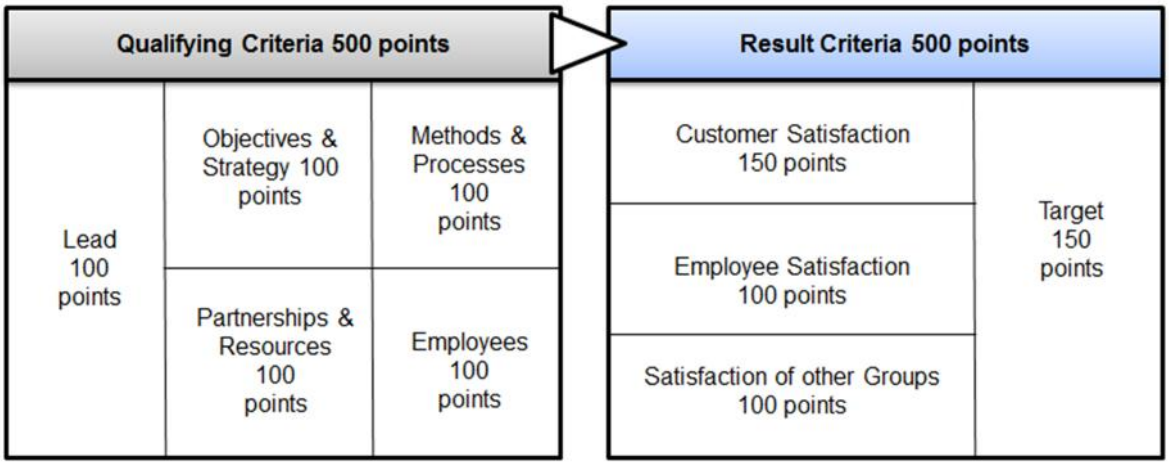


Figure 2.8: Concept of GPM (Meyer & Reher, 2016, p. 9)

The concept of Shenhar & Dvir (2007) as shown in figure 2.9, uses five dimensions of project success. Therefore not only the efficiency and the customer satisfaction of the project are evaluated, but also additionally the future oriented strategic profit of the project is assessed for the company. Depending on the type of project, the question of business success can be very far-reaching in the future and perhaps only be answered several years after the project has been completed. The same applies to the next question, what contribution does the project provide to prepare the organisation for the future. Shenhar and Dvir themselves point out that the importance of the five dimensions is project-dependent. Especially the dimension of preparation for the future is vitally important for strategic projects, because it involves great risks and opportunities. In addition to that long-term effects can only be assessed once the project has been concluded for a long time. (Meyer & Reher, 2016, p. 10)

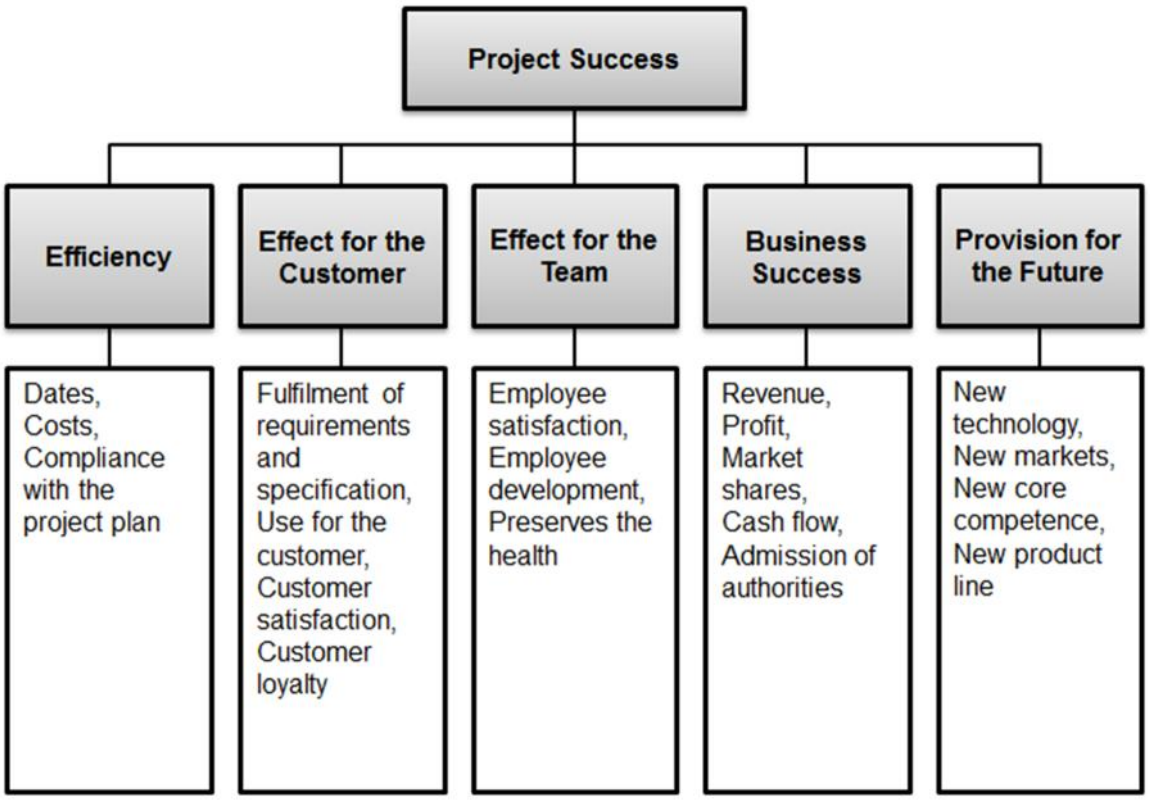


Figure 2.9: Five dimensions (Shenhar & Dvir, 2007, p. 27)

Meyer & Reher (2016) argue that in project management the boundaries of responsibility and competence must be exactly regulated and documented. Thereby it is necessary to clarify where the responsibility of the involved persons starts and ends. The project manager is responsible for the compliance of the agreed terms in the project order. Accordingly, project criteria have to be arranged at the beginning of the project. Shenhar & Dvir (2007) describe some beneficially criteria for the order clarification.

- Criteria that determine the success of the project should already be a guiding factor in the selection of the project and should be named in the project charterer. Additionally, the description of the characteristics and alarm signals may be helpful to know when the project is a failure.
- The criteria of measuring the project success must be fundamental elements of the project plan.
- The arranged criteria of measuring the project success must be controlled and evaluated in project reviews.

Furthermore, the targets for the project are derived out of the project criteria. Meyer & Reher (2016) hold the view, when talking about valuation, project targets must not be missing. The triple constraint of Motzel (2010) describes these project targets: A specific result should be realised at a certain date and with given resources. Targets are defined striven conditions for the future, which should occur as results of decisions (Bea et al. 2011, p. 112). Meyer & Reher (2016) point out, that goals have several functions and make a valuation possible. The most common ones are shown below.

Control functions: The project manager has to ensure that the project is on the right way and follows the project plan. The achieved stages and results are juxtaposed to the planned results and evaluated.

Coordination functions: Projects have a workflow that is represented by process sequences. The process can be coordinated across departments, linear, parallel or simultaneous. In addition, predefined project goals for the employees are defined as guidelines for the temporal and technical order processing.

Selection functions: The selection is the preliminary stage for the decision. Decisions are necessary for achieving of the respective project target and for the successful project coordination of the targets. They serve the employees as a basis for deadline reliability and for project order progress.

Motivation functions: The on time achievement of targets encourages motivation and teamwork. Achieving of project targets and positive order progress can also point to active teamwork with high employee motivation in the company. Motivation has a very high value in the operating result.

Since the objectives of the project are constantly changing, this is due to the fact that at the beginning of the project visions, wishes, strategic targets or others can determine the initial situation. As the project progresses, the sub goals can vary or reorient by the customer's additional information or by problems in the working process. Therefore, the goals should always be updated and checked by the project manager. This means that project targets become requirements which must be clearly and unambiguously defined, fulfilled and checked by the project manager and the project team. (Meyer & Reher, 2016, p. 11)

According to Meyer & Reher (2016), the triple constraint aims at the balance between performance time and costs and also stands as a concept for good, responsible project management. This is shown in figure 2.10. The fulfilment of the scope of the project in the required quality according to defined requirements at agreed dates and keeping the budget is equivalent with success:

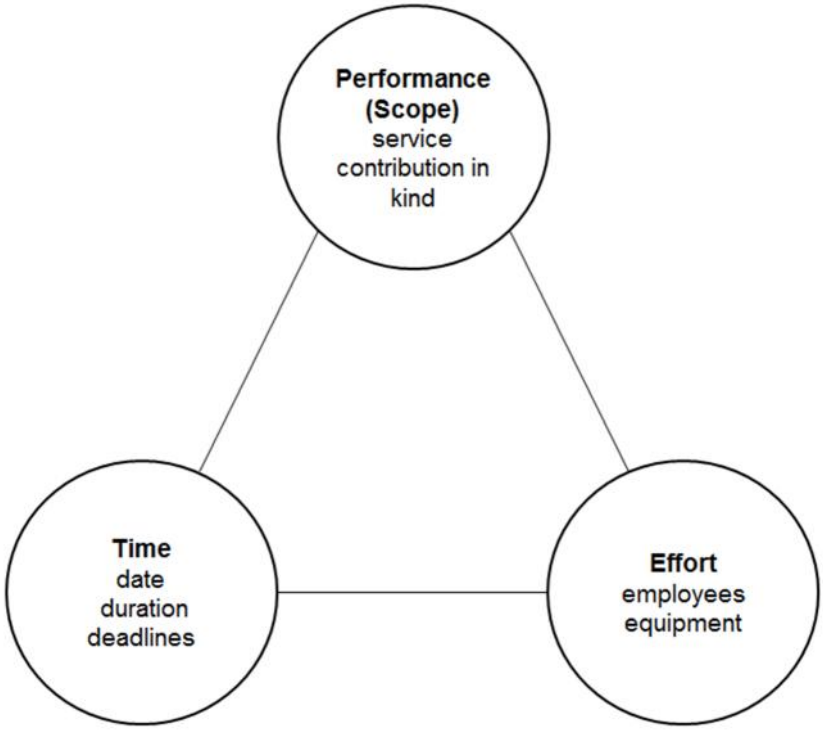


Figure 2.10: Triple constraint (Motzel, 2010, p. 198)

Scope: The scope of delivery and scope of the project describes products, services, reports, conditions and their quality. These results should be available at the end of the project or at a certain time in project process. In the specification phase the description of the quality takes place. Furthermore it determines to what extent such requirements are met which are relate to the entire life cycle of the developed system including the utilization phase and the decommissioning. Therefore important documents are the project order, the specification and the requirement specification. For the implementation the requirement management, quality planning, project structure planning, change and configuration management are significant methods.

Time: Projects are limited in time and each project has a final date. On the one hand the customer sees here the delivery date on the other hand the internal customer the final date. As a consequence final report is available and the cost centre is closed. Within the order further important dates, first stages and millstones have to be defined.

Effort: For the realization of the project a limited amount of resources are available. In projects, personnel expenditure often plays the leading role. In addition, costs for materials, machines, travels, licenses and finally financial resources must be taken into account. The quantities used and the costs are agreed with the customer and form the budget, which must not be exceeded.

These three points of the triple constraint according to Meyer & Reher (2016) influence each other and compete with each other. Exchange relations between cost, performance and time are the key factors. This exchange must be optimized at any time during the project process, in the planning and implementation. Projects are often characterized by the discussion of alternatives and as a consequence decisions, which are large-scaled in the project's initial phases. Since in early phases the costs are still lower, this time slot should be used and afterwards the details of the alternatives should be considered as a consequence in later phases. The resulting decisions should be oriented on triple constraint. If this is not sufficient for a decision, a supporting value analyses can be used.

The decisions are based on information and data which enable the evaluation of the alternatives, however the evaluation is often made more difficult by the concurrent goals between cost, performance and time. The decision-making process is complicated by evaluating and balancing long-term effects. It is therefore recommended to clarify the priorities of the triple constraint at the beginning of the project. The following possible questions to clarify the priority of project targets are:

What is more beneficial to the project?

- If the project is finished earlier than planned?
- If the project costs less than planned?
- If the range of services is bigger than planned?

What is the major damage for the project?

- If the date is exceeded?
- If the costs are exceeded?
- If the scope of service is reduced?

Depending on the situation and the means used, different points are given new priority in the project process. For example, the date of development projects often has high priority from the start. The later the market entry takes place the lower will be the use. This results in the loss of leading edge against the competitor, a too late realisation of sales and consequently a lesser one. In order to meet deadlines, to avoid cost overruns and to realize agreed project scopes, it is necessary to set priorities. In doing this the focus is on the design driver which emphasizes the property which bring the highest customer benefit. (Meyer & Reher, 2016, p. 16f)

2.7.3 Initiation of projects

A structural approach is the fundamental of each management. Therefore in project management projects are disassembled and split up in single partial steps. These steps are called phases. Each phase is characterized with a task and accompanied by a transfer point or a sub goal. These goals are called milestones and are referred to the next phase. To gain a better understanding of the situation and to keep the overview in project management, project plans are made. The plan should include appointments, requirement definitions, risk management and a structure plan. This is the so-called baseline of a project. (Meyer & Reher, 2016, p. 14)

Rupp (2013) states to that, a baseline is a reference configuration. A baseline explains the content and the condition of information at a certain time by reaching a milestone. The main characteristic of the baseline is that information can´t be modified as a consequence it is possible to restore the status or to receive inspection at any point of time. (Rupp 2013, p. 99) With each change, a new baseline is created. Several reference configurations are created during a project, but only one is valid. According to DIN 21500, a baseline is the basis for monitoring and controlling the implementation of the project (E DIN ISO 21500: 2013-06, p. 5).

Project phases generate a kind of macro strategy by proceeding with a thorough planning and consequent realization. This is done when, during the planning process, the project is divided into manageable sections and tasks, so that the complexity of the project is controllable. The DIN distinguishes five project management phases (DIN 69901-2:2009-01, p. 11). PRINCE2® divides the project phases into 3 sections, initiate, subsequent phases and end. This creates more space for the project phases. Figure 2.11 gives an overview of these two types. (Meyer & Reher, 2016, p. 15)

Haberfellner et al. (2012) hold the view that one should always proceed from rough into detail in a step-by-step process during the processing of projects. The project is then processed in planning, decision-making and realization processes. The decision-makers must be involved in the phase transitions in such a way that a hierarchical integration of the project tasks and results into a superordinate strategic overall concept is made possible.

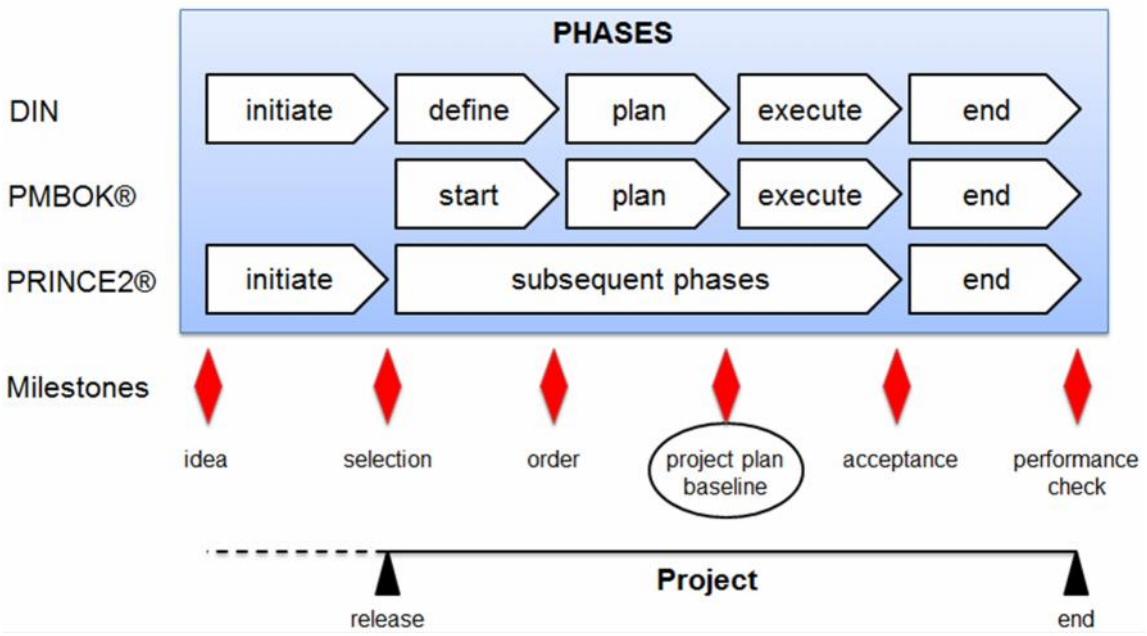


Figure 2.11: Project phases (Meyer & Reher, 2016, p. 15)

Motzel (2006) describes the project phase as a time segment of the project procedure, which is delimited by other sections. Project phases represent agreed activities and certain results. They are strongly oriented on specific project contents. (Motzel, 2006, p. 137f)

Generally a milestone follows the end of a project phase. The successful achievement of a milestone is defined, for example, by the acceptance of certain delivery items and the release of the next phase is only granted in the case of the assumed results. If on the one hand, the decrease is not positive, reworking or repetition must be initiated or on the other hand it results in the abortion of the project.

Becker et al. (2013) point out, that milestones have to be considered as corner dates, based on the performance target of the project. By calculating the deadlines by means of individual activities of the project plan and available resources, it is possible to determine a schedule with the desired time for the project end. In doing so it is important to take the resources and the integrated consideration of dates as precisely as possible into the project planning, as on the basis of this specifications milestones and thus the project end are determined. More detail description of milestones follows in chapter 2.6.4.

Two types must be distinguished when planning phases. On the one hand, general phases which have turned out to be reusable in the course of the project development. The common used models of general phases are PRINCE2® and the PMBOK® as shown in figure 2.11. On the other hand, project-specific phases have emerged with their uniqueness and special adaptation to the respective project, including new milestones. Figure 2.12 shows an example of such a specific model. (Meyer & Reher, 2016, p. 18)

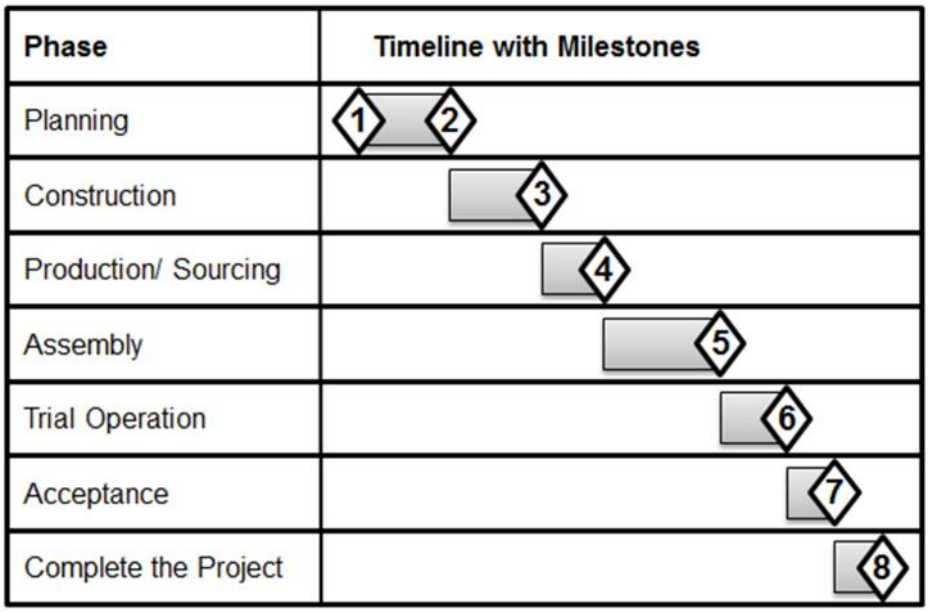


Figure 2.12: Specific project phases for a robotic cell (Hab & Wagner, 2013, p. 94)

Phase model:

There are a variety of different themes in which phase models are used. Not only in project management but also in team development, system engineering or the change and development of social systems according to Lewin (1953), are phase models used for the description. All phase models are similar in shape to the fact that only thoughts and ideas exist at first. In order to get a clear picture, the ideas are first concretized, then put into shape and further specified. The project begins, energy is generated and the implementation is carried out, followed by a final phase in which participants slowly retreat and evaluate the project retrospectively. (Bar-Yoseph & Zwikael, 2007 p. 42)

Meyer & Reher (2015) point out, that with regard to project management, certain tasks have to be carried out within the respective phases. In the context of projects, we distinguish five general phases.

Initiation phase:

This phase is dominated by the management, since this is the responsibility of the internal contractors. This phases end with the decision wheatear to continue or not. The focus is therefore on a selection decision, because different solution alternatives are conceivable and project ideas compete with one another. This selection decision included, among other aspects, assumptions about the expected value contribution, possible risks and opportunities and the assessment of the stakeholders. When the decision for the project precipitates positive, the release is given to specify a target definition. This is developed in the definition phase and is documented in the project order. According to Meyer & Reher (2016), the initiation is not one of the primary tasks of the project manager and the project team. The project idea depends on the origin, either from an external customer himself or from the management of the organization and in some cases out of a running project. Initiation is part of a project and the manner of initiation is important for the project success. Given this knowledge base, it is important to consider that the management or head of department has the responsibility of this phase. The project manager and the project team only begin to intervene in the definition phase or sometimes even when the project order is fixed.

Definition phase:

As mentioned in the previous phase, project manager and project team come here in races. The decision for a project has been made, so the internal project order is prepared and approved by the end of the phase. Other key areas are stakeholder management, the definition of roles, responsibilities in the team and team development.

Planning phase:

In this step, the project plan or project management plan is created. This means that the project manager must ensure the project requirements, the tasks to be performed, the planned throughput times and the completion in the project plan. Strategic approaches of the company and project time table must be coordinate with each other. (Becker et al., 2013, p. 20f)

According to DIN ISO 21500, the **project plan** or so called baseline contains basic plans for the project implementation. The content, quality, deadlines, costs, resources and risks are discussed in the plan. The project plan should list the results of all relevant project planning processes and the measures for the implementation, control and supplementation of the project. The project content can vary in the project plan depending on the subject area and scope. (E DIN ISO 21500: 2013-06, p. 22)

On the other hand the DIN ISO 21500 describes the **project management plan** as a document or a collection of documents which specify how the project should be implemented, monitored and managed. In most cases it is applied to a risk- or quality management plan or to specific parts of the project. To sum it up the project management plan includes the roles, responsibilities, organization and procedures for the management of risks and problems, controlling changes, scheduling, cost planning, communication, configuration management, quality and health protection, environmental protection, safety and others. (E DIN ISO 21500:2013-06, p. 22)

Reuter (2011) describes project management as the conscious design of the project happening. Therefore the project management must be coordinated with the project. The project management plan is made of the consideration of the project management processes and is carried out briefly and tightly depending on the scope and the sector. This can include parts of plans, planning documents up to a project management manual which describes the general approach in the company and has to be adapted to the specific project. In general, therefore, one must distinguish between project plan and project management plan. In small projects, however, only one project plan is used as this should include the project management plan. Good project management is characterized by simplicity and only a valid project plan. Meyer & Reher (2015) mention following documents which must be included in the project plan:

- Internal project order and milestone plan
- Stakeholder register
- RACI chart for the definition of responsibilities
- Team development plan
- Requirement definition
- Work page description
- Risk register
- Quality plan
- Schedule and timetable
- Costs projection

Realisation phase:

In order to keep the project in the realization and implementation phase on course the control activity of the project management comes at this stage into force. In other words, it is important to ensure that the project is carried out as planned. Plans are used as a signposting and flow control and can be changed as required. The main focus now is on topics such as: Advancing the work, initiating the work, identifying the progress achieved, testing, reviewing results and adapting plans if it is necessary. At the end of this phase, the product is created and ready for the customer to complete the project.

Final phase:

Temporal limitation is a main feature of projects. To complete a project, some points must be considered: Tasks such as reflection on the project, final documentation, lessons learned, assessment of the achievements, return of the resources, archiving of the results must be done. Finally the project, the project team and the project manager must be evaluated based on predefined criteria.

Meyer & Reher (2015) point out, to apply these five general phases to a particular project, the individual milestones and tasks for the respective phases must be named and described. The milestones describe transfer points, in which certain results must be available in order to be able to advance with the next phase. Within the scope of the target definition for the project order, it is customary for the client and the contractor to discuss the process and the milestones. In the course of the order clarification a kick-off meeting is offered, in which the process and the milestone are carried out with the project management, project team, customers and management. Additional in the first meeting, the course and the schedule can be discussed in detail and measurement results and test results can be decided.

2.7.4 Project classification

Jakoby (2015) says, that there are no project management methods that are always appropriate for all project because there are very different types of projects. A project involving several thousand people over several years requires different planning and organizational methods than a project with few participants and a few months´s duration. In order to decide which management methods are suitable for a project and which are not, it is helpful to classify projects and then assign the appropriate methods to the different project classes. Projects can be classified to certain criteria. Take for instance the project size which is an important criterion and thus plays an essential role. The numbers of participants, the duration or the costs work well as measure values for the project size. For this purpose the personnel expenditure, measured in person-years is used as a suitable measure value. This includes the number of participants as well as the duration. In addition, in the case of personnel-intensive projects, the project costs are largely determined by personnel expenses. Consequently, the parameters that are responsible for the project size are determined. So far there is no standardized measurement procedure for the personnel expenditures. The idea is that a whole year minus weekends, holidays, absences by illness and after deduction of the vacation (about 30 days) remain in total about 220 working days. Depending on the literature different approaches of how to split up the year are given. Balzer (1998) holds the view, that a year is divided into 10 months with 20, 8 days per month. Given this knowledge base, Jakoby (2015) summarized this and defines as a compromise between inconsistent reality and easy handling three measure values for the personnel expenditure.

- The person day (1 PD)
- The person month (1 PM = 20 PD)
- The person year (1 PY = 11 PM = 220 PD)

There are different opinions when a project is called "big" or "small". Jakoby (2015) argues that this is no surprises as it is de facto a continuous scale. However, if one assumes a division into five sizes, both the number of persons involved in the project and five sizes during the project runtime, certain project sizes are preserved. The results are shown in figure 2.13.

PY	Involved Persons				
Years	1	3	10	30	100
0,1	**0,1**	0,3	1	3	10
0,3	0,3	**0,9**	3	9	30
1	1	3	**10**	30	100
3	3	9	30	**90**	300
10	10	30	100	300	**1000**

	Size	Costs
very small	< 0,5 PY	< 100 T€
small	0,5..5 PY	100T€..1 Mio€
medium	5..50 PY	1..10 Mio €
large	50..500 PY	10..100 Mio€
Very large	> 500 PY	> 100 Mio€

Figure 2.13: Classification of projects (Jakoby, 2015, p. 15)

Projects with few participants and very long run-time or projects with a very large number of participants and a very short runtime are rather rare, so that most projects are located near the diagonals. If you define well-suited boundaries, you get a rough classification, where projects up to 5 PY can be described as "small" and projects with more than 50 PY as "large" and intermediate as "medium". In addition to that, it is also possible to differentiate downwards ("very small" <0.5 PY) and upwards ("very large"> 500 PY). In order to determine the costs, Jakoby (2015) assumes that a project size of 1 PY causes costs of 200 thousand euro. The pure personnel costs are estimated at half of this sum 100 thousand €/PY. Further estimation 10 thousand €/PM can be assumed based on (1 PY = 11 PM = 220 PD). These measure values are rough approximations, which can differ significantly in the specific case. Therefore the use of machines and materials has a considerable influence. As a consequence this depends on the type of the project. The use of the personnel cost indicator is still quite clear, as it allows an initial quick classification of the project size and the associated costs. For a more accurate estimation of the costs, the project type must be taken into account to correct the cost characteristic.

According to Jakoby (2015), another important criterion for classification of projects is the project object. Depending on the object of the project, a distinction between product or service-related projects can be made. Industries in which a great deal of project work takes place are the construction and construction of machines as well as the development of new chemical or biochemical products, the development of electrical and electronic devices and the development of software.

On top of that, Jakoby (2015) added a third classification criterion, the type of project. This should explain the nature of the activities in the project. New research findings are being sought in a research project. It is often uncertain whether results are achieved or not. Research projects are characterized by a great deal of novelty, by more abstract objectives and a high degree of uncertainty in planning. In contrast to this, there are development projects which are slightly less uncertain. A new device, a machine or a program is developed or constructed. The degree of novelty is very high. However, the objective should be more concrete and the feasibility safer than in research projects. On the other side development projects can also create great uncertainty, which often manifests itself at the dates and costs. The next level is projecting projects, which consists in the form of plant construction or designs of software application from existing modules. Such projects have a low to moderate novelty. In most cases, the project is based on a customer order whose scope and aim are usually unambiguous. The main problems are to reconcile contradictory requirements with regard to functionality, deadlines and costs. Another project type that is often used is organizational projects. In this case operational procedures or organizations are to be modified or rebuilt. The project object does not only consist of the interaction and the

implementation of the people involved in the project, but also of the cooperation within the organisation. Therefore the particular challenges of organisational projects are the mental processes among the project participants. The last project type that is listed here is the investment project which has a high degree of maturity due to the frequency of project management. Take for instance the construction of large and unique buildings, roads, dams, islands, canals, airports or production facilities. A particular feature of investment projects is the high cost budget, which is caused by increased demand for machinery, raw materials and components, which requires special attention during planning and control. (Jakoby, 2015, p. 15f)

2.7.5 Problem solving process

As mentioned in chapter 2.3 for the definition of processes, each process requires an input that consists of the problem-finding or the problem-knowledge and the desire for problem solving, which can subsequently lead to an output, the problem solving (Leavitt, 1979, p. 82f).

In this chapter, an attempt is made to view this sequence through a project because each project triggers a problem-solving process with a problem as INPUT and a solution as OUTPUT. A management project is also a problem-solving process that leads to the goal through targeted management. On the basis of problem-solving, project management means the planning, control and conclusion of problem-solving processes for projects in order to achieve these objectives in a timely and cost-effective manner. (Leavitt, 1979, p. 82ff)

Figure 2.14 shows that a project after problem discussion consists of a problem-solving process, which is embedded in the project management. Jaboby (2015) says, since projects can always lead to schedule and subject-related deviations, a temporal overlapping of activities and possible loops are included in the process. In this case, phases with different time sequences and work can be generated. In the initial phase of the project, the problem discussion and the solution cause the creative effort to analyse the problem and the following definition of the project. The time and resources required for the project processing increases with the ongoing project. In the realization phase, the intensity maximum is usually reached, and if the customer is successfully implemented and satisfied, this decreases to the project end. However, the delay in the execution of the project, which can lead to a loss of contract with the termination of the contract, poses major problems. As can be seen in figure 2.14, the process steps and their dependence in the individual phases are roughly sketched. The procedures can be partially sequential or parallel and, if necessary, have to be repeated several times with the help of loops. Such processes cannot always immediately begin and end, but also can flow into each other.

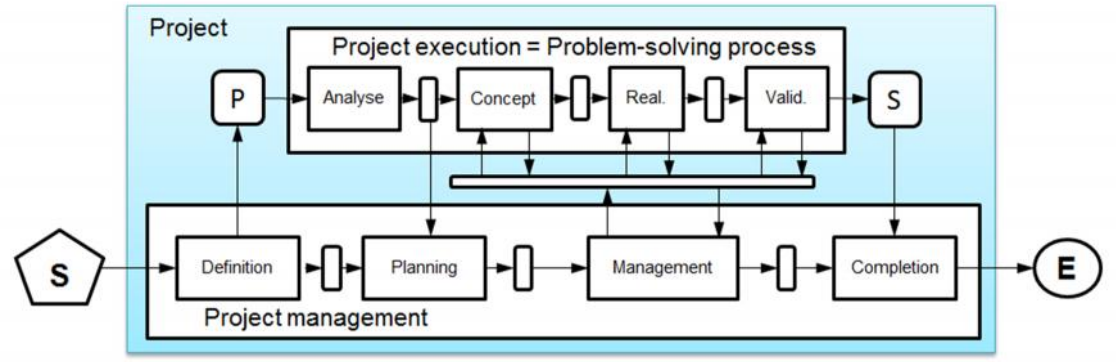


Figure 2.14: Construction of a Project (Jakoby, 2015, p. 31)

Due to the time limitation of projects, a controlled project sequence is important. This is where the concept of project management-life-cycle comes into play, which describes the organizational co-operation and the timing of all activities in a project as a cohesive unit. A project can consist of a larger cycle or several partial cycles. Large projects often consisted of several cycles. Then every single project phase forms a closed cycle. Due to its structure, a project phase can also be seen as a partial project. Therefore partial projects, in turn can run sequentially in procedures, but also run in parallel. (Jakoby, 2015, p. 28ff)

2.7.6 Interfaces

In projects there are often a large number of participating organisations. For this purpose projects are organised in a work-sharing manner and work results have to be coordinated. In other words, all the work, methods, and participating personell are related and interrelated. In order to function as a whole unit, all the available results must match in the practical project work. This is where interfaces and interface management come into play. Interface problems can occur in a variety of areas. Take for instance interdepartmental dependencies with non-performed work and time delay which reject the blame. The result is a delay in time which will have a delayed effect in the later period and higher costs for the company. Or the classic Italian holiday with the wrong plug for the sockets and unable to charge the mobile phone. Electricity cannot flow and the system does not work. In order for a system to work properly, the interfaces to its environment as well as the interfaces between the subsystems must be coordinated with each other. (Meyer & Reher, 2016, p. 29f)

Motzel (2010) describes interfaces as:

- Connections or Interfaces between systems → from project to project environment
- Connection or interfaces resulting from the work processes in the project. They arise between system components.

As to Meyer & Reher (2016), interfaces do not have smooth transitions but rather overlaps, misunderstandings, gaps or misinformation. Therefore interfaces should be designed to ensure the effective connection between the individual systems and subsystems. Such as a computer system in which the various components are connected by cables with suitable plugs and connections. For a smooth process, interface agreements have to be made:

- Rules and responsibilities for the transfer of defined intermediate or final results
- Clear agreements on the appearance of work package results
- Clarification of mutual expectations and making decisions, that have been accepted by the parties
- Consequences for non-compliance

In the following section you will find a list according to Meyer & Reher (2016) of known interfaces that occur in projects.

Client & Contractor: One of the most important interfaces in project work is the client and contractor connection which is generally served by the project manager. In this configuration the client is the customer who has to be satisfied by the contractor and his project team. The customer expects in this interface, to be able to contact the project manager at any time and receive answers to his questions. In the event that the customer would like to directly consult the project team or individual project staff, this should always be done with the project manager. According to the slogan one voice to the customer, this should be taken over by the project manager.

Project & Specialist Departments: This interface between the project team and the specialist departments often entails high conflict potential and communication problems. The project team manages the project, keeps the contract and manages the financial resources. The specialist departments are often the home of the employees who carry out a lot of work. From this point of view, this is a company internal client contractor relationship. The evaluation of the required working effort and their priorities leads to disagreements in the work. At the same time, however, it is a mutual dependency relationship because everyone needs someone else. These interfaces must be handled carefully and emotionally from the perspective of project management.

Project & Internal Client and other projects: This interface is mainly managed by the project manager. In regular internal reviews, he reports to the management about the status of the project in terms of performance, deadlines and costs, presents problems and the main risks and provides a forecast of the technical and economic success. In addition, the lack of resources caused by a variety of ongoing projects at the same time in the company should be also discussed. Points for this would be staff, test stands and overtime. For larger projects, the company strategy and management decisions that are relevant to the project, such as make-or-buy decisions, should also be considered.

Project & User: Often the client is the only one with contact to the user, so the interface between the project team and the user is usually not available or visible. Consequently, the team does not know the user and his needs. Therefore, from the point of view of the project team and with regard to the project result, it is to be hoped that all criteria and requirements of the client with contact to the user, are cited completely in the specification. In the best case the project team is allowed to make contact with the users and also directly integrate the requirements of the user into the definition of the requirements.

Project Management & Project Performance: It is assumed that the deeper the structures are, the more accurate the estimates are possible. At the same time, the number of interfaces increases. This leads to theoretically 45 interfaces for ten work packages and up to 190 interfaces for 20 work packages, if each work package has an interface to each work package. This makes it clear that the detailing of structures has to be restricted. The goal is to minimize the interfaces and to reduce the coordination effort. Additionally, the description and the processing of the interfaces between the work packages are decisive for the project, the product to be delivered and the quality. The project success depends on the extent to which the interfaces are identified, minimized and correctly designed. Figure 2.15 shows how a workpage is integrated in a project phase.

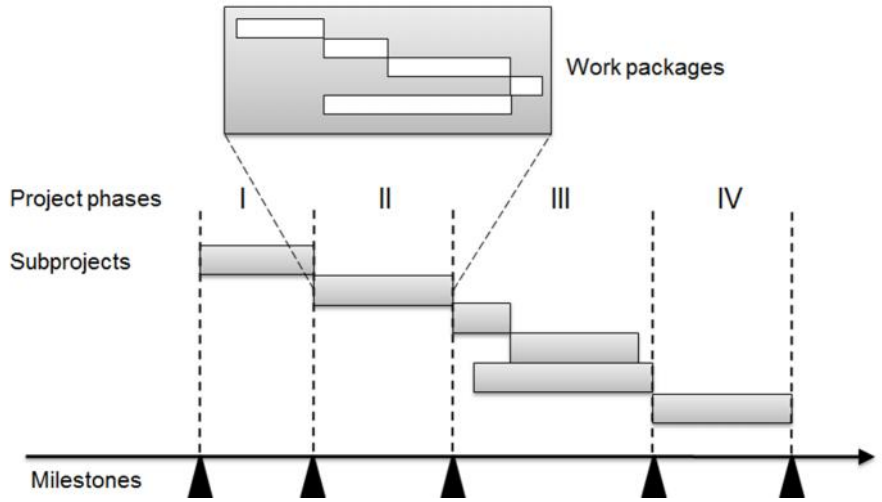


Figure 2.15: Work packages

2.7.7 Claim management

Claim management is the management of the claims of additional services, remuneration, delays of contractual partners. According to DIN 69901-5, a claim is a entilement raised by a contractual partner due to changes or deviations. Felkai & Beiderwieden (2015) hold the view, that the subsequent negotiation of such requirements is a legal task, which is to be assigned to the contract management. In order to derive reasonable claims from the contracting party, to clarify and implement them by mutual agreement, the expected changes and their economic effects are assessed. For this purpose, contract management relies on the operational documentation system and works closely with the configuration or change management. Subsequent requirements can be asserted by both contracting subscribers after conclusion of the contract. The reasons for this can be varied:

- Subsequent **claims by the client** against the contractor usually result from fails of the contractor. Take for instance a lack of fulfillment of contractually agreed obligations
- **The contractor claims** against the client are normally derived from any changes or supplements to the client. Take for instance modifications of the product after the desgin freeze

In the case of change requests of the customer, the claim management system initiates the following process:

1. Clarification of the change requests (which additions, specific part requirements)
2. Record and documentation of changes toward the contract
3. Planning and post-calculation of the implementation of the change requests
4. Submit an offer
5. Negotiate and conclude an additional contract
6. Verify the fulfillment of the obligations of both contracting subscriber

2.8 Process for product development projects

Berry (1990) describes, that a process is a methodology, which is developed to replace the old habits and to guide the activities of the company year by year. It is neither a visitor nor a temporary matter. It is not a matter of toleration and disappearance.

Many companies are struggling with the effort to achieve a process of world class for the successful implementation of products. They are constantly confronted with factors such as increasing pressure, time reduction of product cycles and at the same time increasing the success rate. As a result, more and more companies are turning towards to processes for new processes, the Stage-Gate Systems. This is an attempt to manage, accelerate and guide the effort for the new products. The result is a systematic process according to a scheme or a route to direct a project from the idea to the completion. This chapter should describe the idea of Robert Cooper about a conceptual and operative model for the effective and efficient implementation of project. (Cooper, 2002, p. 125f)

2.8.1 Targets of Stage Gate

Cooper (2002) says that many well-known companies from different sectors have introduced the Stage Gate method. For example, Guinness, Unilever, LEGO, IBM, ICI, Air products, Kodak, Polaroid, Microsoft, VISA, Royal bank and many more. The process is working. The stage gate process is only a tool for process management. But what´s the secret behind the stage gate method and how is the process used?

According to Cooper (2002), seven special targets determine the method of the process.

1. **The quality of implementation:**
   Process details have to be worked out carefully to ensure a high quality of the output. The aim is to increase the quality of the execution. In this case, it is important to concentrate on the completeness of the process. Every activity that is important for success must be taken into account. Secondly, focus on the quality of the activities. Each activity must be performed with the highest quality. To ensure this, quality controls and sampling should be carried out. Finally, concentrate on the interfaces and weak points of the process.

2. **More focus and better prioritisation:**
   Due to a lack of necessary forces and means, inadequate project evaluation and lack of priority assignment or simply by uncertainty about the abortion or continuation of the project, this indicates too weak distinctly gates in the process. Therefore the information input is bad, decision criteria are not clearly defined and thus no coherent decision can be made. The solution to this is to focus the gates more closely in the process and to subject them to specific characteristics and criteria. Additionally, when the gate is reached, a tribunal should decide on resources up to the abortion of the project.

3. **Parallel process work with high speed:**
   It is extremely difficult to shorten the times in a project on the one hand and on the other hand to increase the effectiveness of the development with lower error rates. In order to be less susceptible to errors, the process must be accurate and consequently longer. At this point the parallel process work comes into play. This allows a quality-oriented and rapid process. Thus, it is possible to perform several works at the same time by project team employees. The result is a lower probability of poor performance due to lack of time and additionally the pre-defined time interval drops in the project. The process is consequently cross-divisional.

4. **Cross-divisional team:**
   In many companies the process for a new product is characterised as multifunctional. This means that in different areas the employees are actively working for a project. For companies, it is a matter of creating multifunctional work, but often they are not aware that they have no real cross divisional teamwork. In the following table 1 are a few examples which should distinguish the difference between a real cross divisional project work and a prescribed.

Prescribed	**Real**
Team members come to the meeting but they are not representing the interest of the project team but the interest of their department.	The team is cross divisional and occupied with employees of different departments who have time for work.
Promised tasks cannot be fulfilled due to normal activities in the department; in addition they are covered with work by the department boss.	One team leader is elected who is responsible for the whole project and is free from other tasks.
Team members receive a high responsibility with a low authority, because decisions are still made by the department boss in the background.	The whole team is accountable to the supervisor. Also bonus payments and variable salaries are oriented towards the performance of the whole team.

Table 1: Diference between real and precribed cross divisional project work

5. **Strong market orientation:**
   It often lacks at market orientation and market assessment. In order to optimize the success rate of projects, market orientation should be an integrated part of the process. From the beginning to the end of the project, the marketing must play a decisive role. Some examples of supportive marketing activities are customer-driven idea generation, market assessment in advance, competitor analysis, customer reaction during development, test of the concept and test by the user.

6. **Better homework at the beginning:**
   Success or failure of a product is already noticeable in advance. Carefully completed homework at the beginning and a clear product definition at the start, mark the most successful projects. These run-up activities contribute decisively to the later development phase, which provide the entrepreneurial data necessary for a successful implementation. Nevertheless, most of the financial resources are always spent in the middle and back sections of the project. Consequently, the performance quality decreases at the beginning. In order to successfully implement projects, there are essential activities that should be dealt with in advance: Such as technical forecasts in advance, market assessment in advance, detailed technical forecasts, estimation of production and implementation, estimation of resources and potentials and entrepreneurial decisions on the overall project.

7. **Product with competitive advantage**
   A frequent mistake of companies is that the effort for the superiority of the product is not sufficient anchored in new processes. In order to incorporate this striking success factor of the superior product into the process, some things have to be considered. Each gate should have a special criterion for product superiority. In addition, the product definition should not only include challenges of performance and technical specifications, but also an aimed consideration of the value of the product for the customer.

With these seven targets the method of stage gate can be implemented in a current process.

2.8.2 First generation

In the 1960s, for the first time in the course of military and NASA projects, processes with a phase-based reporting system were published, which were called processes of the first generation. These processes were derived from purely technical projects and had innumerable tedious controls at reporting points. The use of these controls was to ensure the successful execution of a number of key functions. In other words, the process consisted of measurement and control methods, which ensure an efficient operation and compliance with the plan. In addition, it must also be ensured that the tasks are actually fulfilled and that the deadline is met. The first process types were such cascade processes as are often used in software development, see figure 2.16.

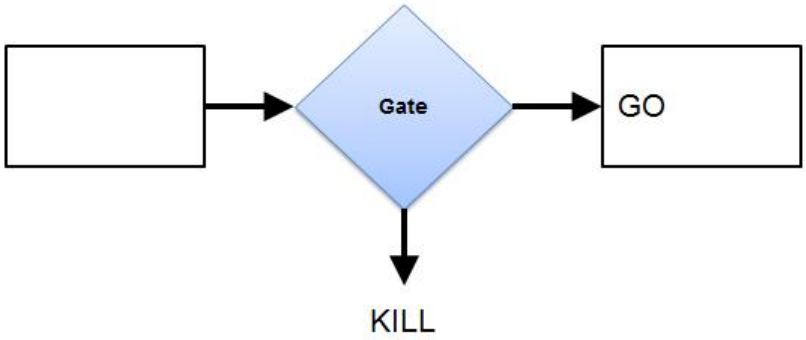


Figure 2.16: first generation of process

These processes were primarily oriented towards the technical direction, such as design and development, and were neither cross divisional nor taken into consideration for marketing and production in the team. They were built exclusively on the control function which was seen by employees as very time-consuming. The Stage-Gate-Process of the second generation has a different fundamental structure than the process from the sixties. Like the process of the first generation, the Stage-Gate-Process has individual phases with subsequent control points. However, in the Stage-Gate-Process of the second generation, the critical points of the first process are avoided. For example, the control points should not only be defined by one decision-maker and also a cross divisional method should be strived. The process of the second generation, which is described in the following chapter 2.8.3, shows a strong co-operation of the customer, the integration of good practices and parallel working methods. (Cooper, 2002, p. 165)

2.8.3 Second generation

The process of the second generation from Cooper (2002) splits the innovation process in several predefined sections. Every section or stage is subdivided into predefined, cross divisional and parallel activities. Each new stage is entered through a previous gate. The gates are used as a checkpoint for quality control, as a control point for the process and for the decision about the abortion or continuation of the project. This construction of the structure with stages and gates is called “Stage-Gate-Process”.

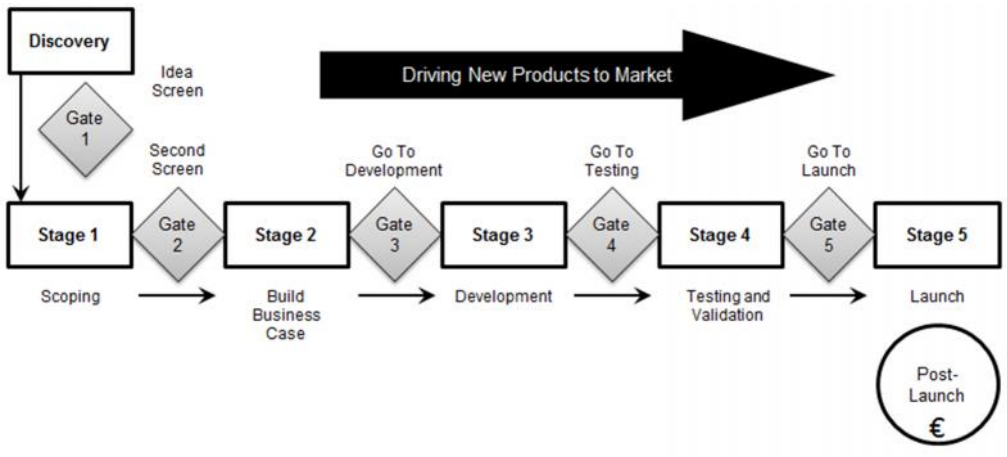


Figure 2.17: Typical Stage Gate Process (Cooper, 2002, p. 146)

Through the Stage-Gate-Process, a project is divided into five or six clearly identifiable stages, which are designed in the way that sufficient information for a decision is available to go through the

gate. Every stage is cross divisional structured. Because of the cross divisional structure of the stages, is there neither a Research & Development stage nor a separate Marketing stage. The stages are designed in such a way that each one consists of a certain set of parallel activities. These are managed through project employees of different functional areas in the company and integrate the seven targets of the stage gate method as described in chapter 2.8.1. With the help of these activities, information can be gathered and the degree of uncertainty reduced. The more the project progresses, the higher will be the commitment. Figure 2.17 shows a typical stage gate process of Cooper. First of all, it´s start with the discovery or so call pre work, to identify good opportunities and ideas. The next stage is the scooping to analyse the project in advance. Then the following stage starts with building a business case. That means to carry out detailed investigations with research work in the technical and market-related area. Further a definition of the project, justification and a plan. The development stage is the next which includes the detail design development and an elaboration for upcoming production processes and implementation processes. The following stage is called testing and validation. In this stage, all the tests and trials are taken into account in the company and by the customer and additionally the marketing and the production are checked. Finally, the launch includes start of serial production, sales and marketing. Additionally, the strategic elaboration should be mentioned, which covers all stages and therefore not listed. (Cooper, 2002, p. 146f)

Verworn (2005) holds the view, that creating a common understanding of the course of the process is the main advantage of the stage gate process. Furthermore, clear objectives are also set, on which the projects are measured when entering the gate. After each phase, a check is carried out. In this way an uncontrolled approach to the next phases is clearly structured in order to increase the efficiency and effectiveness of the individual phases. But the Stage-Gate-Process is also criticized regarding its sequential design. The reason is that the processes can be delayed because missing information at the gates prevents a further development of the projects in other areas. As a result, Cooper (2002) introduced the process of the third generation to ensure more flexibility.

2.8.4 Third generation

In order to make the gates less strict and allow overlapping of phases, Cooper (2002) has introduced the Stage-Gate-Process of the third generation, to make the process even faster and allocate more efficient resources. Given this plan, six fundamental principles were included in the third generation.

- **Fuzzy Gates**
  With this expansion type of gates, one would like to extend the classic divalent decision-making principle of gates. Gates can not only have the status Open and Closed as in the second generation, but also intermediate states. In other words, the decision to continue a project if a specific event will takes place in the future. Such a decision is decided upon in the absence of relevant information and is linked to a later shown positive result. For example, if a project reaches a gate and the established results are not yet complete, such as the clarification of a legal question, the stage gate process of the 2 generation will shut down the gate until it is clarified. As a consequence this has the effect of a reduction of process speed and possible changes in time. Here, the process of the 3rd generation is faster, in such a case the permission for a continuation is given. The missing result will be included in the next stage, and when the result is reached it will be confirmed again before a tribunal. In case of a satisfactory clarification, the next stage will be completely released, but in the event of negative clarification, the project will be examined and accordingly cancelled or redesigned. To sum it up, fuzzy gates give the possibility to continue a project despite missing information, but in spite of this it is checked whether the information actually arrives and meets the requirements.

- **Fluidity**
  The process of the third generation is adaptive and fluid. There are no fixed conditions of certain activities in the individual stages. Rather, one speaks of an overlap or a continuous flow of the stages. Take for instance activities that are only dealt with in the next stage can be gained by an overlap in an earlier phase. This is useful for activities that extend over a long period of time. Thus, a new stage begins to run even though the previous is not yet completed. Nevertheless, the gates remain as control points, including their budgeting powers, for the respective stages. Before the tribunal comes together, however, a large part of the tasks required in the respective stage, mostly those which are building up for the next stage, should be fulfilled. Figure 2.18 gives an overview of the functioning. This approach is closely related to the fuzzy gates. At this point it should be clear that the fluidity refers to the overlapping of stages with gates in comparison to the fuzzy thoughts which refers only to the gates.

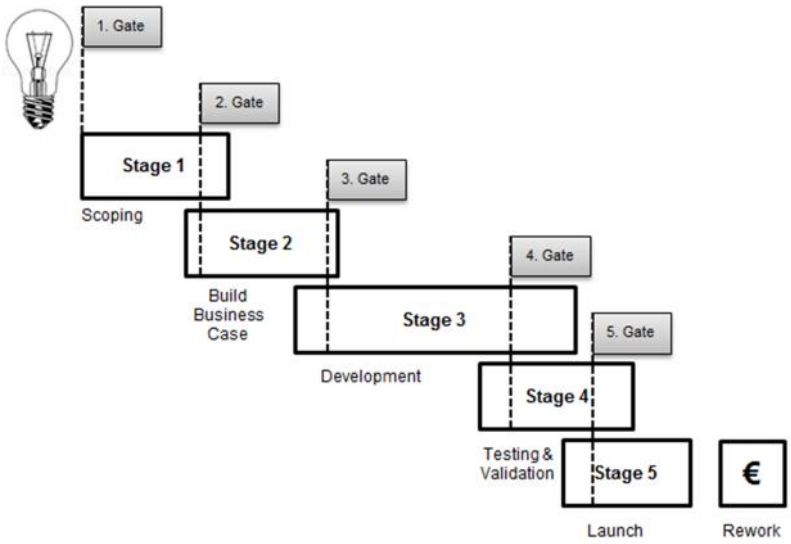


Figure 2.18: Fluidity (Cooper, 2002, p. 169)

- **Flexibility**
  The Stage-Gate-Process is not a law and must not necessarily be complied with. It should be possible that each project runs through the process according to its risk and its needs. Depending on other factors such as the extent and duration of the project, gates can be skipped or combined. However, the decision must be made in full awareness of the associated risks. Depending on the risk of the project, stages, activities and gates can be deleted, which must be taken on the basis of the previous gate decision. The consequence is a so-called sprint process, as illustrated in figure 2.19. In this case, however, only abbreviations in the area of repairs, extensions, improvements and revisions should be made. In addition, it should be mentioned again that a separate classification of projects, as described in chapter 2.7.4, facilitates the decision for or against a sprint process.

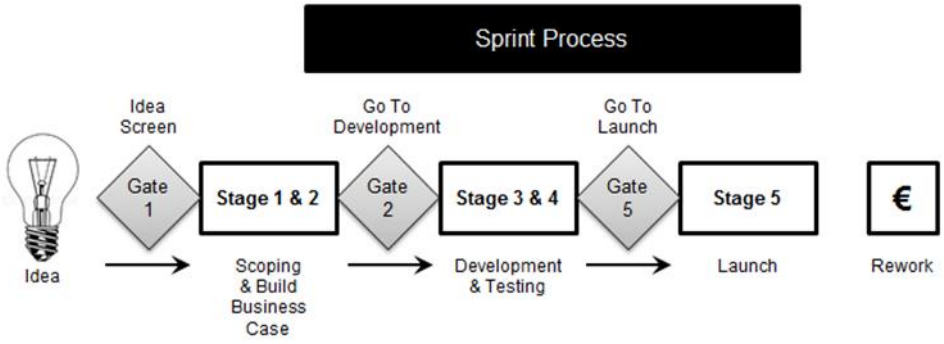


Figure 2.19: Sprint process (Cooper, 2002, p.168)

- **Focus**
  A further special feature of the third generation is the focus, which refers only to the most promising projects. Therefore all the whole projects of the company must be treated with portfolio management to ensure a possible selection of all projects. The selection is made with the help of usability analyses, economic models and portfolio methods. The resources for the excluded projects flow to the remaining projects.

- **Mediation**
  This step describes the necessity of a person to successfully launch stage gate into a company. This means that the process cannot be integrated into large companies without a process manager or process keeper who manage and mediate the process. The process manager has the function of ensuring the efficient and effective procedure of the process. At the same time the process keeper should act as a referee between the various groups, ensures compliance with the process rules and also makes sure that all gate decisions are made in sense of the project. Furthermore, he also supervises the project team, helps in terms of difficulties and obstacles and takes care of the presentation of all results to be delivered. Improvements and adaptations in the introduction of the process in a new department as well as in the assignment of employees in the process count in addition to his tasks. Therefore it is apparent that no complex process is implemented by itself. The key to the success of Stage-Gate-Processes lies not only on design but also on how the process has been implemented. In case of a stage gate failure, the reason is located rather in the implementation than in the design.

- **Renewable**
  Based on accumulated experience, the processes of the stage gate are constantly renewed and improved. Many companies contribute to this. These five principles quoted above of the third-generation are such an example of ongoing improvements. New adaptations of the stage gates to the specific needs of the company are also possible. For example, International Paper had problems to assemble all members for the tribunal. Therefore they developed web based gates, where each member of the tribunal can independently check the result of the gate. Another example is Guinness, who replaced the traditional idea screening in their NaviGate-Process with the stage, identification of unfulfilled customer requirements and the definition of promising opportunities. Given these examples, it is apparent that the process should be subjected to continuous review and minor improvements. In order to have an effective third-generation process, stage gate experts advise to including only partial elements of the third generation, such as flexibility and

focus. After a successful ramp-up phase, all speed-increasing factors of the third generation can be gradually added.

Cooper (2002) holds the view, that using all these six principles in the process, increase the speed but at the same time, it also increases the risk by the extended range of discretion and thus makes the process more sensitive. This could lead to need of action. Consequently, the process must be managed more experienced and professional, because the more freedom one takes out, the higher the risk becomes.

2.8.5 Differential diagnosis of the State-Gate-Process

This chapter serves to eliminate possible misunderstandings about the stage gate process. Cooper (2002) describes four main points to separate the process.

1. **No fixed system**
   Since the stage gate system is only a schema, it is not subjected to any fixed requirements. Thus changes can be made to the adaptation of the respective process for company specific circumstances. Common model changes of companies are:

- Not every project passes all stage or gate of the model.
- Every project is individual and therefore activities or gate criteria can be changed or cancelled
- Activities can be relocated to other stages for a better time management

2. **No bureaucratic system**
   When the stage gate system is used correctly, it promotes all the features of speedy project work. This would be a clear approach with established set points and targets, a self-responsible project team which acts cross divisional, and decision gates with clear criteria. Sometimes introductions of new systems in management are met with additional conferences and subsequent paper work. But this is about an adapted, systematic process and not about bureaucracy.

3. **No functional and phase structured control system**
   The stage gate process should not be confused with the phased review process used by NASA from 1960-1990. This process of NASA was equated to a relay race and was based on sequential rather than parallel processing. Thus the development of new products was almost doubled. Constant handover in the process of functions or the transfer to new project teams showed a constant confusion and no real uniform responsibility for the project. Compared to this, the Stage-Gate-Process is designed to increase throughput speed. With parallel implementation of activities in the individual stages and cross divisional functions, clear requirements can be defined and time-saving working promoted. Thus, a responsible project team can be set up for each project.

4. **Not only project management**
   There must be a clear distinction between micro processes as they occur in project management and macro processes such as stage gate. Macro processes are guiding other processes. Stage gate does not replace project management, but refers to process management. Project management is applied within the individual stages of the process. Therefore, it is not possible to dispense with reasonable project management methods.

2.8.6 The Milestones

Milestones are the decision points in project management. Only when the predetermined result is fulfilled can the next phase can take place. But how is a milestone exactly defined and what differences are there? Meyer & Reher (2016) are of the opinion that, milestones are events with special significance that describe a situation and are referred to at a certain point in time. On the other hand Motzel (2006) describes characteristics which lead to a definition. These are shown below.

- number or a clear allocation
- name or short description
- description of measurable and verifiable results that must be present
- description of a decision

Consequently, Meyer & Reher (2016) say that every milestone needs an exact content with a target date. Therefore milestones are results of the project process which describe a certain status at a certain time. The content of the milestones is exactly defined at the beginning of the project. Milestones are placed at the end of a phase and partially within a phase. These are predominantly concrete deliverables, which must be available at a certain date. The present results are checked and examined in the course of a review. Milestones can describe the beginning or the end of an activity, but not the activity itself and as a result they must be meaningful. Furthermore milestones are so called checkpoints, quality gates and project synchronising points. They should simplify the communication and feedback with the customer but also with other stakeholders too. Additionally, intermediate results can be checked and the customer, the management of the project executing organisation, the internal client have the possibility to check whether the project will bring the expected benefits or not. Expected output could be the increase of company value. Milestones should clarify two main questions:

- Are we doing the right things?
- Are we doing the things right?

These questions should be answered from the view of the customer, of the internal management and of the stakeholder.

Meyer & Reher (2016) point out, that milestones have the advantage of minimizing the risks. Following risks can be reduced:

- The product and the quality don´t match the expectations
- Costs and dates don´t match the expectations
- The type of cooperation doesn’t match the expectations
- The expected benefit does not occur

Due to the work-based organisation of processes in projects, they often run in parallel and must therefore be coordinated with one another. Hab & Wagner (2013) describe, that milestones are important transfer points, which can be released upon a successful advance performance as an input for the next producing performance. The transfer points ensure that things fit together. Milestones synchronise the partial performance to produce the next secure initial situation for the following phase. Building on this, the project participants are orientated towards the next step.

Milestone decision:

Meyer & Reher (2016) describe three different types of decisions with which a milestone is linked. These are shown in figure 2.20.

1. No problems, everything is okay, we are in time, let´s go on → **GO**
2. Only parts of the target are fulfilled, rework is necessary until all partial results of the milestone are reached → **HOLD,**
3. New insights question the project and can lead to the decision to abort → **KILL**

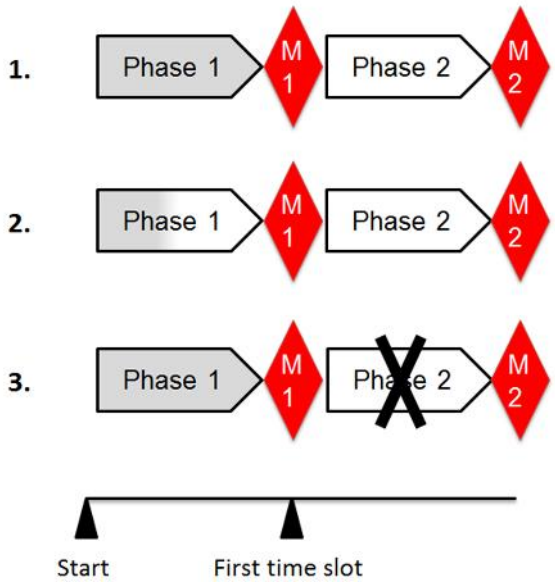


Figure 2.20: Three types of decisions

The second decision is the most common one. As a result of delays at the beginning of the project, this leads to phase overlaps, which in turn entails new risks. Because overlapping of phases has the result of milestone postponements which lead to the delay of subsequent orders or the exceeding of delivery dates. Also any stoppage in the project results in deadline delays and therefore financial losses. In this case, the project manager has to skillfully control the downtime through early causal research and act accordingly. Depending on the type of project the third decision is not always possible. In case of a company internal development project the decision to cancel the project in early phase can be an economic benefit, but if this is a projecting project with a customer order it is depending on the contract design. It is very important to consider claim management in the contract design. Furthermore, the abortion of a project is influenced by the cost overrun on the one hand through the customer himself or on the other hand through the contractor. It must be noted that the abortion affects the relationship with the client and the customer, has a loss of competence and financial consequences. (Hab & Wagner, 2013, p. 89f; Meyer & Reher, 2016, p. 17)

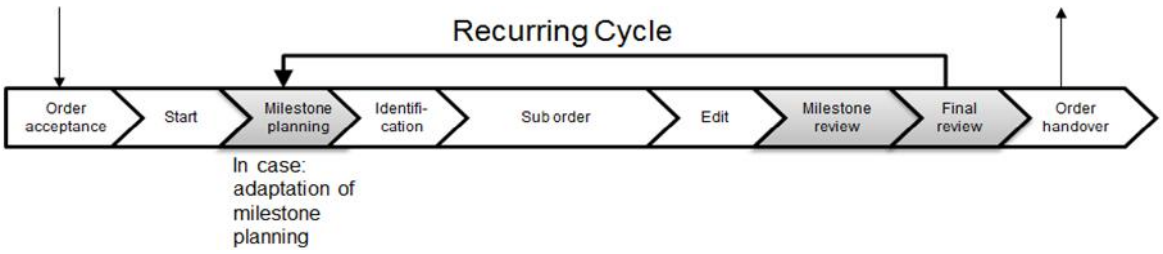


Figure 2.21: Milestone procedure (Suter et al., 2015, p. 261)

In order to successfully implement milestones in a project, the first step in the milestone procedure, shown in figure 2.21, is the creation of a milestone plan. The milestone plan includes a temporal division of the project into sequential and testable subprojects or phase sections. In addition, it is important to keep the distances of the milestone dates short, in order to minimize the inaccuracies in the effort estimation and thus also make corrections in the event of changes with a lesser effort possible. On the other hand a learning effect is carried out on the basis of repeatable assessments of effort and risk by short cycles. The next step is the milestone review. In doing so, guidelines which are associated with the milestone are checked and examined for the degree of fulfilment. This is where the above-mentioned decisions are made, which in the case of non-completion, require the immediate reworking or corrections of work to achieve the overridden project goal. The final step is the completion of the order check, which checks all the milestones for their completeness and thus determines whether all the standards for the order have been fulfilled or not. If the assessment is positive, the project is handed over to the client. In the case of an incomplete project, the milestone planning is started again. In addition, the order completion test still serves the changes or the short-term wishes of customers. Changes are never easy to handle in the project business and can often provide very difficult in complex projects. Furthermore companies rarely want to refuse something to the customer and therefore accept the change, which results in the loss of obligation for any planning and preparation. However, the changes can be taken as an opportunity to improve the planning deficits and errors in the solution concept. Nevertheless, a mechanism that prevents the acceptance of non-negotiated changeover demand should be taken into account. (Sutter et al., 2015, p. 260f)

2.8.7 The Gates by Cooper

According to Cooper (2002), gates are more present in the process management. Each stage follows a gate with a tribunal. The tribunal at the gates is predominantly made up of managers of the various areas. They control the resources required by the project manager and the project team for the next stage. Gates are used to set the course of the process for the project and to control it. They work as a checkpoint at which the quality is controlled. In the course of which, the continuation or abort of the project is decided, the project is assigned a priority and a decision about the route is taken for the next stage. Furthermore, they are used as a barrier to prevent the projects of going on without finishing the last section. In addition, they set the next tasks, results or the budget for the next gate.

Gate decision:

Decisions in a project are neither irreversible nor are all resources allocated to the project. The decisions of the gates can rather be seen as a series of option decisions. It all starts with a presumption that gets a stronger binding against the project at every further decision point. Furthermore, to specify the decisions at the gates, a reasonable balance between strict and weak decisions should be taken. On the one hand a weak decision does not sort out loss projects and incorrect distributions of resources out, but on the other hand a too strict decision leads to the rejection or aborting of valuable projects which have not yet been recognized as such. Additionally, the key criteria for or against a project, should reflect the general objectives of the company's approach and the new product endeavor. It should be mentioned that the tools of the product evaluation have to be realistic and easy to apply. For managers the data requirements, the work processes and the interpretation of results must be clearly defined. (Cooper, 2002, p. 266f)

Structure of gates:

Cooper (2002) has provided the gates with similar structures, see figure 2.22, which are described below.

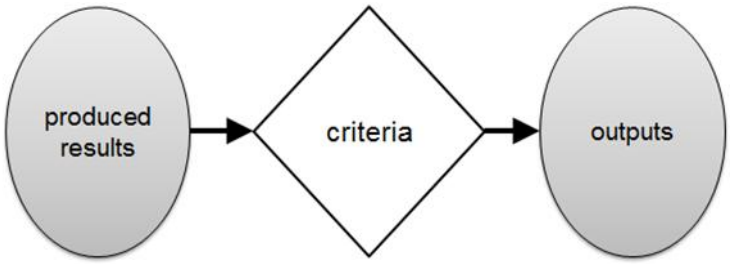


Figure 2.22: Construction of gates (Cooper, 2002, p. 148)

1. **Produced results**
   At the decision point, the project team and the project manager must provide pre-defined activities and results as shown in figure 2.23. These values are clearly defined at the exit of the previous gate on the basis of a standard for gates. The expectations of management to the team correspond exactly to these values.

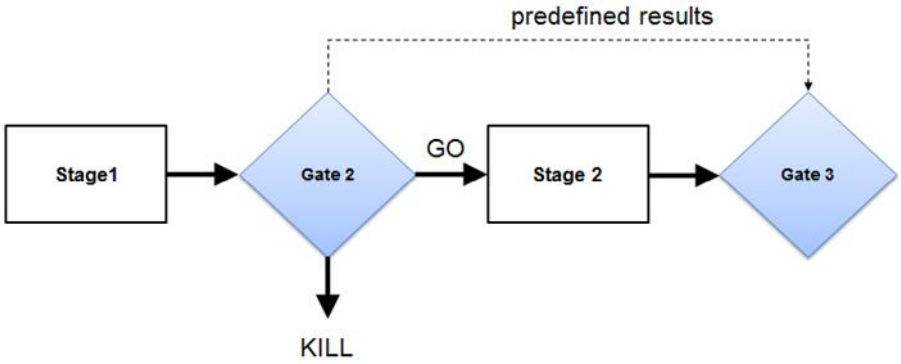


Figure 2.23: Working of pre defining results

2. **Criteria**
   They serve as the basis to make the project team measurable. The team has to be measured. Through a checklist with all necessary conditions, bad projects can be replaced at an early stage. For example, does the project fit to the strategy of the company or are the standards for the environment, health and safety reached. In addition there are criteria to be filled or desirable factors. These are provided with a point system in order to define priorities. Take for instance the extent of the product benefit, market effectiveness and the ability of the interplay of core competences.

3. **Outputs**
   The defined outputs are the taken decisions, the approved action plan for the next stage, the checklist for the results of the next gate and dates for the tribunal meeting. The decisions include the abort, continuation, wait loop, repetition of stage or of individual activities. In comparison, the action plan includes required staff, approved finance budget, staff resources and agreed time limits for the next stage.

2.8.8 Comparision of gates and milestones

In the literature there are many different explanations or opinions on the structure or content of milestones and gates. As a result it is not directly possible to clearly differentiate the respective philosophy of the definition of milestones and gates. Therefore, in the following table 2 from several sources according to Cooper (2002), Suter et al. (2015), Jochem et al. (2010), Becker et al. (2013), Jakoby (2015), Meyer & Reher (2016), the most common information was compiled. This table provides an overview of the bandwidth taken from the literature of definitons of gates and milestones.

Gates	Milestones
• Gates are available in solid process management structures as well as in project management • Gates are in the marko process of a project • Gates are not only open or closed; they can also assume intermediate states. • Gates are subject to a clear criteria test • Gates are always at the beginning of a new stage • They are synchronisation points • Gates represent breakpoints • Each gate has a tribunal • Meeting at each gate • Quality control through pre-established company-internal criteria • Informations to be provided are always set at the previous gate • Gates have fixed positions • By the company pre-fixed criteria, make the project team measurable and can eradicate missed projects dadruch • Gates have a uniform structure (results, criteria, outputs) • Gates have budgeting powers	• Milestones are used in project management • Milestones are in the macro and micro process of a project • Milestones are only used to manage a project and do not make any decisions about abort or continuation • In the case of milestones, the temporal aspect is at the forefront • Milestones can also be within a project phase • Milestones can mark the begin of the phases, phase release, or phase completion • Milestones do not have any stoppoints • Milestones are defined at the start of the project • Position of the milestones is not fixed • Milestones are adaptable and can be interpreted as desired • Amendments can be accepted on the basis of fairness, which means that the planning loses liability

Table 2: Gates and Milestones

3 Case studies Palfinger

This chapter gives an introduction and summary of the case studies “Blowfish” and “Hägglunds”. The following names and detailed project data have been changed as a result of the confidentiality agreement with regard to business-internal data. The projects are graphically prepared and described with the help of a timeline, which is marked by striking project events.

3.1 Case study Blowfish

On the timeline in figure 3.1, the individual project events are presented as important steps for the project work. Due to the long negotiation period up to the actual order, the implementation phase of the project started after two years. The actual implementation of the project was completed after thirty-six months with delivery.

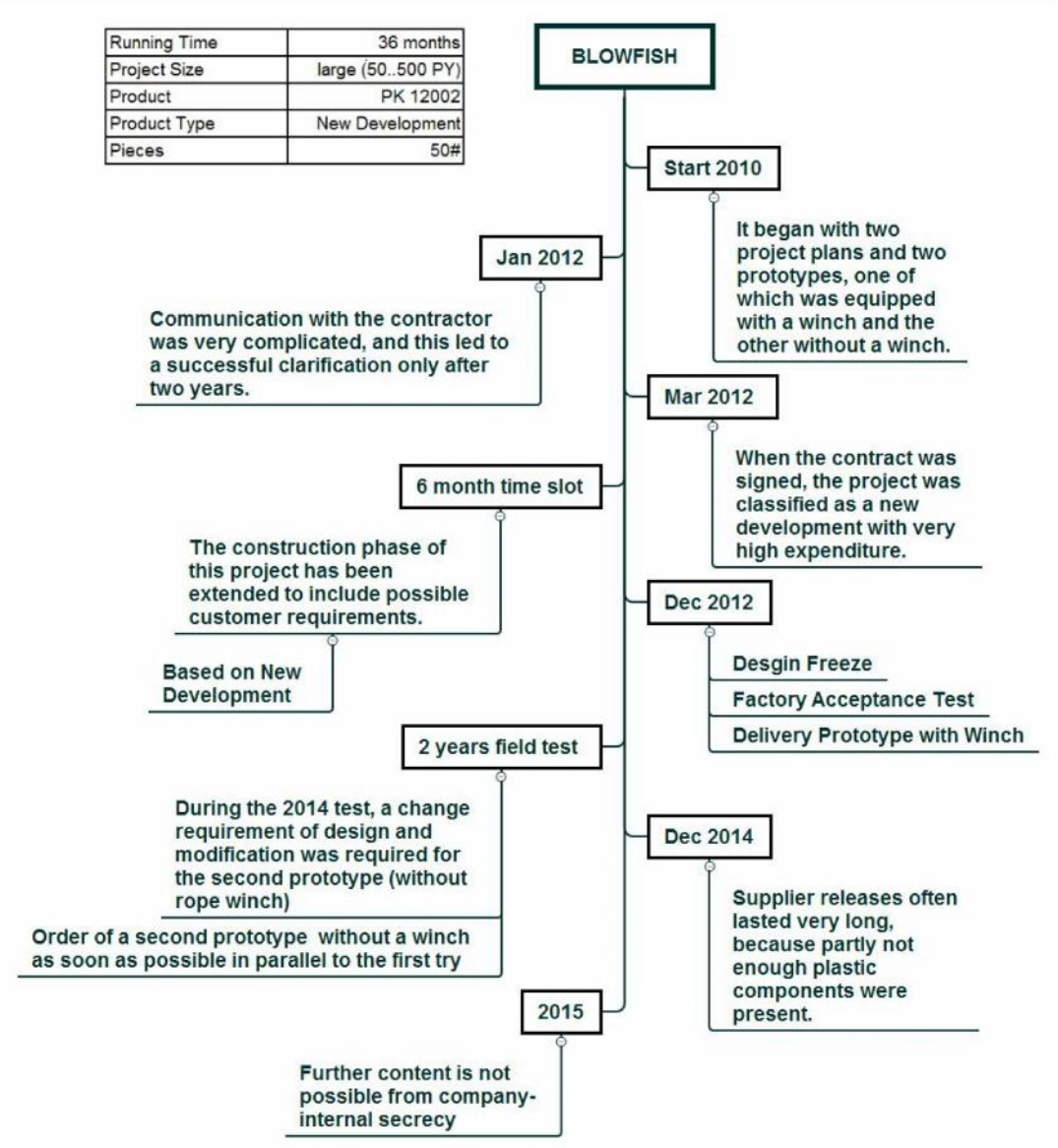


Figure 3.1: Project Blowfish

3.2 Case study Hägglunds

In the second project "Hägglunds", the lead time for contract negotiations was much shorter and was initiated by a request for information. Palfinger was able to offer both of the required solution variants and thus won over several competitors. The project implementation from the start of the contract until delivery was thirty months. The exact thematic areas are explained in figures 3.2 and 3.3 and provide an overview of the project procedure.

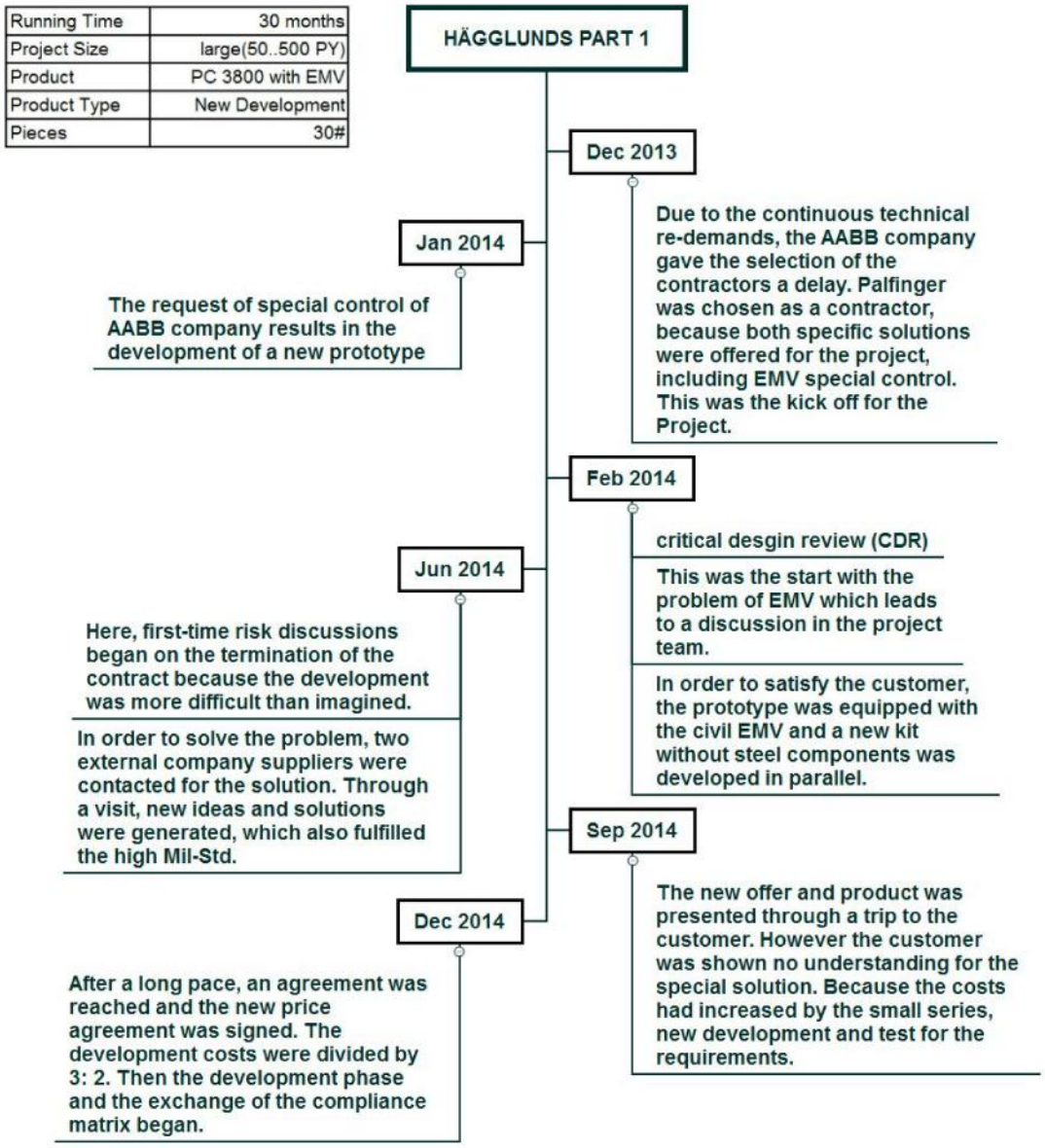


Figure 3.2: Projekt Hägglunds part one

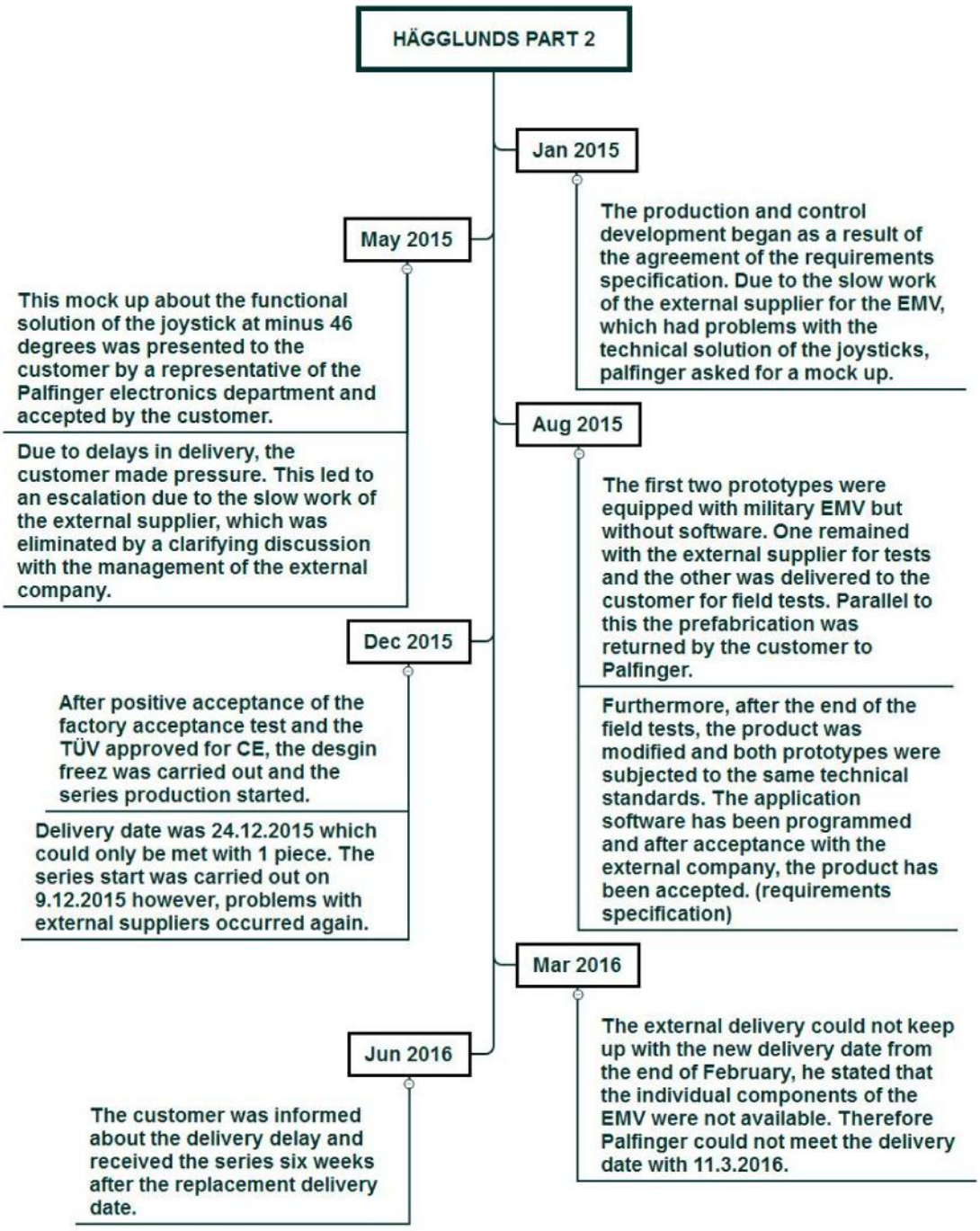


Figure 3.3: Project Hägglunds part two

4 Evaluation and analysis based on the case studies

In this chapter, the current situation is analysed and evaluated on the basis of the case studies in the department PDS in relation to the process and project management. For this reason questionaries have been used. The questionnaire can help to obtain rapid information on the existing technical knowledge in a company or department for the realisation of specific projects, to obtain personnel resources and to achieve a larger number of employees involved in projects at the same time. In the subsequent workshop with the employees involved in the questionnaire, the results obtained can be discussed in the employee's forum and the ways of realisation can be clarified. After this, the results obtained are prepared to identify possible bottlenecks and areas which require action. Furthermore, the expert workshops will be used to deal with the areas identified in the questionnaire in which there is a need for action.

4.1 Questionnaire

The following questionnaire was compiled for the most part from quantitative questions in combination with isolated qualitative questions.

The goal of this questionnaire is to obtain an overview of the momentary situation, which relates to the initial phase of the project, the structure of the project processes and their processes in the department Palfinger Defence Solutions

In order to achieve this, a questionnaire was prepared in the first experiment by analysing two case studies with the employees of the PDS. This questionnaire was based on pure assessment of the PDS division. Therefore, project management topics, such as strategic decisions, market orientation, customer satisfaction and the necessary resources for the project phases, process processing and process maturity were examined. The answers of the departments involved in the project followed directly. From their point of view, the methodical requirements for a project process and its procedure were not yet developed and therefore could not be queried. Given this initial situation, the questionnaire was tailored to the current needs of all stakeholders.

This second questionnaire was based on the process maturity of projects in the PDS of two case studies. In previous discussions with other departments, it was found that special attention ought to be paid to the estimation of projects and their processes before and after conclusion of the contract. In addition, the start-up management is added as a further point, which should include the date of the introduction of the new project into the serial process of the company Palfinger.

In the following chapter, we will once again present the broad classification between the first and the second questionnaires. The content of the questionnaire is then explained, and the special questions and their background are discussed.

4.1.1 Construction and ideas of the questionnaire

The questionnaire was exclusively devoted to departments of the company Palfinger, which were involved in one or both projects. These included product management, construction, testing / prototyping, mechatronics, PDS, tuning centre, assembly Köstendorf, assembly Lengau, manufacturing, purchase, customer service, quality management, controlling, legal department and service. The target group of the interviewed persons hold different appointments in the company Palfinger, from employees to heads of department.

The questionnaire was divided into four sections and subdivided into closed and open questions. The closed questions could be answered by means of a cross-check, whereby a statistical evaluation was made possible. The open questions could be answered by text fields, which should

provide an even more accurate picture of the situation and additional theme signs. To avoid misunderstandings, the questions were comprehensible and briefly formulated.

In the course of the master thesis, two questionnaires were drawn up which differed in the structure and in the subject areas of interest. The first questionnaire was based only on the questioning of a department and the investigation of two case studies. This proved to be insufficient and thus additional divisions were added to the creation of the second questionnaire. The second questionnaire was related to the process maturity and the start-up management of PDS. In the following table 3, you will see the section structure and the difference between the two questionnaires.

Questionnaire for project maturity - Palfinger Defence Solutions		**Questionnaire on process maturity - Palfinger Defence Solutions**	
I.	General information	I.	General information
II.	General assessment of the projects "Blowfish" and "Hägglunds"	II.	General assessment of the projects "Blowfish" and "Hägglunds" **before** conclusion of contract
III.	Assessment of overall satisfaction of the clients of the projects	III.	General assessment of the projects "Blowfish" and "Hägglunds" **after** conclusion of contract
IV.	Evaluate the extent to which the following disturbing factors influence the project development	IV.	Start-up management

Table 3: Comparison main content of the first and second questionnaire

In table 3, it is apparent that the general part still remains. The general assessment of the two projects was surveyed in more detail and split into two areas. It has been divided into the topics of the general assessment before contract conclusion and after contract conclusion. The general customer satisfaction with regard to projects was deleted and included with individual questions in the general assessment. Finally, the disturbing factors of the project development were replaced by the question of the start-up management, as this is aimed at targeting the series process and improvement potential.

After an extensive explanation of the initial situation of the questionnaire and of the misunderstandings in communication and self-estimation which provided the preliminary conclusions in this master thesis, the explanation of the individual questions can now be started. In the following section the questions are listed and briefly explained.

I. General information

This serves the proof that the interviewees also actually work in the examined work area.

1. From which department of the company Palfinger are you coming?

This question serves the orientation and the better assessment in order to determine how far the respective department is integrated and informed in special process steps of the project.

2. **How many years of professional experience at Palfinger do you have?**
   Here could be chosen the following:
   - 1-2 years
   - 3-5 years
   - 6-10 years
   - >10 years

   In combination with the question, about the department, conclusions can be made about the expert levels and the significance of the remaining questionnaire.

3. **Were you involved directly / indirectly in the projects "Blowfish" and / or "Hägglunds"?**
   This question should give an overview of the participation of the project as well as the perspective of the assessment of the situation.

II. General assessment before contract conclusion

All questions in this section have been designed in such a way that a mood picture of the situation, before the contract conclusion, could be produced. For this purpose, a subjective assessment of highly satisfactory (1) to unsatisfactory (6) could be given.

1. **How do you generally assess the information flow of customer requirements?**
   In this context, conclusions about the flow of information between the divisions in order to take account of major developments that are expected to occur in the hour calculation are to be determined.

2. **Have the customer requirements been processed in detail before the project is accepted?**
   This question shows whether customer requirements with new development were already known in advance or have only arisen during the course of the project. This is one of the essential and decisive preconditions for project calculation.

3. **How well do military and technical standards in customer requirements be considered?**
   The military sector entails a set of additional norm and standards which must be taken into account in the project and consequently must be taken into account in the customer requirements. This question is intended to provide an insight into how far this has been taken into account by the project participants.

4. **Have these requirements been tested for technical feasibility?**
   In the case of project business, the customer is usally king and the customer satisfaction plays an essential role for follow up business. There must be no premature promises of technical feasibility in the contract dialogue before the feasibility has been adequately checked.

5. **Are the necessary special areas available for military-technical requirements?**
   At this point it is mentioned that the division PDS, up to now has recourse to civil products and modified these accordingly. For this purpose, an overview of the possible company-specific provision of specialists from the respective areas for the group military should be provided.

6. **Has the contract been checked for possible deviations before approval by all persons responsible for the contract?**
   In the course of a project it can occur that an unexpected, new development which was not writen down in the contract arises. The reason for this is that the customer has very special requirements or military standards, which are not taken into account by the civilian variant.

7. **Are legal framework conditions checked before the order is accepted by the responsible department?**
   At this point a general overview of the review of orders by the legal department should be obtained.

8. **Are the necessary resources (personnel, budget, facilities, etc.) sufficiently available in the respective departments?**
   Research into the two case studies has resulted in resource problems during project processing. This question is intended to provide information about possible resource bottlenecks in military projects.

9. **How well does the collaboration between all persons and departments involved in the contract succeed?**
   The cross linking processes as it takes place in the project management is to be examined here. (See chapter 2.6)

III. General assessment after contract conclusion

This section consists of on the one hand partially open questions and partly closed questions. This is intended to create a mood picture and at the same time the possibility for additional notes should be given. More detailed information on the structure can be found in the appendix of this work.

1. **Have the order content and scope of the projects been described accurately enough to estimate the duration of the projects in a realistic way?**
   In this case, it should be assessed whether a project extension could be prevented in advance by correctly assessing the upcoming project contents.

2. **Is the project handling of 2010-2016 generally speaking…**
   Here could be chosen between:
   - Significantly better
   - Slightly better
   - Remained unchanged
   - Tended to be worse
   - Much worse

   This questionnaire makes it possible to determine whether a continuous improvement of the procedures over the years has been achieved. (Lesson learned)

3. **On the basis of which characteristics a lack of process maturity becomes clear?**
   Here could be chosen between:
   - Product does not meet customer expectations
   - Due to quality problems
   - Business objectives (profit, turnover, etc.) are not achieved
   - The requested quantities / volumes cannot be delivered
   - Communication between departments

   - Plus an open question about: “Further characteristics of the lack of process maturity?”

   This question is intended to address more precisely the possible need for action in the process maturity and to identify the cause of the problem. For this, a possibility was created for the employees to introduce their additional topics.

4. **Are there any unforeseen problems during the implementation of the project after the conclusion of the contract, which significantly influence the technical processing and cost calculation of the project?**
   Due to frequent customer changes following the conclusion of the contract, new developments can arise as small projects which have not been taken into account in the contract and which significantly alter the pre-calculation. In order to get a better overview of this situation, this question was asked.

5. **How long does it take until the project completion that all the goals agreed in the project are reached or all open points have been completed?**
   Here could be chosen between:
   - > 12 months
   - 6 to 12 months
   - 3 to 6 months
   - < 3 months
   - Immediately

   This question is intended to provide an insight into the process of reviewing parallel processes and the possible restructuring of existing process flows. According to this, the duration of the project could be reduced in total.

6. **In order to improve the process maturity I would ensure the following improvement in the project development?**
   This question was posed as an open question and serves to establish and determine the potential for improvement in project development, in the areas of leadership & managemenet, project organization, project management, quality, resources, information and communication and customer orientation. With the help of the employees, a comprehensive picture can emerge.

7. **How is the ongoing organization of projects to be assessed?**
   This question provides an overview of the company’s internal project organization.

8. **Were all departments informed about projects in time?**
   In order to determine a specific hour calculation of departments, upcoming projects must be named as early as possible. In the military business, project start-ups can take several years. The responsible departments for the project management must nevertheless be able to calculate the possible upcoming projects. Out of this context thee question was asked.

9. **Could the pre-compiled hourly calculation be complied with?**
   Verification of question eight whether the hour calculation was sufficient and could be maintained.

10. **Where do you see possible problems in the hour calculation?**
    In order to get an even better picture of the situation from questions eight and nine, question ten was made public.

11. **Was the design freeze implemented in time?**
    The design freeze is the switch of requiremnet specifiction to the product production process. In order to ensure a structured process flow, the design freeze must be carried out on time.

12. **Do you have sufficient resources to complete the projects in a timely manner?**
    The question is to check whether resource management works.

IV. Start-up management

This section is intended to provide information on the introduction into the serial process and to provide insights on past projects. For this purpose, a combination of open and closed questions was worked on in this section.

1. **How do you generally assess start-up management during the transfer to the series?**
   In doing so, one should get a general picture of the phase of the transfer from the startup management to the series production.

2. **How well were the following business areas prepared for the series launch in the past in their opinion?**
   More precise research on the cause of question 1 is raised here and is intended to draw attention to possible gaps in the cooperation at the beginning of the series. For this purpose, the subjects of the medium could be judged from inadequate (1) to very good (6).

3. **In order to improve the process maturity, I would provide the following improvements in start-up management**
   In this case, additional input from employees for the start-up management in the areas of leadership & managemenet, project organization, project management, quality, resources, information and communication and training was wanted.
   .

4. **What important findings from recent years have been gained from past projects?**
   Finally through this open question, the most important achievements of the last year were collected in the project, to raise the current situation.

4.1.2 Results and evaluation of the questions

The survey began on 1st September 2016 and was carried out until 25 October 2016. The language of the questionnaire was chosen in German in order to avoid precise responses and distortions of the results. A total of 20 persons were involved, which are necessary for the execution of military projects. The return rate finally revealed 14 questionnaires. In the following section, all questions are listed with their original answers and interpreted in terms of their special features.

I. General information

In the course of the survey by a questionnaire, the department listed in figure 4.1 were written down. In total, the response rate was 14 questionnaires. At least one questionnaire was answered and returned by each department.

Bereich	Anzahl
Konstruktion	2
Mechatronik	4
Palfinger Defence Solutions	3
Tuningcenter	2
Einkauf	1
Rechtsabteilung	1
Service	1
Summe	**14**

Figure 4.1: involved departments

Figure 4.2 shows that the majority of the employees interviewed had more than 10 years of professional experience at Palfinger. This makes it possible to conclude a comprehensive experience with the company's internal procedures and project business.

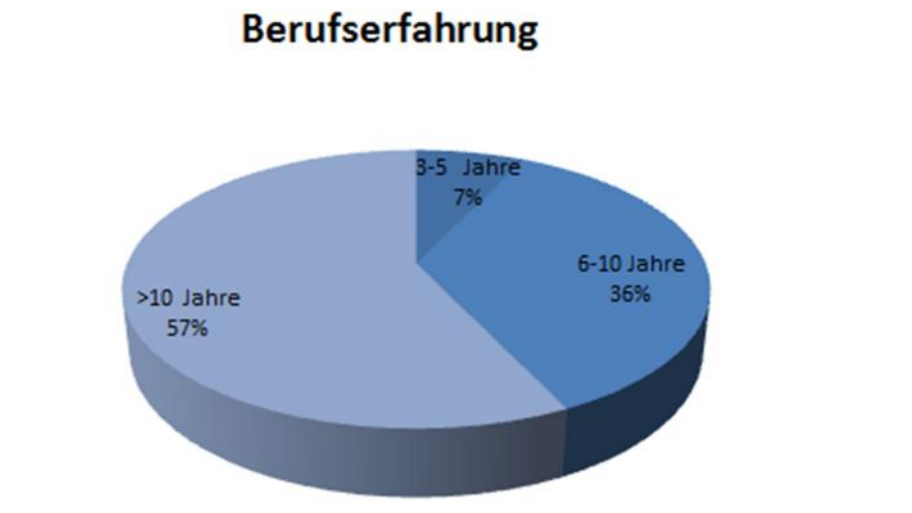


Figure 4.2: Work experience

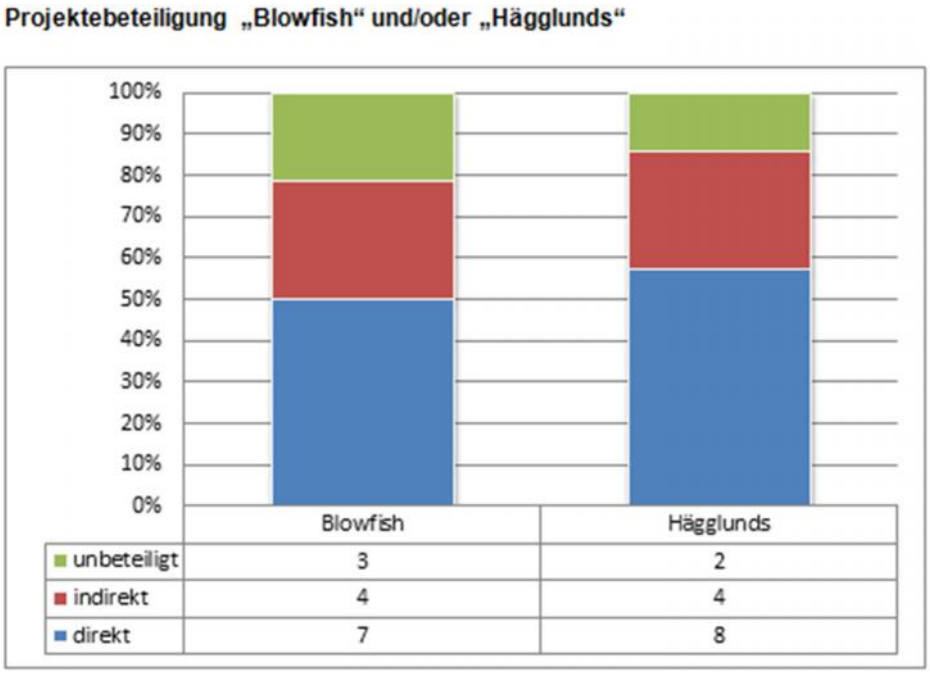


Figure 4.3: Participation in the case studies

The figure 4.3 shows that more than half of the participants were engaed in the projects “Blowfish” and “Hägglunds”.

II. General assessment before contract conclusion

1. Wie schätzen Sie ganz allgemein den Informationsfluss der Kundenanforderungen ein?

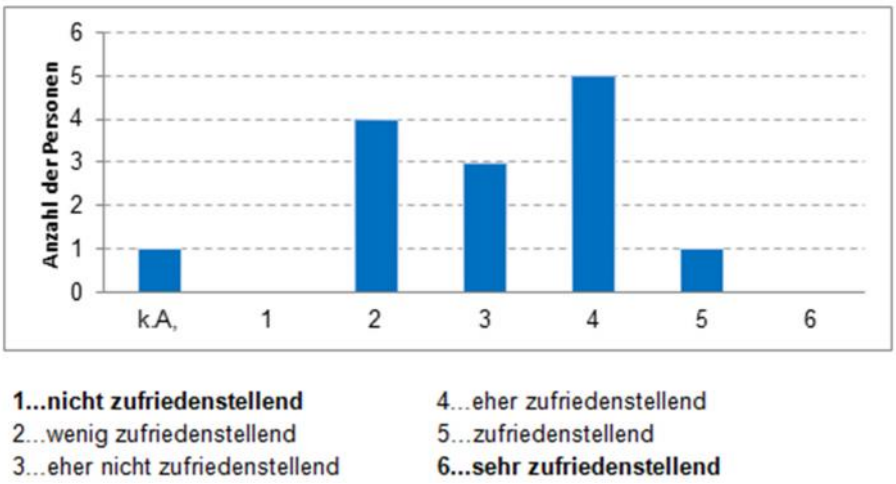
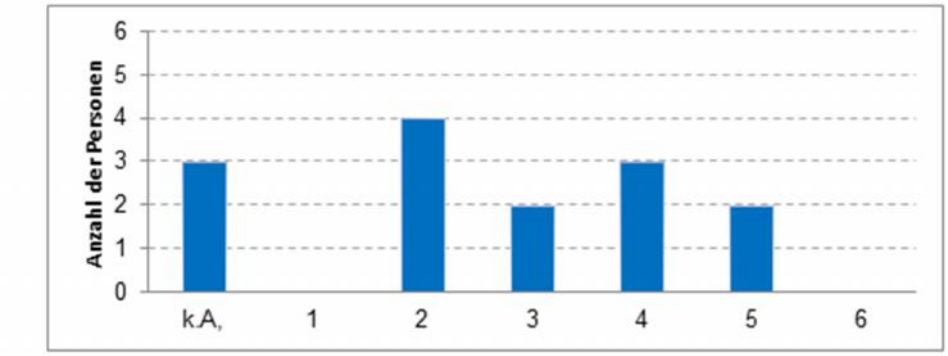


Figure 4.4: Flow of information

The participation in the question in figure 4.4 amounted to 13 persons, with an average value of 3.23 and is therefore between rather not and rather satisfactory.

2. Wurden die Kundenanforderungen vor Projektannahme detailliert bearbeitet?

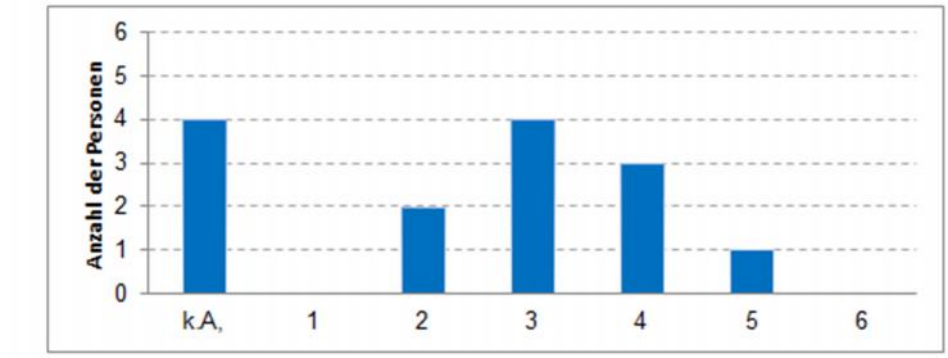


1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.5: Customer requirements

The participation in the question in figure 4.5 was 11 persons, with an average value of 3.27 and is therefore between rather not and rather satisfactory.

3. Wie gut gelingt es die militärischen und technischen Normen in den Kundenanforderungen zu berücksichtigen?

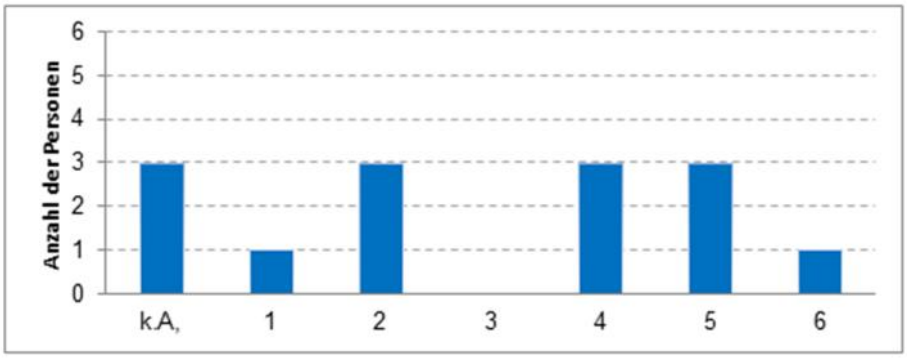


1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.6: Military Norm

The question in figure 4.6 shows a participation of 10 persons and has an average value of 3.23. Thus the average value is between rather not and rather satisfactory.

4. Wurden diese Anforderungen auf technische Realisierbarkeit geprüft?

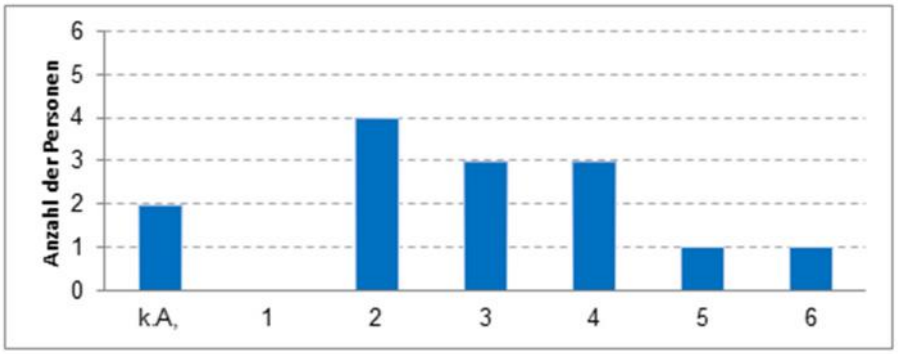


1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.7: Technical feaseability

The participation in the question of technical feasibility in figure 4.7 was 11 persons, with an average value of 3.64 and is therefore between rather not and rather satisfactory.

5. Stehen für militärisch technische Anforderungen die notwendigen Fachbereiche zur Verfügung?

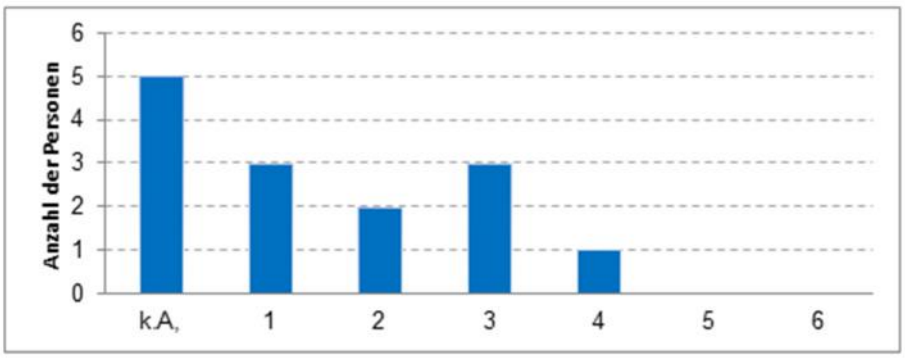


1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.8: Special departments

The participation in the question in figure 4.8 was 12 persons, with an average value of 3.33 and is therefore between rather nich and rather satisfactory.

6. Wurde der Vertrag vor Freigabe von allen für den Auftrag zuständigen Personen auf mögliche Abweichungen geprüft?

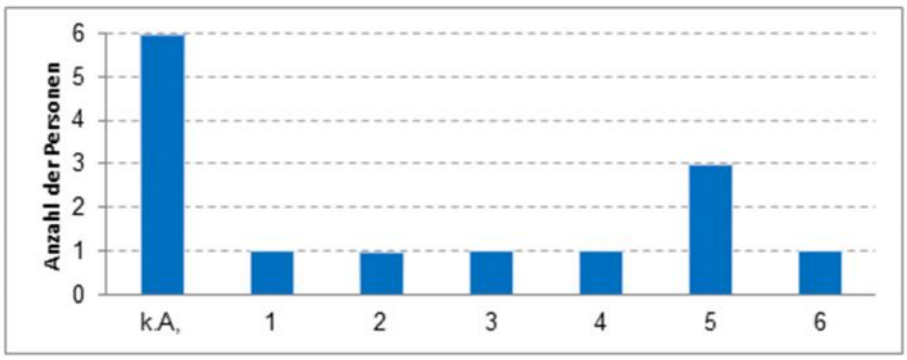


1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.9: Release

The participation in the question in figure 4.9 was very low and amounted to 9 persons, with an average value of 2.22, and is therefore next to less satisfactory.

7. Werden rechtliche Rahmenbedingungen vor Auftragsannahme von der zuständigen Fachabteilung geprüft?

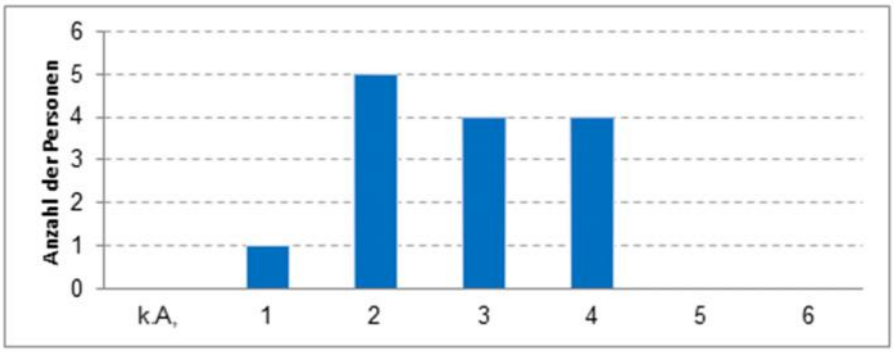


1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.10: Contract framework

The participation of the question in figure 4.10 was very low with 8 persons and therefore gave the highest mean of 3.88. In this section of the questionnaire, the average value is almost satisfactory

8. Sind die benötigten Ressourcen (Personal, Budget, Einrichtungen etc.) in den jeweiligen Abteilungen ausreichend vorhanden?

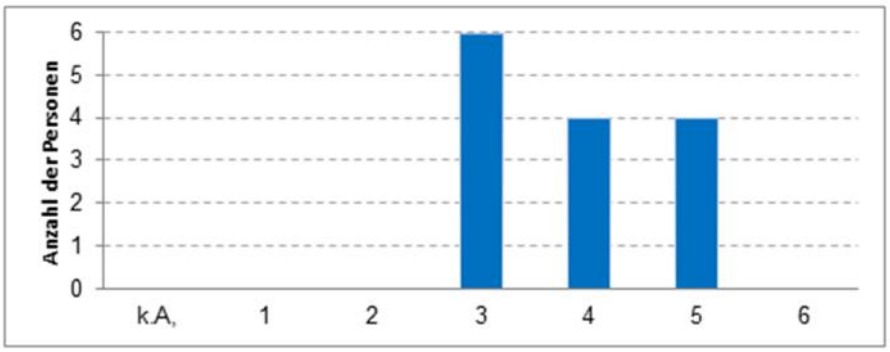


1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.11: Resources

The participation in the question in figure 4.11 was 14 persons, with an average value of 3.07 and is therefore rather not satisfactory.

9. Wie gut gelingt die Zusammenarbeit zwischen allen am Auftrag beteiligten Personen und Abteilungen?



1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.12: Teamwork

The participation in the question in figure 4.12 was 14 persons and with the largest involvement also has one of the highest mean values of 3.86. Thus this is almost more satisfactory.

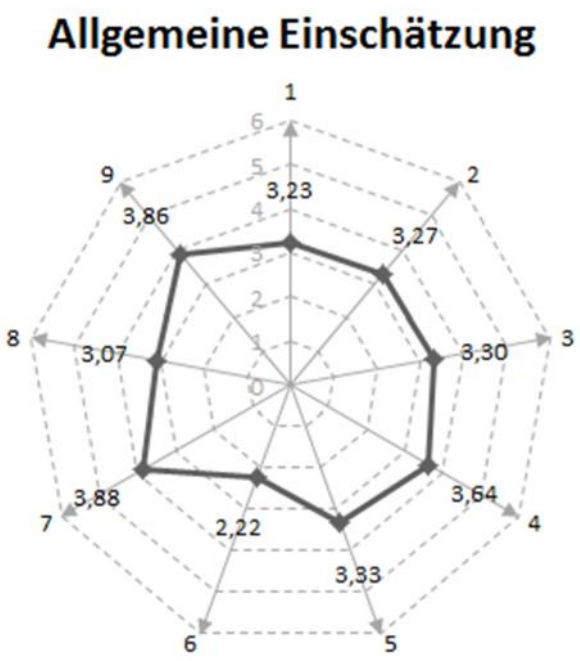
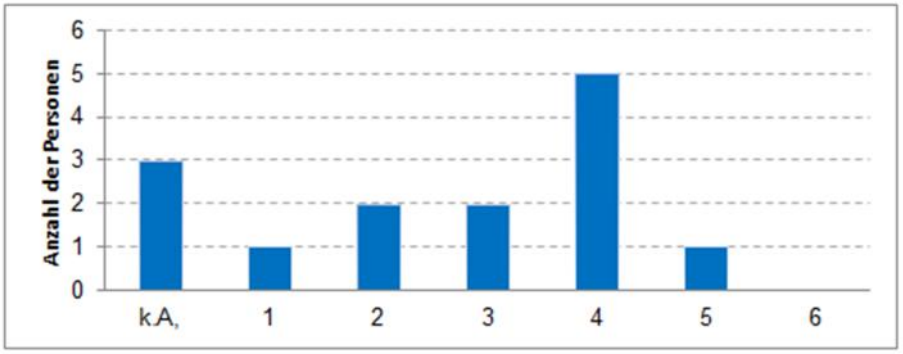


Figure 4.13: General overview of the nine questions

Figure 4.13 shows a average value estimation of the results of the first nine questions. The evaluation of the general assessment of the projects “Blowfish” and “Hägglund” before contract conclusion shows a quite balanced picture. What is striking here is the bend in question six on the contract test, which was rated by only a few employees and was evaluated by the available ratings with rather less satisfactory. This is followed by question seven on the legal examination of the framework conditions, the highest average rating with rather satisfactory and with the least participation.

III. General assessment after contract conclusion

1. Wurden Auftragsinhalt und Umfang der Projekte genau genug beschrieben, um die Dauer der Projekte realistisch abzuschätzen?



1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.14: Content and scope of projects

The participation in the question in figure 4.14 was 11 persons, with an average value of 3.27 and is therefore between rather not and rather satisfactory.

2. Ist die Projektabwicklung von 2010-2016 tendenziell...

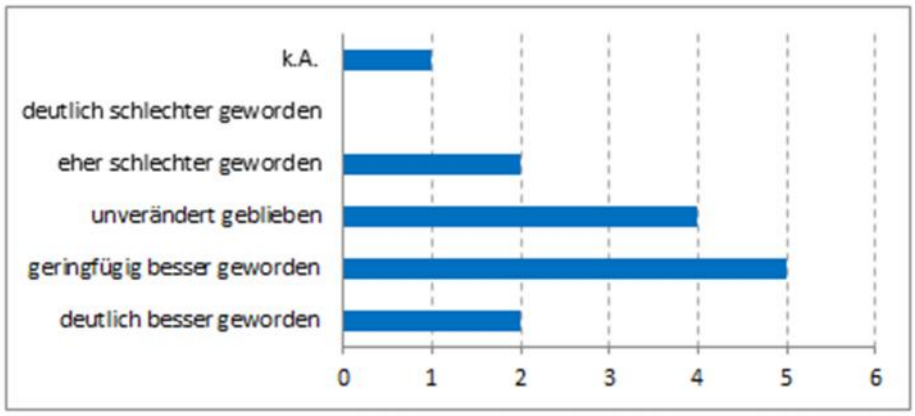
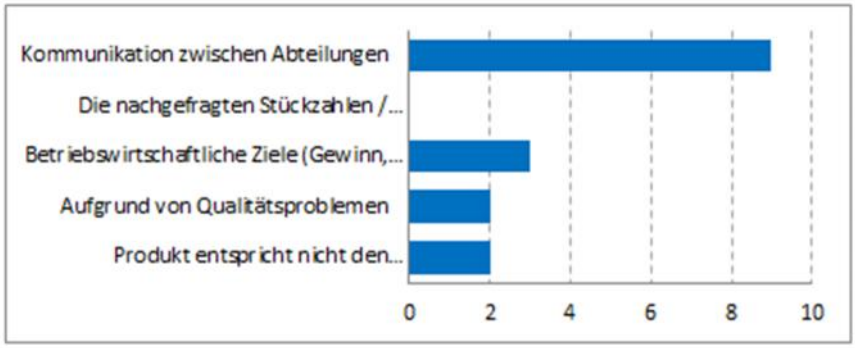


Figure 4.15: Lesson learned

The participation in the question in figure 4.15 was 13 persons and shows a slight to unchanged project management.

3. Anhand welcher Merkmale wird eine mangelnde Prozessreife deutlich...



a. Weitere Merkmale zur mangelnden Prozessreife?

- Erwartungshaltung von MIL-Kunden könnte auf Grund fehlendem Fachwissen nicht direkt im Zuge der Diskussion/ Verhandlung mit dem Kunden kritisch hinterfragt werden. "Unscharfe" Auftragsbeschreibung bzw. hohe Erwartungshaltung der Kunden führte zu "kritischen" Situationen in der Projektumsetzung.
- Kurzfristigkeit der notwendigen Projektrealisierung geht zu Lasten anderer Projekte, entsprechende Kapazitäten werden nicht vorgehalten.
- Fehlende Erfahrung der Fachbereiche im Bereich militärischer Anforderungen und Abwicklung militärischer Projekte.
- Kundenanforderungen sind nicht 100% definiert und bekannt bzw ändern sich häufig während des Projektes.
- Mangelnde Liefertreue während der Serienlieferung
- Anforderungen bei Auftragsannahme nicht bzw. nur tw. Klar; Massive Änderungen und zus. Anforderungen während des Projektes; Tw. Anforderungen bei "Fertigstellung" Prototyp unklar
- "PDS-Projekte habe massive Auswirkung auf andere laufende Entwicklungsprojekte im zivilen Kranbereich. Produkteinführungen im Serienkran müssen aufgrund von spontan eingesteuerten PDS-Projekten um Monate verschoben werden. Extrem hoher organisatorischer Aufwand (Projektpläne) und Unruhe in der Abteilung.
- Projekte liegen viel zu lange beim Vertrieb bis sie dann an die anderen Abteilungen zum umsetzten weitergegeben werden und dann muss immer alles unter Zeitdruck durchgeführt werden. Zusätzlich sind meißtens noch Abklärungen notwendig die dann unter Zeitdruck erfolgen und nicht ordentlich durchgeführt bzw. abgearbeitet werden
- immer wieder Änderungen -> kein Design Freeze

Figure 4.16: Characteristics of process maturity

Clearly the communication between the departments in figure 4.16, was chosen as the main feature. The customer requirements frequently changed in the course of the project are proving to be a further consideration. In addition, the lack of information flow, which has an effect on the calculation of the hours and thus on the realisation of the projects, was clearly addressed. A further consequence of the lack of flow of information during the project initiation of military business is represented in the internal rejection of civile projects due to the too late need man houres for military projects.

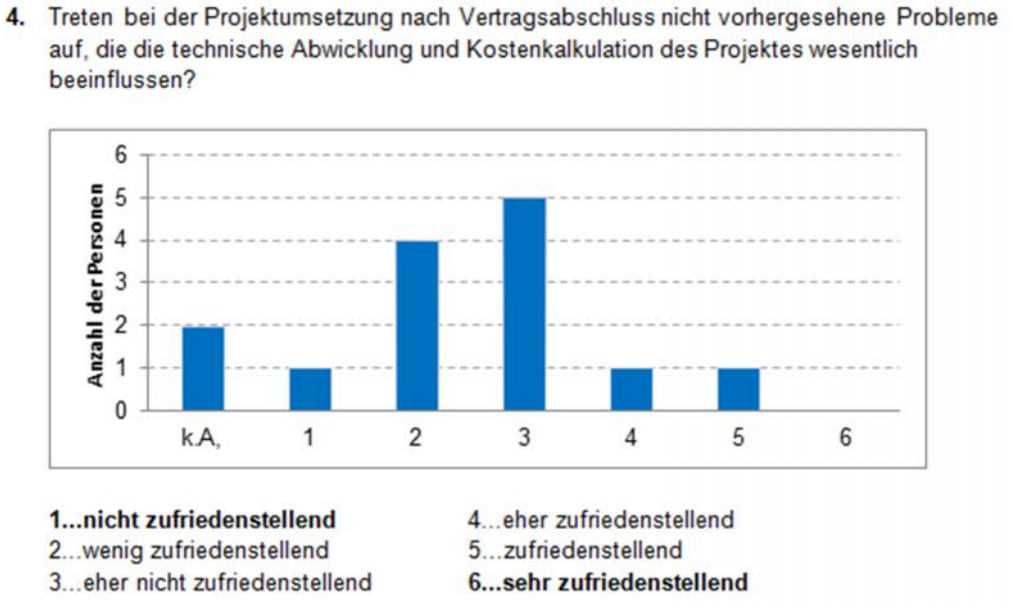


Figure 4.17: Problems for calculation

The participation in the question in figure 4.17 was 12 persons, with an average value of 2.75 and is therefore not very satisfactory. Thus the points mentioned in figure 4.16 are confirmed.

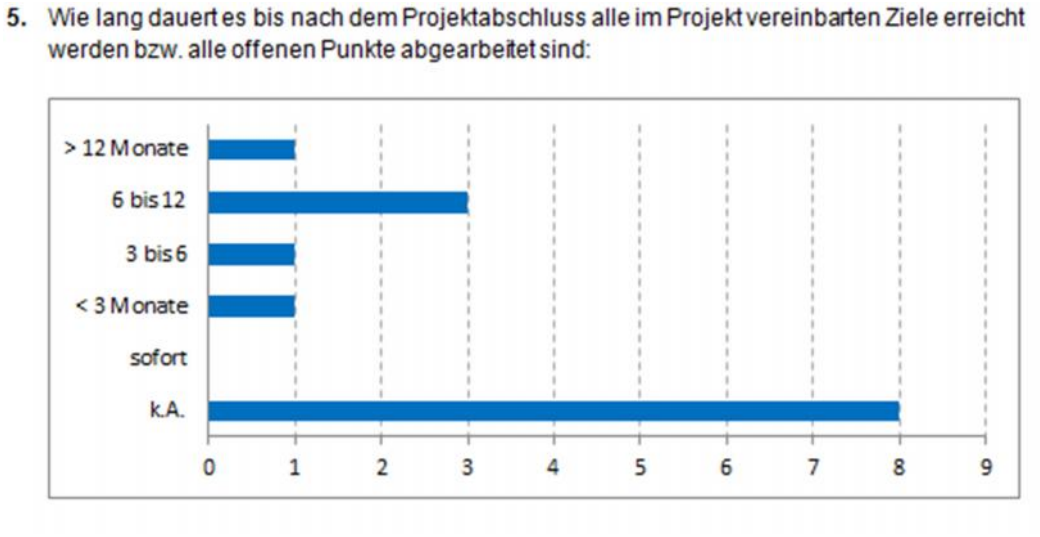


Figure 4.18: Project finish

The participation in the question in figure 4.18 amounted to just 6 personnes and shows a clear trend of 6-12 months for the post processing time of projects.

6. Um die Prozessreife zu verbessern würde ich für folgende Verbesserung in der Projektentwicklung sorgen:

Verbesserungspotential

Führung & Management

- PDS gehört gesamtheitlich "gemanagt". Aktuell ist der Fokus rein auf Vertrieb. Implementierung einer Managementfunktion mit gesamtheitlichem Führungsverständnis. Die Jobbeschreibung Vertrieb PDS ist mit Schwerpunkt "Technischer Vertrieb" zu definieren. Eher ähnlich Projektgeschäft z.B. Railway, wo ja auch technisch affine Kollegen federführend das Projekt/ Angebot mit der Entwicklung erarbeiten und nicht die Entwicklung die Ausschreibung von vorne bis hinten lesen darf. Erfahrungs- und Wissensaustausch innerhalb Team PDS funktioniert nicht - da viel unterwegs + keine gezielten Maßnahmen für Erfahrungsaustausch. Jeder PDS Vertriebsmitarbeiter schickt Ausschreibungen mit ähnlichen Anforderungen an die F&E Truppe. Viele Fragen könnten PDS intern schon beantwortet werden.
- Bereitstellung notwendiger Ressourcen, Planung vorhandener Ressourcen
- Generell ist frühzeitige Kommunikation aus meiner Sicht der Schlüssel für alle involvierten Bereiche.
- Nicht alle beteiligten Abteilungen sind für solche Sonderprojekte entsprechend aufgestellt (Kapazitäten, know-how,,,) natürlich müsste das langfristig aufgebaut werden und kostet das Geld.
- Regelmäßige Projektstatusrunden inkl. Kapazitätsvorplanung mit zu erwarteten Projekten / Reihenplanung
- Zeitgerechteres einsteuern von Projekten. Nicht erst nach Jahren wo es beim Vertrieb liegt und nichts gemacht wird
- Wenn MIL gewünscht, dann richtig. MIL Projekte funktionieren so nebenbei nicht.

Figure 4.19: Suggestions for improvement part 1

All points of a possible improvement of the project maturity were put up for discussion shortly after the survey. In figure 4.19 the following statements on leadership and management are emerged:

- Fine quality goals
- Exchange of knowledge within PDS team (targeted measures) → Relief of R & D
- Increase capacity / competence for special projects
- Implementation of a management function with overall management skills
- Project / work out an offer with the development → Product range
- Similar requirements can be clarified within the PDS team
- Include development in early project phase to plan existing resources
- Regular project status rounds including capacity planning with expected projects / series planning
- In time triggering of the projects

Projektorganisation

- gibt's die? Es gibt eigentlich nur Vertriebler die naheliegend verkaufen wollen und deshalb Projekte/ Aufträge in die Organisation schieben. Ein laufendes Projektportfolio mit Übersicht der laufenden Ausschreibungen, Aufträge und Tranchen Lieferungen konnte mir bis dato nicht gezeigt werden.
- Vermischung zweier Berufsgruppen Vertrieb und Projektmanagement im gleichen Projekt (gleiche Person) bedingt sinnvoll - unterschiedliche Anforderungsprofile
- Struktureller Aufbau der Projektteams
- Für jedes Projekt (wenn Bestellung vorhanden) muss beim Kick-off ein Projektplan mit klarer Aufgabenverteilung für sämtliche involvierte Abteilungen erstellt werden.
- Reifegrad der Anforderungsdefinition / Auftragsprüfung vor Auftragsannahme erhöhen
- aktuell fehlt aus der Corp. Service Dokumentation das Projektmanagement.
- aktuell ist die Projektorganisation sehr schlecht
- Frühzeitiges Einbinden der Fachabteilungen und vollständige Kommunikation des Projektumfanges
- Abstimmungsrunden zum Projekt einführen in einem festgelegten Zeitraum, damit jeder der in dem Projekt involviert ist auf aktuellen Stand ist.
- Projektleiter definieren

Projektmanagement

- Projektmanagementressourcen im Bereich PDS. Bedeutet aber nicht, dass das Vertriebsteam einfach dort alles "abladen" kann. Auch die Projektmanagementskills im gesamten Team müssen angehoben werden.
- Abläufe, Ziele und Terminplan definieren und Einhaltung verfolgen, risk Management Abläufe definieren
- Projektmanagement als eigenständige Tätigkeit, Zusammenfassung mehrerer Projekte sinnvoll
- Fortbildungsmaßnahmen im Bereich Projektmanagement für die Abteilung PDS.
- Abwicklungskompetenz für gesamtes Projekt aufbauen
- fehlt heute
- Selbstorganisation in der PDS-Abteilung: Projektpläne mit Kunden erarbeiten etc.
- Erstellung eines ordentlichen Lasten bzw. Pflichtenheftes damit die Umsetzung des Projektes fehlerfreier und mit weniger Zeitaufwand realisierbar ist.
- realistischer Zeitplan

Figure 4.20: Suggestions for improvement part 2

In figure 4.20, the following statements on project organisation and project management can be found:

Subject organisation

- Comprehensive project manager
- Early involvement in upcoming projects to create appropriate capacities
- Current project portfolio with overview of current tenders, orders and tranches deliveries
- Develop / implement project organisation
- Maturity of requirement definition / order check before order acceptance
- Defined area of responsibility

Subject management

- Improve project management skills
- Fixing the product in requirement specification (Design-Freeze)
- Define risk management procedures
- Further training in project management for PDS
- Improve time management
- Communicated process management
- Earlier integration of documentation, service and training

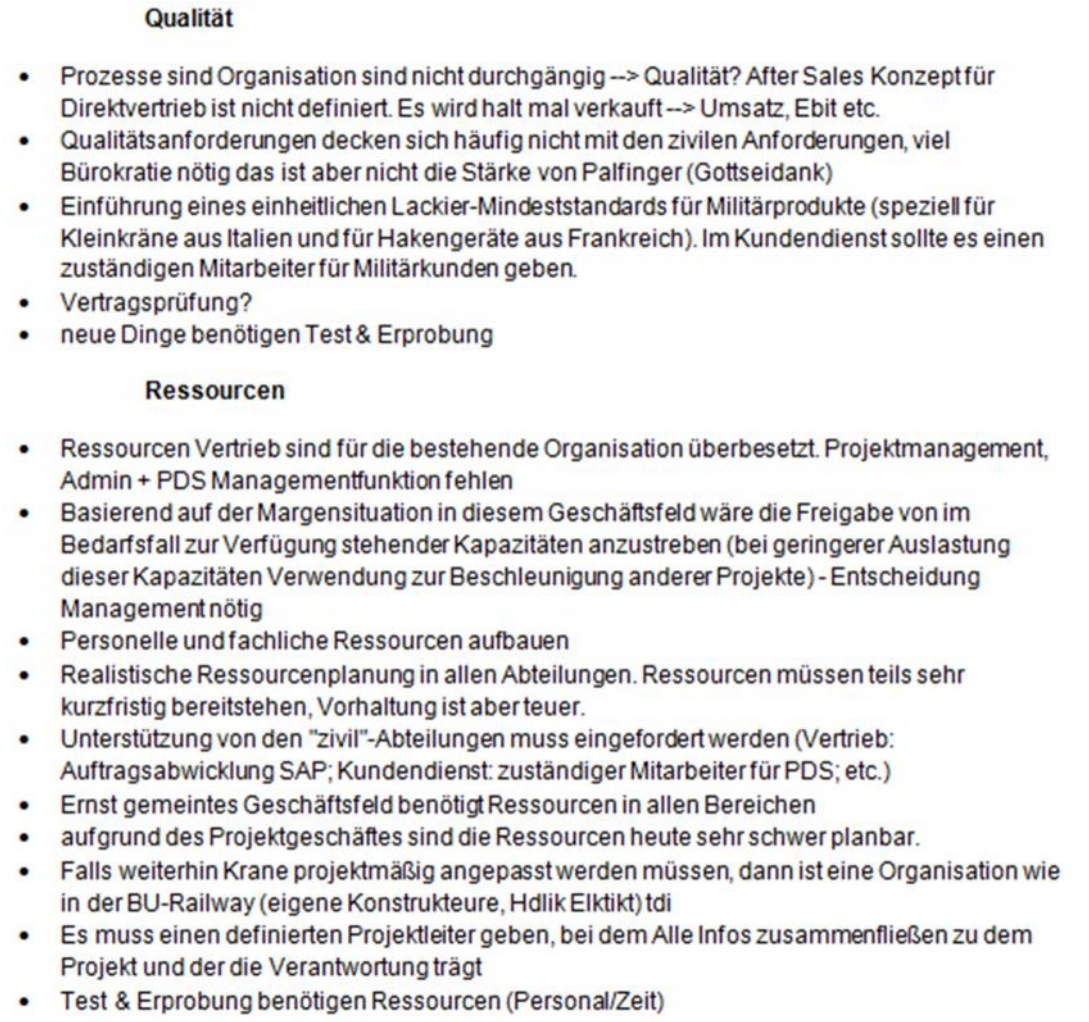


Figure 4.21: Suggestions for improvement part 3

On the topic of quality and resources, the following statements are given in figure 4.21:

Subject quality

- After Sales concept for direct sales
- Create product range for military → Military quality requirements
- Uniform minimum painting standards for military product
- Quality control in process

Subject resources

- Project management resources in the PDS area
- Build personnel and professional resources → Project management, Admin + PDS management function
- Possibility of short-term provision of resources
- resources for testing and trial
- Resource planning of series (~ 90%)
- Based on the market situation in this business area, the release of capacities available in the event of a need would have to be achieved → At lower capacity utilization to accelerate other projects

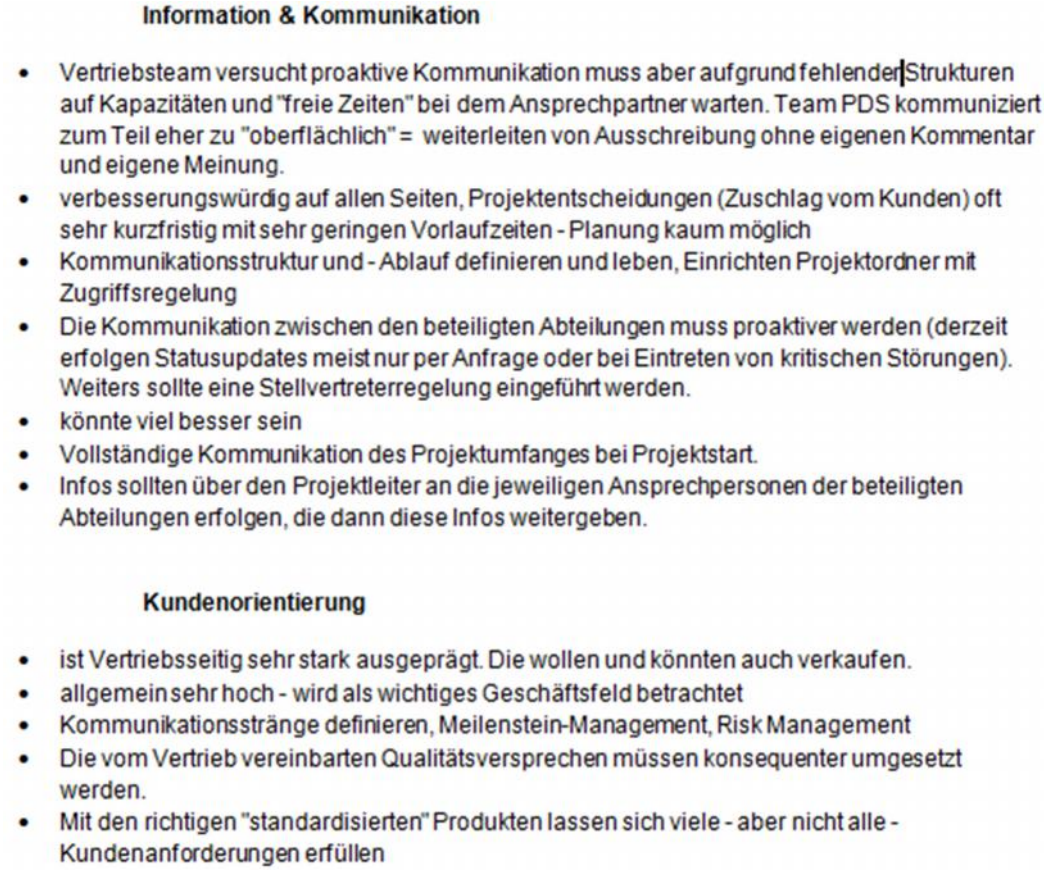


Figure 4.22: Suggestions for improvement part 4

Finally, in figure 4.22 the fourth part of the question about possible improvements in project maturity, statements on the subject of information and communication as well as customer orientation are emerging:

Subject information & communication

- Improve the flow of information
- Improve communication between departments
- Define the communication structure and process
- Set up project folders with access control
- Substitute regulation
- proactive communication
- Information about the project scope at project start
- Project manager hands over information

Subject customer orientation

- Customer service → Responsible for military customers
- Quality promises must be implemented

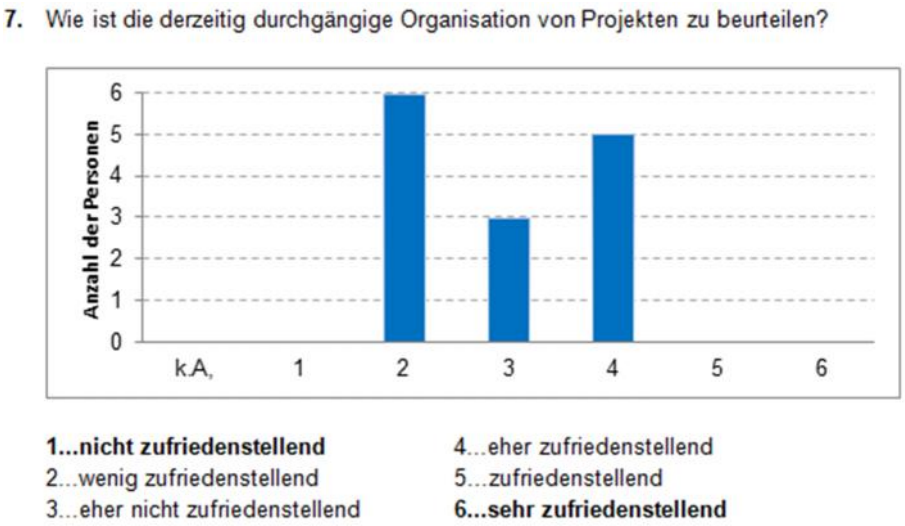


Figure 4.23: Project organisation

The participation in the question in figure 4.23 was 14 persons, with an average value of 2.93 and is thus close to satisfactory results.

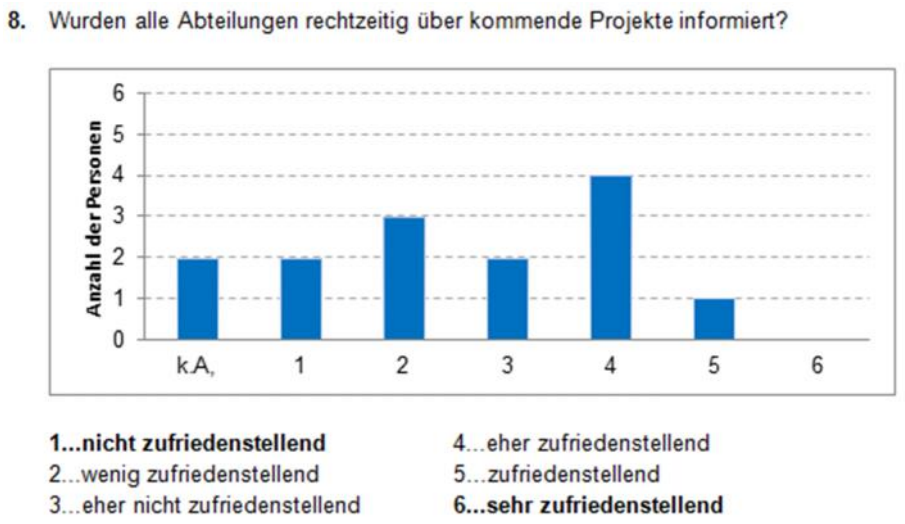
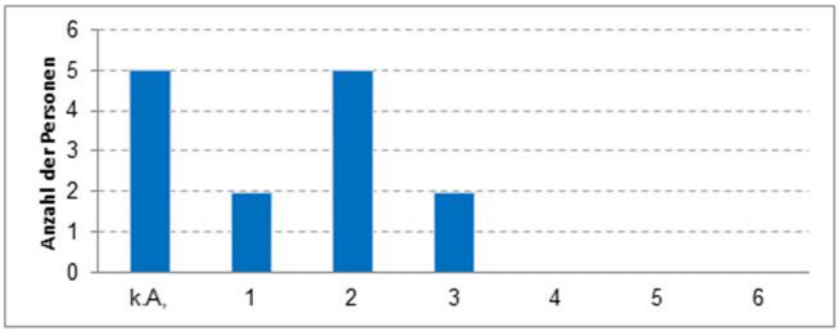


Figure 4.24: In time management

The participation in the question in figure 4.24 was 12 persons, with an average value of 2.91 and is thus close to satisfactory results.

9. Konnte die vorab erstellte Stundenkalkulation eingehalten werden?



1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.25: Hour calculation

The participation in the question in figure 4.25 was 9 persons, with an average value of 2 and is thus exactly in the case of less satisfactory results.

10. Wo sehen Sie mögliche Probleme in der Stundenkalkulation?

- Erwartungshaltung Kunde deckt sich nicht mit Palfinger-intern definieren technischen und funktionalen Lösung.
- optimistische Haltung / Beurteilung Lösungsansatz erfolgt oft unter Zeitdruck
- Teilweise werden von Fachabteilung abgegebene Stundenabschätzungen in der Realisierung massiv überschritten
- Kundenanforderungen sind sehr schwer zu erfassen und ändern sich häufig sehr spät.
- Die Stundenkalkulationen basieren meist auf subjektive Einschätzungen der Konstruktionsabteilung. Jedoch wird der damit verbundene Zeitaufwand in nachgestellten Abteilungen (Dokumentation, Ersatzteilcenter, Logistik, etc.) nicht berücksichtigt. Die Gesamt-Stundenkalkulation wird von der Abteilung PDS geschätzt und in die Preiskalkulation aufgenommen.
- Anforderungen ändern sich
- aufgrund fehlender Informationen ist eine Aufwandschätzung sehr schwierig
- Projektumfang war nicht vollständig kommuniziert
- wird im Fachbereich Einkauf nicht durchgeführt, nicht bekannt
- Wenn Änderungen hinzukommen zu einem festgelegten Pflichtenheft und es dadurch zu einem erheblichen Mehrstunden Aufwand kommt.
- nachträgliche Änderungen im Projekt machen eine realistische Kalkulation unmöglich

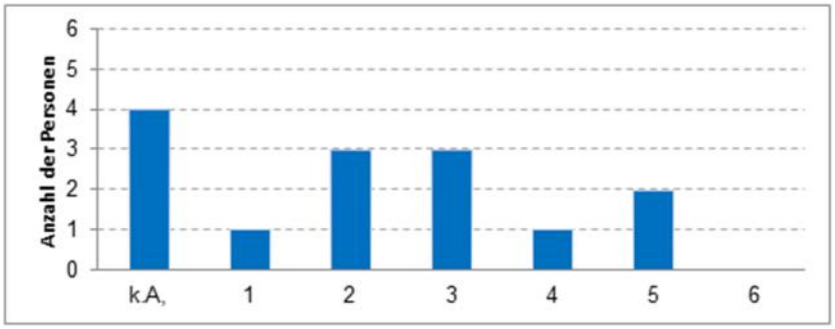
Figure 4.26: Problem of hour calculation

In Figure 4.26 possible problems were presented in the hour calculation and summarized as follows:

Subject hour calculation

- Hour estimates in the implementation massively exceeded
- Customer requirements are very difficult to record
- Related time expenditure in the following departments (documentation, spare parts center, logistics, etc.) was not considered
- Subsequent changes in the project make a realistic calculation impossible

11. Wurde der Design Freeze rechtzeitig durchgeführt?

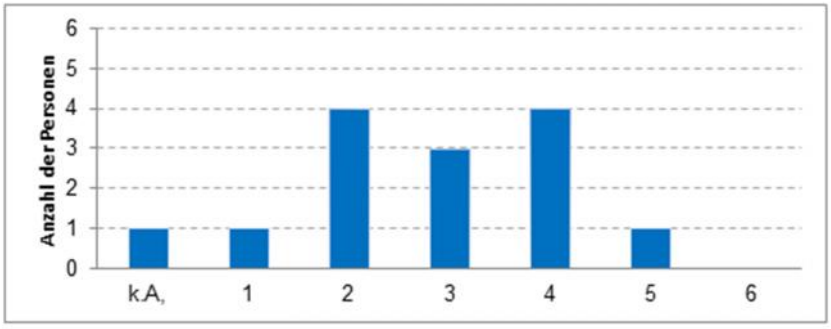


1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.27: Design freeze

The participation in the question in figure 4.27 was 10 persons, with an average value of 3 and is therefore exactly rather not satisfactory.

12. Verfügen Sie über ausreichende Ressourcen, um die Projekte zeitgerecht fertigzustellen?



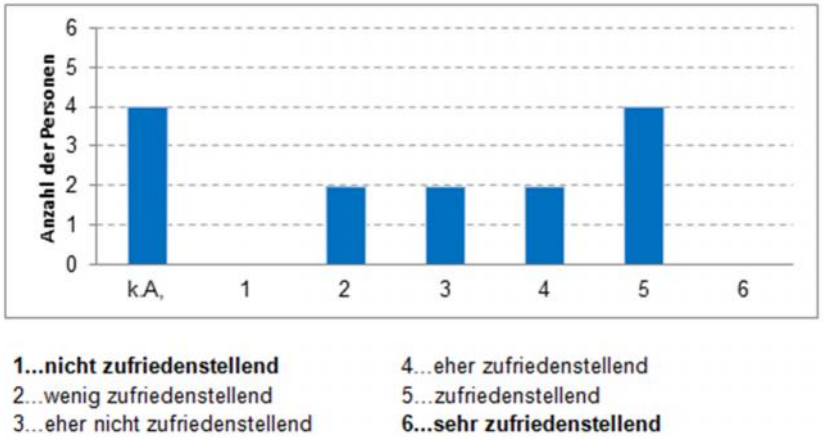
1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.28: Resources

The participation in the question in figure 4.28 was 13 persons, with an average value of 3 and is therefore exactly in the case of rather not satisfactory.

IV. Start-up mangement

1. Wie schätzen Sie ganz allgemein das Anlaufmanagement bei der Überführung in die Serie ein?



1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5...zufriedenstellend
6...sehr zufriedenstellend

Figure 4.29: Start-up management

The participation in the question in figure 4.29 was 10 persons, with an average value of 3.8 and is therefore close to rather satisfactory.

2. Wie gut waren die folgenden Unternehmensbereiche auf den Serienstart in der Vergangenheit ihrer Meinung nach vorbereitet?

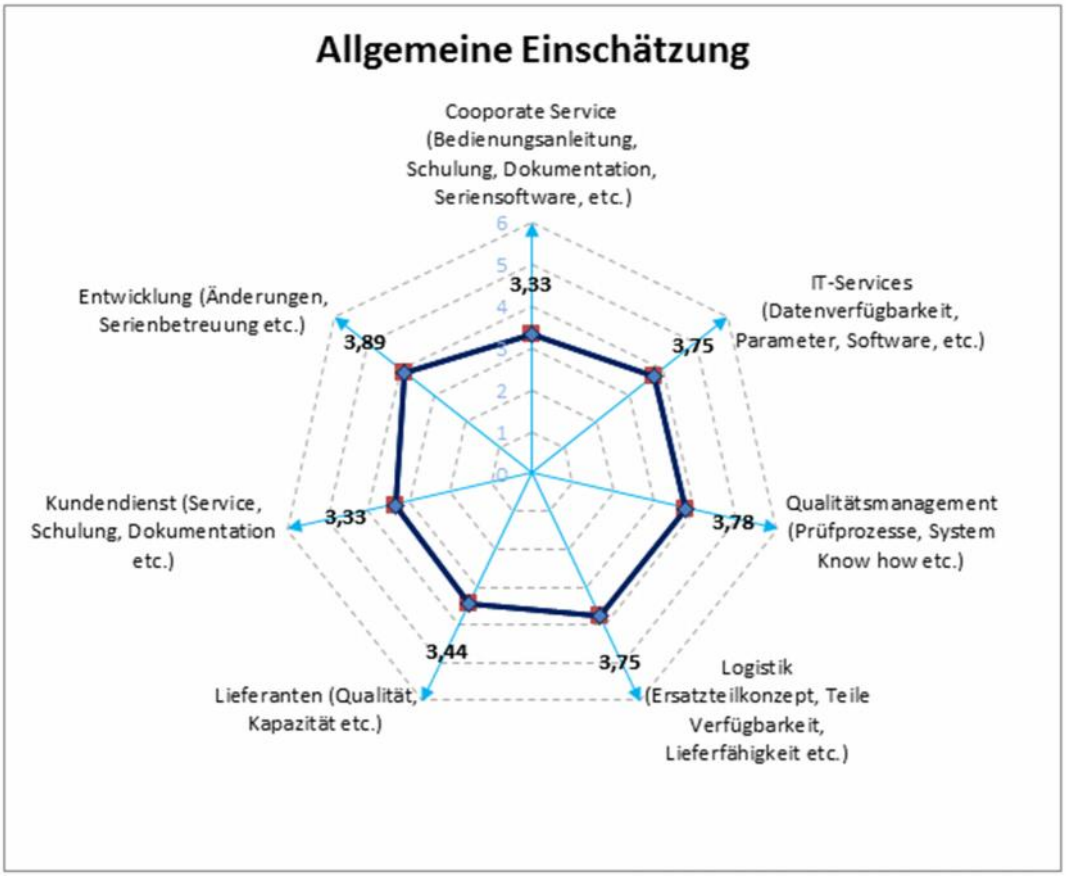


Figure 4.30: Serial start

Figure 4.30 gives an overview of the preparation of business areas for the series start. For this purpose, points could be awarded between (1) less satisfactory to (5) sufficient or even (6) very good. It has become clear that the areas of development, quality management, logistics as well as the IT area lead the field rather positively.

3. Um die Prozessreife zu verbessern würde ich für folgende Verbesserungen im Anlaufmanagement sorgen:

Führung & Management

- Bereitstellung notwendiger Ressourcen, Ernennung von "mil-Spezialisten" in den in Frage kommenden Fachbereichen
- Bei allen Bereichen: engere Kommunikation
- Keine Beurteilung von IV da hier zu wenige Informationen bei den beiden Projekten. Hauptaufwand bei beiden Projekten Proto + Änd.
- ist absolut notwendig!
- Ist durchaus verbesserungsfähig.

Projektorganisation

- Projektteam definieren
- ist absolut notwendig!
- Ist durchaus verbesserungsfähig.

Projektmanagement

- Abläufe, Ziele und Zeitplan definieren und standartisieren, Projektmanagement "leben"
- ist absolut notwendig!
- Ist durchaus verbesserungsfähig.
- Projektleiter & Projektmanagement

Figure 4.31: Startup management improvements part 1

All points of a possible improvement in the start-up management were also discussed shortly after the survey.

Figure 4.31 shows the following sets of statements in the fields of management & managemet, project organisation and project management:

Subject leadership & management

- Appointment of military specialists in CON, TC, E-CON
- Increase and create liability

Subject project organisation

- Project manager in PDS define, separation of sales
- Combine project management in small projects
- Split up of project / serial business
  Project plan with clear task allocation for all involved departments

Subject project management

- Improve project management understanding
- Communicated project- and process management
- Develop project plans with customers
- standardized procedures

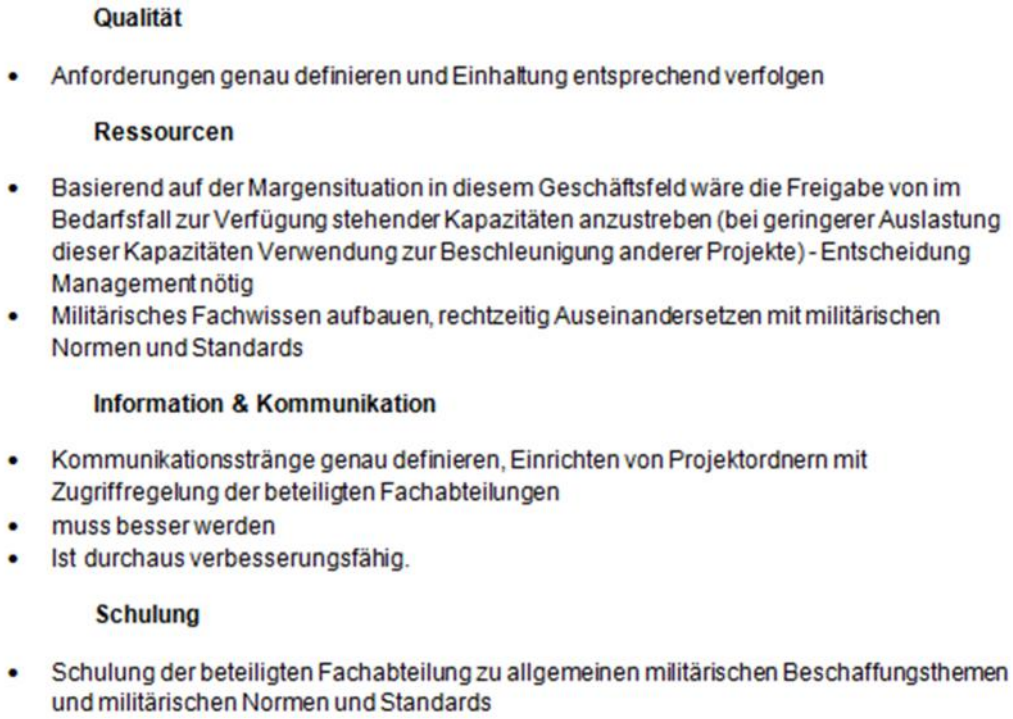


Figure 4.32: Startup management improvements part 2

Figure 4.32 shows the following accumulation of statements in the Quality, resources, information & communication and training:

Subject quality

- Quality assurance of MiL standards (NATO STANAG, MiL STD)
- Early integration QS
- Quality support in the project to meet high customer requirements
- Project business to create scope for possible short-term customer changes
- Serial business no changes

Subject resources

- Building and sharing military expertise with other departments
- Building basic knowledge of current MiL standards

Subject information & communication

- Clearly define communication strings
- Set up project folders with access control for the participating specialist departments
- Expand the secrecy area to get better information exchange
- Early information on upcoming projects
- Improve of communication with suppliers

Subject training

- Training the involved department to general military procurement issues and military Norm and standards
- Trigger documentation in time → Training start

4. Welche wichtigen Erkenntnisse aus den letzten Jahren wurden aus vergangen Projekten gewonnen?

- Die Anforderungen/ Erwartungshaltungen der MIL-Kunden steigen. Palfinger hat noch nicht die richtigen Produkte/ Systeme. Die Qualifikationsmatrix und Ressourcen für dieses Geschäftsfeld sind unzureichend. Wir wollten schnell mal ein kräftiges Stück vom Kuchen haben, ohne Investitionen in die Organisation und Abläufe zu tätigen.
- Unverzichtbares Geschäftsfeld mit wesentlichem Anteil zum Unternehmenserfolg (langfristig)
- Für die Abwicklung von militärischen Projekten bedarf es gewisser organisatorischer und personeller Ressourcen, die zurzeit noch bedingt verfügbar. Aufbau des Bewusstseins, dass militärische Projekte andere und höhere Anforderungen beinhalten, als das zivile Seriengeschäft.
- Kundenwunsch, Realisierbarkeit und Zeitschiene: Wunsch und Wirklichkeit klaffen zT stark auseinander; das gilt es zu verbessern
- Ein geordnetes und vor allem an die beteiligten Personen/Abteilungen kommuniziertes Projekt-u. Prozessmanagement ist rudimentär für die erfolgreiche Abwicklung eines Militärprojektes. Trotzdem muss ein Spielraum für eventuelle kurzfristige Kundenänderung bleiben bzw. auch die Bereitschaft diese Änderungen umzusetzen ("Kunde ist König").
- Man muss sich vieles selbst organisieren. Ziviler Bedienkomfort ist bei militärischen Geräten nicht realisierbar!
- "Vertragliche Vereinbarungen in der Konstellation Kunde <-> Palfinger <-> Lieferant müssen innerhalb den zuständigen Palfinger Fachbereichen geprüft werden, um eingegangene Verpflichtungen ggü. dem Kunden auch an den Lieferanten weiterreichen zu können. Zusatz: • Darüber hinaus fällt es schwer eine Einschätzung für Projekte abzugeben bei denen man nur punktuell hinzugezogen wird u. wenig über den gesamten Projektumfang u. Projektstatus/-zeitplan erfährt. Dies erkennen wir bei den abgefragten Projekten als größte Schwachstelle. Gleich wie bei denen ist dies auch bei einem aktuellen Projekt für MIL-Kanada zu bemängeln (wenig bis gar keine Informationen).
  - Zudem werden regelmäßig techn. Änderungen bei externen Entwicklungspartnern (Lieferanten) angefragt, wonach ein Design Freeze nicht zu erkennen ist.
  - Zuletzt ist es auch wichtig vertragliche Vereinbarungen in der Konstellation Kunde <-> Palfinger <-> Lieferant innerhalb den zuständigen Palfinger Fachbereichen gegen zu prüfen, wonach Verpflichtungen ggü. dem Kunden bestmöglich an den Lieferanten weitergereicht werden. Dies ist eine konkrete Lessons learned aus dem Hägglunds Projekt! (EINKAUF)"
- Projekt ist seit einiger Zeit im Haus bekannt, wird jedoch sehr spät an die jeweiligen Abteilungen weiter gegeben.
- MIL benötigt eigens entwickelte "milfeste" Systemkomponenten bzw. Produkte.

Figure 4.33: Project findings of the past

The information and characteristics in figure 4.33, on the recognition of recent years, which have not already been clarified in the previous open questions of chapters II and III, are now described below:

- Defining core teams (project / series)
- Regular project status rounds with protocol
- Early clarification of project / serial business → timetable (Design-Freeze)
- Adaptation of increasing requirements / expectations of MIL customers
- Closer communication with CON, TC, E-CON

4.1.3 Conclusion of the results

According to the results of the evaluation and combination of open and closed questions, five essential theses were filtered out. These are shown in table 4.

Thesis #1: Targeted communication **the key** for stimulating processes
Thesis #2: Permanent instead of **situative** project organisation
Thesis #3: Active instead of **resting** processes
Thesis #4: Strategic orientation for **efficient** order processing
Thesis #5: Proactive „fire prevention**“ instead of reactive** „ fire deletion**“**

Table 4: Five Theses

The first thesis about the target-oriented communication was set from the fields on the question of co-operation in the company, review of orders and by repeated appointment in the open question. In order to successfully execute the processes in a project, the communication must work in a targeted way in each area. Also at the beginning about upcoming projects which thus make a real hour calculation possible. So it is about how to communicate.

In the second, we are dealing with generally valid control processes in PDS in order to ensure targeted project management and project organisation. For the processing of military projects, a certain organisation and an adequate resource provision is required.

The third focus is on active process management and project management. Processes require a process manager who takes care of the process procedure and the active implementation of the process.

Efficient order processing is the key word. In order to be fast in a process at the end, it is necessary to prepare strategically at the beginning. The fourth thesis was derived from the project period, product management, product portfolio and the targeted project organisation.

In order to promote problem-free project implementation and working methods, the project and its relevance for the affected company segments should be communicated interactive at an early stage. On this foundation, the fifth thesis is based.

4.2 Expert workshop Palfinger

Following the survey of the questionnaire and the five theses that followed, workshops for the further develop of the approach were used. The expert workshop Palfinger was carried out in a small frame at the company Palfinger.

The structure of the topics was divided into three workshops to achieve the best possible result. Therefore the five theses were defined as the fields of action, which should be used as a guide for the workshops as shown in table 5. The goal is to implement with the fields of action, the occurred points of the questionnaire in the new process set-up for the Palfinger Defense Solutions.

Field of Action	Date	Participants
(1) **Organisational structure & core process of PDS** (flow of information, tasks of the employees)	November 2016 (M1) / 2 hours	Engineering, PDS, Mechatronics, Kaizen Coordinator, Project Manager Crane, TU Graz (Student)
(2) **Process & meilenstones** (Focus at the beginning of the process, who to increase flexibility for customer changes; time table)	December 2016 (M2) / 2 hours	Engineering, PDS, Mechatronics, Project Manager Crane, TU Graz (Student)
(3) **Responsibilities & Interfaces** (accountable persons in process steps, claims of involved departemts)	Jannuary 2017 (M3) / 2 hours	Engineering, PDS, Mechatronics, Project Manager Crane, TU Graz (Student)

Table 5: Fileds of Action

Figure 4.34 is intended to provide a better idea of how to further proceed in this master. This short project plan is similar to the schedule for the company acceptance, according to the achievement of the last mile stone M4. The project plan starts after the definition of the fields of action, with the first workshop, this is equivalent to the achievement of the first milestone M1. The results, which were compiled in the first workshop, will be further processed to deal with the topics of the second workshop. After the second workshop the same procedure for the third workshop takes place. At the end of the last workshop, the results are collected and used as a basis for a detailed discussion of the structure of a stage gate process. After refinement and targeted adjustment, the results are presented to the responsible management. The process of Palfinger Defense Solutions is implemented with positive approval and managed by a responsible project manager.

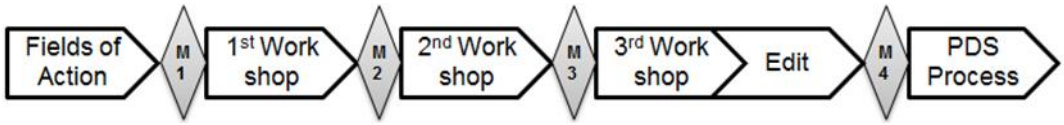


Figure 4.34: Project plan for the PDS process

In the following chapter, the topics discussed in the workshops are briefly described, their procedures are described and the output is presented.

4.2.1 First Workshop Palfinger

Which **topics** were treated?

In the first workshop at the company Palfinger, the topics listed in the first fields of action, the organisational structure and the core process of the Palfinger defense solutions are to be determined. In the first section, the department of PDS is deliberately confronted with the raised five theses. Furthermore, the organizational structure in the PDS division is to be analyzed and possible variants of restructuring are to be developed to improve the project management.

The goal is to slightly modify the pure sales department for process-oriented project management. According to this, a core process of the department PDS is to be raised on this basis. The aim is to complete all process steps and correct procedures up to the entry into the series process.

How were methodical **procedures** followed?

For the correct holding of the workshop, the project manager crane acts as a dissemination leader with the assistance of the student. Additionally, in the first workshop, the kaizen coordinator enters as mediator in conflict situations. The topics were dealt with the help of flipchart and power point support.

What was the **output**?

At the beginning of the workshop, the project manager crane was once again given the critical points, which were summarized in the theses, from the questionnaire. To this end, the representatives of the departments of engineering, mechatronics and PDS were asked to assess the theses to the correctness and their assessment. After agreement of the theses of all those who had been asked, the PDS was rolled up and discussed. In this context, there was initially a conflict between the activities of the PDS and the mechatronic. The Kaizen coordinator referred here to the change management, see chapter 2.3, and intervened.

The main topic was the understanding of the job description in the PDS. How far is the responsibility of sales people in the department? Where are transfer points and docking points? So far, this department is composed of a head of sales and other sales representatives as shown in figure 4.35. In this form, a process-oriented focus is not possible. Without the right organisational structure, processes can not work.

Thus, the organisational structure must be raised simultaneously with the process definition. Furthermore, the positions and functional descriptions of technical sales must be clearly defined. In the field of military, industry is subject to industry-specific distribution. The points are as follows: how far is the processing handled by the sale, where is a common denominator in the sales team know-how, since there is a very high share of similar boundary conditions, strengths, standardisation and spare parts guarantees.

Here the question arises about the expectation of the organisation to the team sales. In which quality and execution is there a handover to the project management? Where are the tasks of project management? Are the links here between sales and development or also in the aftersales area? Only in this way is the whole system coherent. This is the core point, because the departments have completely different expectations among themselves or a different one than the area itself. This is the focus in the first workshop, to deal with it. There must be a clear understanding between the departments and in addition, a proper and honest communication must arise. Consequently, the focus was placed on a breakdown of sales representatives into specific

areas, see figure 4.35 on the right, which should help each other out depending to the utilization. This increases the reaction time and proximity to the customer.

The senior applications sales must devote himself to the tasks for the further development of the department and a future-oriented application to the process form. As a result, a project manager is added to strategically coordinate the projects as an administrator for PDS.

The project manager prepares the product with the sales and controls it. The sales employee goes back to his activity and the project manager communicates as an interface with the following departments, get feedback and report the HoD the status. Deadline monitoring, inspection, coordination and information about the technical content of the project are his tasks.

The sale must provide customer, contract and risk assessment, support the project manager with talks to customers and introduces the project manager technically. The knowledge is then passed on to the following departments by the project manager.

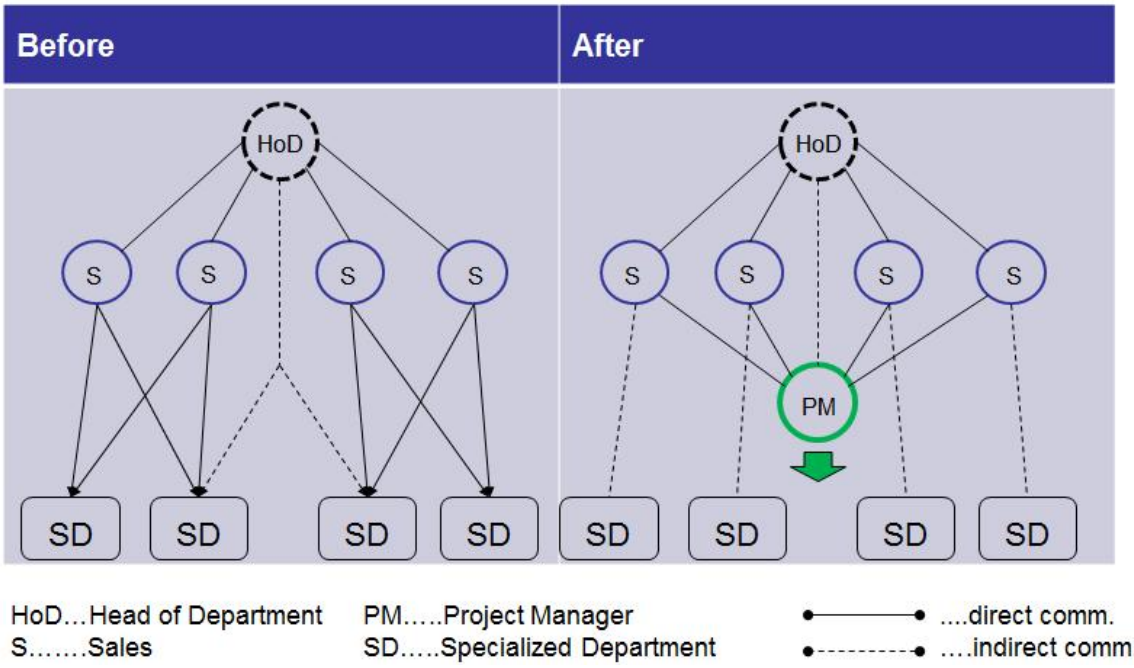


Figure 4.35: Structure PDS / technical sales department and project manager

The following structure was also approved by the top management: A head of department with four central sales offices and a project manager for the process organisation.

In order to be able to operate these interfaces as a project manager, it requires a basic core/control process and it is necessary to generate elapsing interfaces. Chapter 2.6 gives a short explaination about the definition of a process. The interfaces will be analysed in the third workshop. At the same time, the core process is a basic structure that takes all the necessary points into account. The defined core process was created as in Figure 4.36.

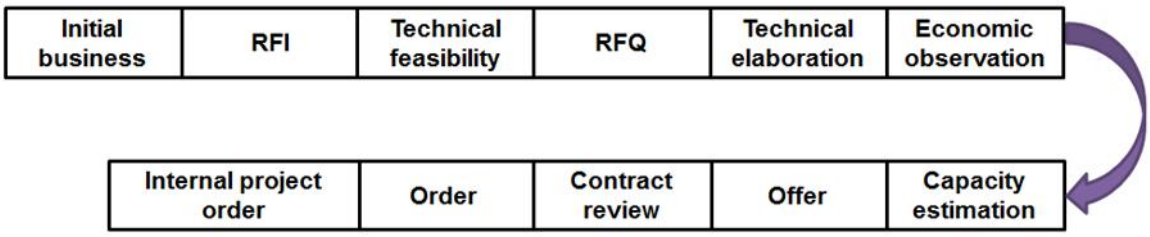


Figure 4.36: Core process part 1

Not only the process after acceptance, but also the creation of the business should be involved. The tasks of the workshop were tried to process, but it was not completed as the discussion around the organization lasted longer than expected.

Knowledge of the participants:

- HoD needs relif → PM useful
- Possible product portfolio for the future
- Product management
- Information pool (product range)

4.2.2 Second field of action

Which **topics** were treated?

In the second workshop the points of the first workshop were completed and then the program of the second workshop was executed. Topics of the second workshop include responsibility for the respective process step and possible milestones, see chapter 2.8.6.

How were methodical **procedures** followed?

For the correct holding of the workshop, the project manager crane acts as a dissemination leader with the assistance of the student. The topics were dealt with the help of flipchart and powerpoint support.

What was the **output**?

At the beginning of the second workshop a short update of the last results was given. Furthermore, the core process was continued. This process can be used for all 5 products (boats, craylers, taillift, crane, hooklift) in the PDS. Therefore, process steps, which were constantly being repeated in the project business, were generated in order to generate a structured process management (refer to chapter 2.5)

After reviewing the last results, a milestone M1 was defined at the beginning of the process and the topic of the internal project order was taken up again. Here, on the other hand, a specification exists and therefore this step was renamed into requirement specification.

Since there can only be one customer order that has to be processed, the next step summarizes what has to be done. In addition, the contract review is also included.

In the course of this, it was unanimously recognised that the contract review had to be carried out before or at the same time with the order in order to clearly determine whether this could be met. For this purpose, the contract audit was classified according to the offer because there may still be

negotiations for changes in the offer. The contract examination has been concluded with the creation of the order.

As a further topic, the customer changes were taken into account which with the process step requirement specification and thus end with the design freeze. At the same time, this is a guarantee for the Palfinger company to ensure the dates in the project plan. These steps allow to maintain the requested number of hours.

This is where the claim management also begins to work, see chapter 2.7.7 (evaluation, assessment and impact result in costs, resources and time). This must also be taken into account in the contract.

At this point, the discrepancy with customer changes was taken up again, resulting in a further milestone M2 with a fixed date to ensure the schedule for the final release. After this, the remaining process steps as shown in figure 4.37 were discussed in the development phase (prototype to FAT) of the core process.

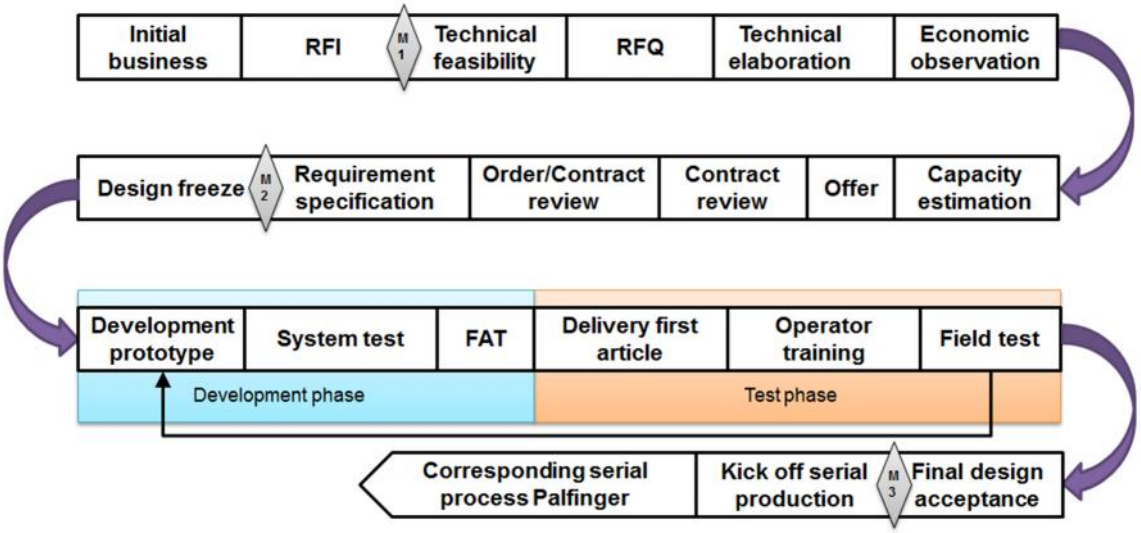


Figure 4.37: Core process part 2

In addition, after the test phase, small changes can be made, which are drawn to the prototype step with a loop. After that, a milestone M3 was chosen as a kickoff for the serial entry. With the introduction into the series process, the process configuration ends in the workshop, because from this point onwards the series process palfinger continues.

The next topic concerned the responsibility and the coordination of the individual process steps. Who is responsible for the process step and who must coordinate? For this, a list was created by means of flipchart, which was further elaborated by a post-processing in a RACI model. For this purpose, the following chapter will be explained in more detail. In addition, it should be mentioned that the new structure, including Project Manager, has been involved. This ended the second workshop.

Knowledge of the participants:

- introducing of claims with budget (e.g.: 1claim = 500€)
- Limit customer changes with fixed dates
- Difference project coordinator/project manager must claim the blame (has powers)

4.2.3 Third field of action

Which **topics** were treated?

In the third workshop at the Palfinger company, the topics will be dealt with as to the exact degree of responsibility and involvement as well as the interfaces. It is to be determined which areas are involved in the process steps and in which form. Thus, the roll description becomes the subject in the third workshop. In addition, clear interface agreements must be made. This is of course adjusted to the core process defined above.

How were methodical **procedures** followed?

For the correct holding of the workshop, the project manager crane acts as a dissemination leader with the assistance of the student. The topics were created by a list-run with the help of a flipchart and by excel tables more precisely documented.

What was the **output**?

The third workshop started with an again presentation of the core process by the project manager crane. With the help of a short excel table, see Figure 4.38, the participation of all departments involved in the process step could be included. Furthermore, discussions about the responsibility and coordination, which must be clearly clarified for each process step, have led to a discussion.

The role of the project manager was discussed hereIt was to clarify whether there were powers for his acting or this purely coordinating functionsIt showed that the project coordinator is not to be renamed to the project director, but nevertheless the responsibility in the individual process step has.

With the help of interface descriptions, the propriety of responsibility and the powers can be regulated. In the figure 4.38 the responsibility (coordination) was marked with orange and accountability with red. Each individual process step has been analysed and assigned. The more detailed elaboration of the RACI model follows in the following kaptiel 5.3.

Step	Process	Sales	Project Manager	Customer		involved departemen	R = Responsible A = Accountable C = Consulter/Executer I = Informed
1	initial business	A		I		PDS	
2	RFI	A	R			PDS, TC, KON,MEC, Arbeitstechnik(Lack)	
3	technical feasibility	A	R			PDS, TC, KON,MEC	
4	RFQ	A	R			PDS	
5	technical elaboration	A	R			PDS, TC, KON,MEC	
6	economic observation	A	R			PDS, TC, KON,MEC, DOKU	
7	capacity estimation	A	R			PDS, TC, KON, MEC, DOKU, Montage	
8	offer	A	R			PDS, Legal, Quality	
9	order/contract review	A	R			PDS, Legal, Quality	
10	requirement specification	A	R			PDS, TC, KON,MEC, DOKU, Einkauf, Musterbau & Versuch	
11	design freeze	I	R	I		PDS, TC, KON,MEC, Einkauf, Logistik	
12	development prototype		R			TC, KON, MEC, Quality, Musterbau & Versuch, Service, Fertigung, Arbeitstechnik (Lack),	
13	system test		R			TC, KON, MEC, Quality, Musterbau & Versuch, Service	
14	FAT = factory acceptance test		R	I		PDS, TC, KON, MEC, Quality, Musterbau & Versuch, Service, Customer	
15	delivery first article		R	I		PDS, Quality, Versand	
16	operator training		C	R		(PDS), Schulung (C)	
17	field test		R	I		Customer	
18	final design acceptance; if NO, then addiational loop 12(modification prototype)	A	R			PDS, TC, KON,MEC, DOKU, Einkauf, Musterbau & Versuch	
19	kick off serial production	A				KON, MEC, TC, DOKU, Service/ Kundendienst(KD), Musterbau & Versuch, Quality, Montage , Einkauf, Fertigung, Logistik, Ersatzteilcenter, F&E, Arbeitstechnik, Versand, Schulung	
20	corresponding serial process Palfinger						

Figure 4.38: Responsibilities

Given this basis of the agreement of responsibilities and role description, occurring interfaces could be talked about.

The discussion was to clarify the cooperation with the PDS and the upcoming development activities in the area of PDS. After clarification of the object, the form, length and location and time were further recorded.

In the event of non-compliance, which should be avoided in the future, escalation levels were set for all parties involved. This also serves the project coordinator as a tool for the enforcement.

Knowledge of the participants:

- Interface agreements in groups
- Clarification of responsibilities

The results from the three workshops were further elaborated and combined with the help of project management and process management to form a new customer-oriented stage gate process. The results are presented in detail in the following chapter.

5 Final process model

Building on the insights of the workshops, the process is further developed in this chapter by the method of Robert Cooper (2002).

According to Cooper (2002), a frequent mistake by companies is that the efforts for the superiority of the product are not anchored in new processes. In order to incorporate this striking success factor of the superior product into the process, some things have to be considered. Each gate should have a specific criterion for the product suberiority. Furthermore, the product definition must include not only requirements for performance and technical specifications, but also a aimed consideration of the added value of the product for the customer.

The idea is to create the process with the help of project management advantages and the innovation concept or process of Cooper (see chapter 2.8). This create a hyprid process that combines the advantages of milestones and gates and is combined with Palfinger-specific stages on the basis of the core process.

For this purpose, the stages are subdivided into several core process steps, which have been determined as described above in the expert workshops. By focussing on breaking down the individual stages, followed by gates, and checking the special targets for the stage gate method, the process can be further optimized and can thus be accelerated, better controlled and thus also achieve an efficiency increase.

5.1 Palfinger Gates & Stages

This chapter now separates the micro level of the project management and the macro level of the Stage-Gate-Process. In order to create an effective and structured composition, as described in chapter 2.8.3 figure 2.17 by Cooper (2002), it required some logical and defined goals. Chapter 2.8.2 explains and describes the most important factors in order to obtain a functional Stage-Gate-Process. In this chapter, the individual sections of the stage gate process for the Palfinger defense solutions are examined and the stages with the corresponding gates are explained more in detail.

The first step in the direction of a Stage-Gate-Process was to find out whether there is a control process? A clear picture of the situation and the process emerged through the survey of the process maturity. In view of this, the core process could be prepared in the workshops and brought to paper.

In the next step, the phases were assigned to the individual process steps. Since we are still talking about phases, the individual project management phases are renamed here in so-called stages according to Cooper. As already mentioned in the chapter on project management, process steps are found subdivided in the phases, which are now suborinented to the stages.

To complete the Stage-Gate-Process, the stages were prefixed decision gates presented. Figure 5.1 shows the complete representation of the process. The six gates in this process, among others, are available as feedback rounds and as external evaluation points for completed projects.

First of all, criteria for the evaluation of the project for the individual gates must be drawn up. On the basis of this, the project can be evaluated afterwards and a conclusion can be taken. The responsible tribunal for decisions in the individual gates, is internally predefined according to the project, and can also be furnished by the project team himself. The respective project team in PDS consists of the head of sales, the process coordinator and the sales representative of the relevant focus in the project.

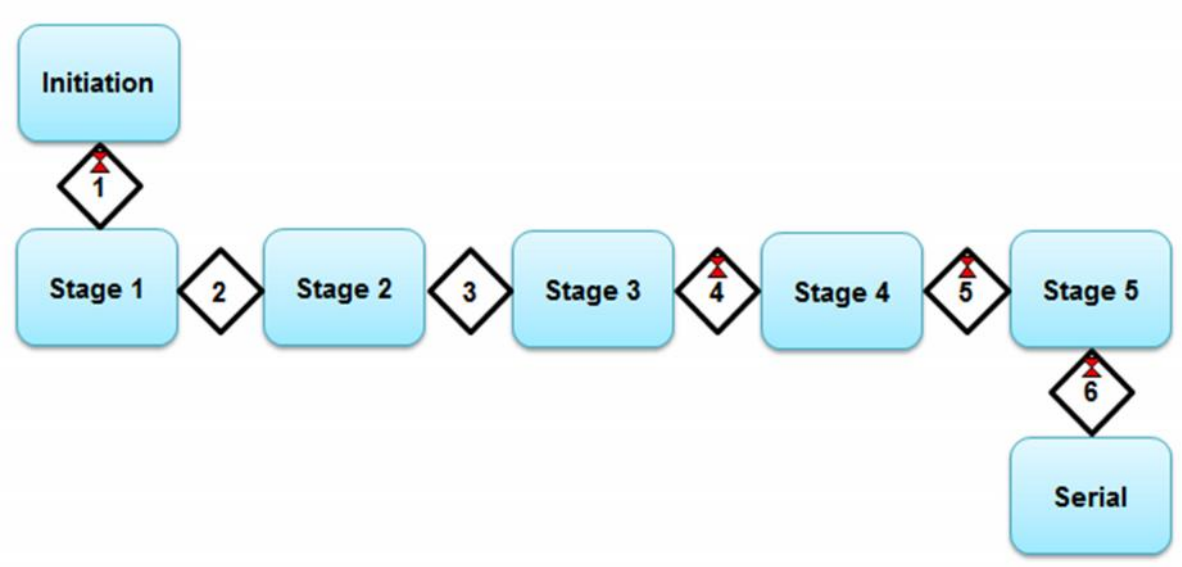


Figure 5.1: Stage-Gate-Process PDS

For the exact explanation of the stages and gates, appropriate sections were picked out and explained in the following way.

Initiation:

The initiation of the business of PDS is the starting point of the process. Every tender is created by an idea, a renewal of obsolete machinery or necessities. In this section, orders are carried out through calls for tenders or through the special type of request for information (RFI), which corresponds to a collection of technical information for the customer. In other words, there is more or less a detailed document about what the potential customer wants to have or believes he wants to have.

Furthermore, direct inquiries and rough requests for military purposes will be answered. The period in which such a business is initiated in the military field may extend over several years. As customer expectations and reality often do not meet directly in this segment, many RFIs often take place until you reach the desired product. The evaluation of the RFI requirement is controlled by the sales team.

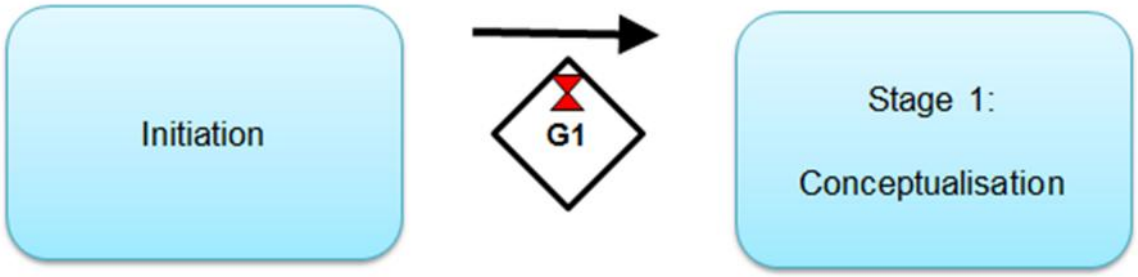


Figure 5.2: Idea screening

Gate 1: Idea screening

The first gate was marked with a milestone, characterized by the red sand clock, see figure 5.2, in order to integrate a temporal component into the process sequence. This means that if you continue to set a project deadline, you have a clue for the project start and can thus control and calculate the necessary resource expenditure in combination with the project's scope estimation and further dates. This represents the start of the project and serves as the first location discussion with the tribunal for the project coordinator and senior sales manager.

In doing so, it should be decided whether the project is feasible or not or what opportunities would be offered. If the decision is positive, it is also decided at this point which classification of project is involved, such as a product change or system change (see chapter 2.7.4). Depending on the decision, the project can be executed in a speed or standard process, in order to increase the throughput speed.

In addition, the gate is not only a project start, but can also be viewed as an information pool for a future product portfolio. At the end of the decisions, the next criteria for the following gate are clarified. The postion of the gate was chosen after careful consideration, regarding the core process, before the technical feasibility, in order to control the flow of information between sales and technical departments by the project coordinator and to build up know how in sales. The possibility of a fuzzy gate is not to be excluded here, but more information about that case is given in chapter 5.2.

Checklist for gate 1:

- Set the project startup
- Resource planning
- Go or kill decision for the project
- Depending on the classification → speed or standard process
- Information collection for future product portfolio
- Criteria for G2

Stage 1: Feasibility

This stage clearly moves in a loop with the initiation of the business, since the technical feasibility check is answered by the technical departments. Thus, questions which can not be answered by the sales employees wit the internal knowledge or FAQs, will be passed on and will be examined by the project coordinator with the appropriate departments.

If you handle the RFI and the technical feedback cleverly, you could control and forecast what the request for quotation (RFQ) is about. The RFQ therefore corresponds to the specification of the customer, which is sent to the contractor by means of a quotation request. In the case of a series product, this section falls away. In this section the critical homework tasks according to Cooper (2002), as described in chapter 2.8.1, are thus completedThe definition of the product is in this and at the beginning of the next section the main aspect. The properties, requirements and specifications as well as the desired product characteristics are defined in this step. The more detailed the work is, the less changes will take place in the end.

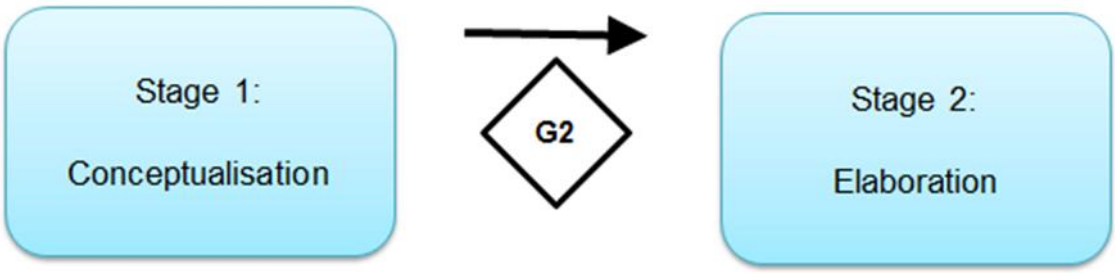


Figure 5.3: Second screening

Gate 2: Second screening

In the second screening shown in figure 5.3, the project is again checked for realisability, on the basis of the information obtained from RFI and the technical feasibility. The specification created by the customer can be checked again and in case of a positive evaluation, it could be moved forward into the section with higher resource use and strong commitment.

It must be decided whether the criteria for the realisation can be fulfilled. Additionally, criteria that are only obtained from the first section, such as criteria for customer reaction or criteria from legal requirements, depending on the project request, can be collected. Furthermore a short, quick calculation and rough estimation take place in order to include the economic factor.

For easier evaluation of the criteria, a point system can be used. In this gate, the previously established criteria are checked and with the tribunal the offer request discussed At the end of the decisions, the next criteria are again clarified for the following gate, such as a complete project plan, see chapter 2.7.3.

Checklist for gate 2:

- More accurate assessment of realisability
- RFQ → inform tribunal
- Short calculation
- Set criteria for G3 (standard process only)

Stage 2: Elaboration

This stage is dominated by the calculation and the offerings in combination with the technical elaboration. Technical feasibility is the rough estimation of the overall package, and thus a strategic assessment.

In contrast, the technical elaboration is the description for the professional erxpertise and the company's internal skills. What the company is able to perform or produce. Furthermore, the effort estimation and the price estimation have to be made.

given this base, a calculation and a price adjustment for the economy are carried out. Es It has to be not only sold the product, but also the associated time and the technical know-how. As described in chapter 2.8.1, the supply routes, production costs and investments must be investigated. Legal and patent-related considerations should also be taken into account in special

solutions. In addition, the capacity estimation is performed along the entire value chain. At this point, the delivery times are also roughly defined and the tranche coordinated, or even the customer's request for delivery dates or lot size is roughly included. The exact delivery schedule is part of the order.

The last part of this section is the offer given by the sale. In the offer, 90% of the framework conditions are clarified, whereby the majority of the technology must already be fixed. Contract negotiations also take place here and must be clarified with the management. This may lead to a renewed offer. For example, payment changes from 30 to 90 days, etc. Offer negotiation can take a period of several months to meet requirements. In this section, the critical homework is done as described in chapter 2.8.1.

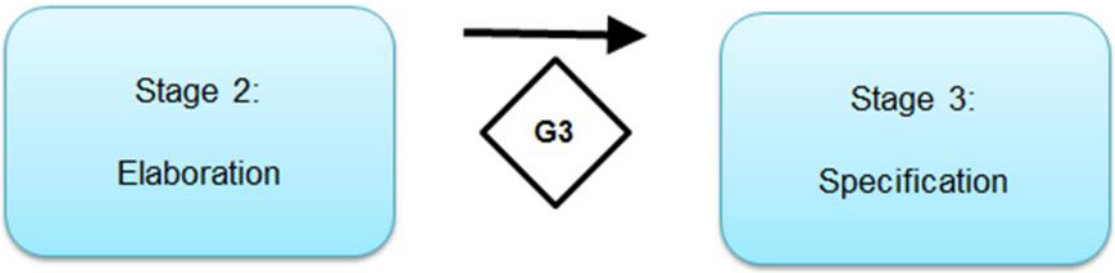


Figure 5.4: Last possibility

Gate 3: Last possibility

In case of inconsistencies or fears of massive costs, Gate 3 in figure 5.4, is the last possibility to cancel the project. With the decision for the project, massive funds will be released with the next step. With this gate, an overview of the last section, with all its activities, will be gained. It should be checked whether all previous steps have been duly completed and are also fully fulfilled. Furthermore, the criteria established in the previous gate are checked by the tribunal and a closer look is taken at the fianzanalyse and the offer. Subsequently the tribunal decides whether to approve the funds or to cancel the project.

In terms of an approval, the project plan can be carried out as submitted. At this point a time limit for the fourth gate is also decided in order not to unnecessarily lengthen the next stages and to show the customer a deadline for changes. An important criterion for gate four is the conclusion of the value-added inspection

Checklist for gate 3:

- Last chance to cancel
- Project plan template
- Financial analysis
- Check offer
- Realse of all funds
- G4 date & criteria

Stage 3: Specification

In the negotiations, changes always occur or are eliminated and thus a loop between offer and order is turning. At the same time, however, the analysis of whether everything is economically correct and legally correct must be done. The contract audit plays a further important role in the context of the order.

All regulations for further changes after the design freeze, which concern a system change or product change must be clearly clarified by competent claims in the order. The customer must be informed in full about this in order to prevent surprises with additional payments. On the side, payment plans and risk management are also ongoing.

The contract can not be accepted until a responsible check has been carried out to clarify what is required here. After several clarifications of the order, the order finally will be concluded in parallel with the concluded contract examination, by all responsible departments.

Subsequently, the internal project order, which gives information about what ultimately needs to happen, provides details. In other words the requirement specifications must be drawn up completely, with all the customer changes and additional information included. In order to hedge the department, in this process step, the integration of the claimangement arises, as it was extracted from the workshops.

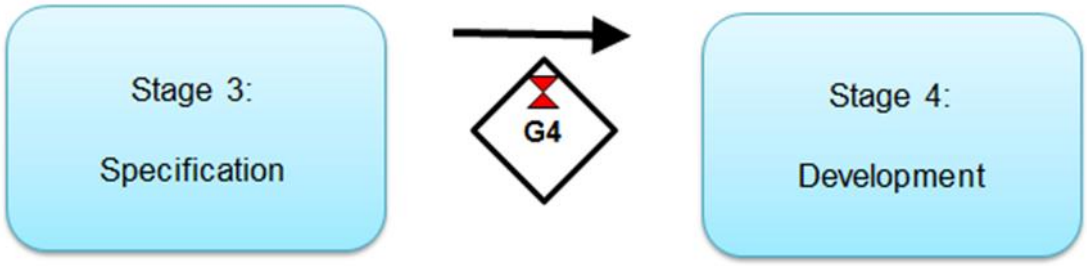


Figure 5.5: Internal kick off

Gate 4: Internal kick off

With the entry of the fourth gate in figure 5.5, the start discussion takes place for the internal kick off. All necessary data are collected and presented again. The gate with a milestone character also acts as a fixed date. For customers this can serve as an orientation until when changes can be made, which can be carried out without delay and thus guarantees the fixed observance of the delivery dates and lot sizes negotiated in stage two. This avoids wasting processing hours on the basis of project costs. Completion of the value-added inspection must also be checked in this gate depending on the size of the project, as this is not a series and project costs can not be stressed too much.

In this case, the fixed dates for gate five and gate six are decided on the basis of the requirement specification, which are provided with scope for provisional claims or changes according to the field test. Accountability is transferred from the head of sales to the project coordinator, with information to all involved.

Checklist for gate 4:

- Requirement specification check
- Information of all participating departments of development
- Accountability changes from Head of Sales → Projekt coordinator.
- Value added inspection completed
- G5 and G6 scheduling

Stage 4: Development

The next step after the requirement specification is the design freeze by incorporating all the information of the requirement specification. This includes, among other things, the MiL Std and take into account Norms. Subsequently it is sent to the customer and he is further informed that from now on only changes by claims are possible as documented in the contract. This means that the flexible customer changes, which are a must in the military business, are limited by the fixed date of the gate four in order to avoid unnecessary resources without payment.

At this time, the documentation, the service and procurement topics for external parts have to start in order not to delay the conclusion of the project. The project coordinator is responsible for informing the departments and taking care of the procurement area

With the beginning of this stage, the scope of the product is defined and the signal for the product development is given. With the development of the prototype, which includes electronics and mechanics, the sytem test in the house as well as the factory acceptance test, it is guaranteed that the product meets all requirements under controlled conditions. If the product is prolonged, an additional project plan with internal milestones can be developed. At this point it refers to the comparision between milestones and gates in chapter 2.8.8. At the end of this stage, the prototype must be ready for acceptance and ready for the customer.

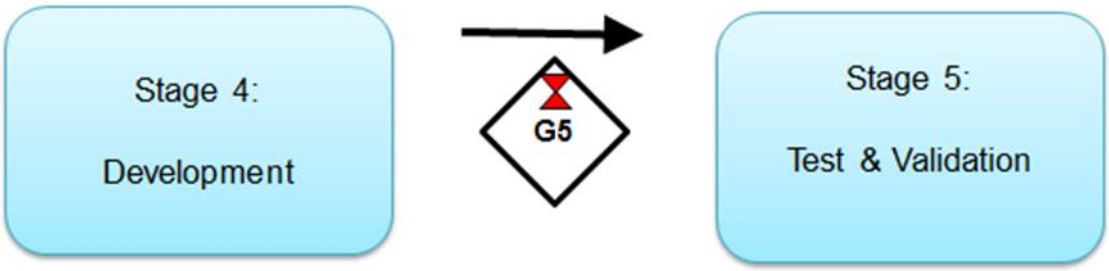


Figure 5.6: Hand over

Gate 5: Hand over

This gate again has a fixed date which has been decided in gate four. The gate in figure 5.6 is used to monitor the prototypes and to observe the process. In doing so, the quality and compliance with the specific requirements for change will be reviewed. Additionally, the status of service, documentation should be collected. In the event of a positive assessment, the product is released for delivery to the customer. In terms of a negative review, immediate rework should be initiated, but the risk can be minimized considerably by working closely in the previous stages. If necessary

changes occur after the field test, a loop is initiated as described in stage test & validation and the gate is passed through as often as essential.

Checklist for gate 5:

- Deadlines
- Right timetable
- Quality and modification check
- Release for customer

Stage 5: Test & Validation

In this stage, the prototype, which counts as a final product for the customer, is provided to check the required requirements in a field test. The product is in this stage only at the customer. This procedure is common in military projects. For the perfect handling of the product, the customer is given a training which also can then be supported by a serviceman in the field test of the customer. The coordinator is available to assist the customer at any time, since he has the connection to the customer. In the end, the customer returns a feedback to the contractor, by not having anything to complain about the product in the best case.

If the customer calls for changes, there is a jump back to the development of the prototype in the core process in the form of a loop and the desired change is worked into. These amendments are considered in advance in the contract and whether they are based on a claim or otherwise, in order to prevent any misunderstandings.

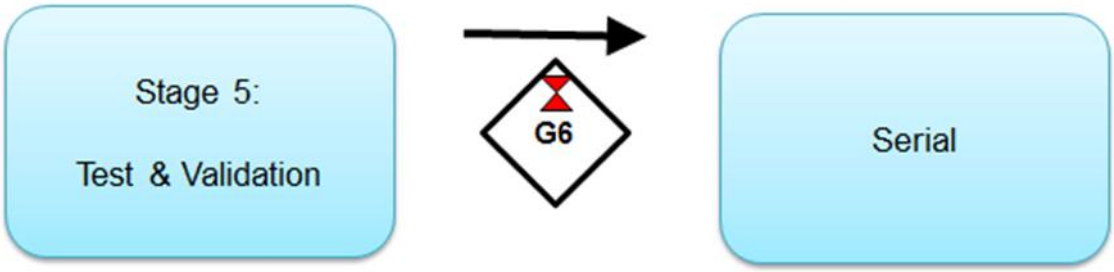


Figure 5.7: Product acceptance

Gate 6: Product acceptance

In the last gate in the process of Plafinger Defense Solutions shown in figure 5.7, is again a fixed appointment which was made in the G4. By checking the date, it can be judged whether or not the delivery date is to be observed. In addition, this fixed date is the customer's indicator to mention his change requests which may occur in the field test, in a timely manner.

Until this date, the customer must submit the final design approval in order to be able to be supplied by contract. After confirmation of the customer, the decision of the entry into the series process Palfinger is approved by the tribunal and further supervised by the coordinator. In the event of delay, appropriate measures are defined and supervised by the coordinator.

Checklist for gate 6:

- timetable
- Measures for time delay
- Release for steering of the serial process

Serial:

If the desired product is convincing in all tests, the final design acceptance is requested by the customer. At this point, Palfinger's standard production serial process is used, depending on the type of project and definition in the contract. In this process the customer is in contact with the coordinator. Furthermore, it should be noted that the documentation should be completed with delivery of the first serial device. What is more, there is a repeated kickoff for pre-series / series implementation. The project coordinator accompanies and monitors the project until the end.

In military projects, the first series product in addition to the standard series process is once again taken off. The batch one test takes place at the company.

In this configuration of the process, the focus is placed very strongly on the first stages. According to Cooper (2002), the activities of a development process are decisive at the beginning, to ensure the success of the process. In order for the individual process steps to be combined more effectively, the process was checked with the seven factors of the stagegate method. The results are presented in the next chapter.

5.2 Evolution of the Palfinger standard process

The next step in the development of the process is the verification of the success methods of chapter 2.8.1. The process is now being viewed more critically in order to increase the speed, flexibility and fluidity as described in chapter 2.8. The improvement of a process is an ever-recurring necessary step in order to keep the process on a high level and to take account of the restructuring. The perfect process, which always works and fits, does not exist in this kind.

In figure 5.8 the process is shown with all process steps from the core process. As Cooper (2002) has already written, also this process is not an irrefutable law, which must be adhered to. Depending on the project, individual steps can be combined or omitted. Flexibility is the key word for the process, which is discussed in more detail in chapter 5.5.

The process was equipped with so-called fuzzy gates in the first gate till the third gate, see chapter 2.8.4, which are indicated by the miniature gates below. In the first gate, which is identified by a milestone character, a loop or rather an additional possibility of the process continuation was integrated. Depending on the feasibility, which should be communicated with the relevant specialist departments, the gate can be extended forward till the complete result. In addition, the long communication times with the clients are also taken into account. The next gate can also be forwarded if the results of the RFQ are not yet fully available or the feasibility can be checked. Because of skillful control of RFI and technical feasibility, a forecast can be taken and this could lead to a competitive edge. The third gate is intended to enable the possible exchange of offer negotiations in a loop with the order audit.

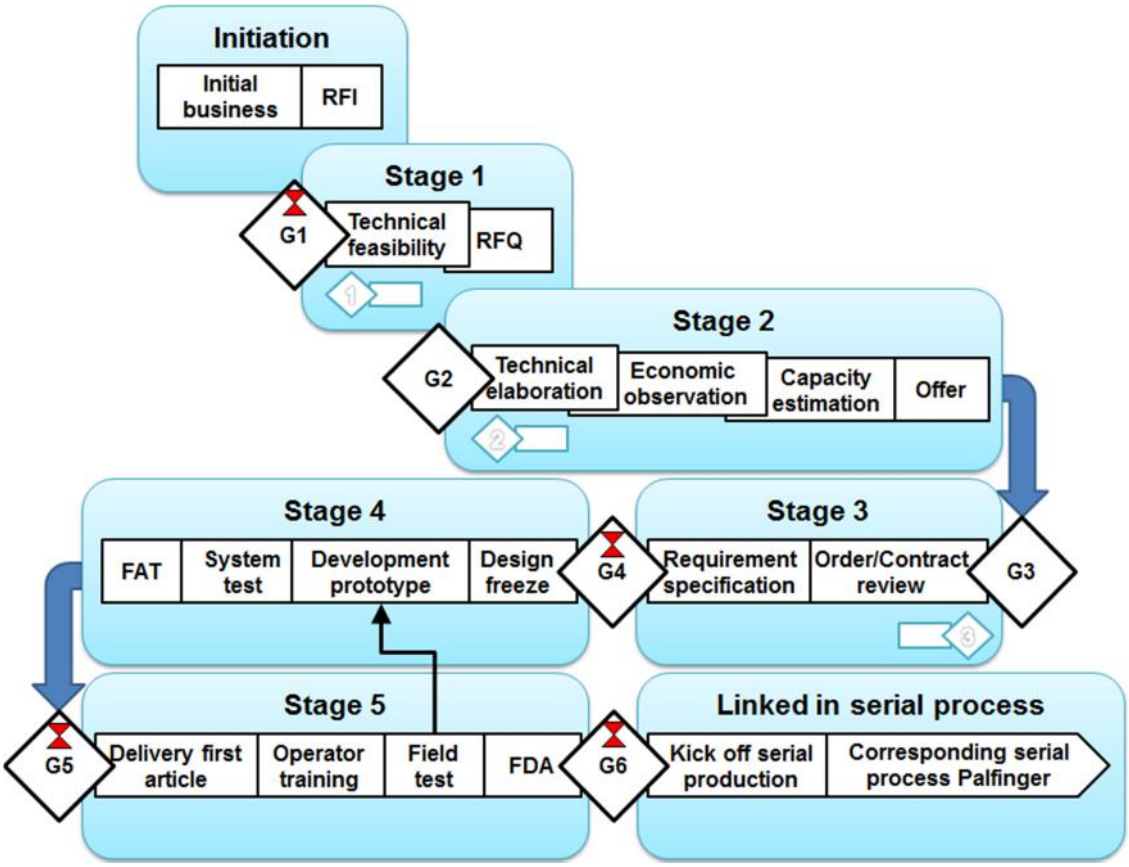


Figure 5.8: Flexible and fluid Stage-Gate-Process PDS

In the process PDS, the first three stages were displayed overlapping, in order to be able to start activities at the same time or in a loop. In this variant the reduction of the lead time, also due to a possible forcast from stage one to stage two, was taken into account. Despite the overlaps and fuzzy gates, the criteria and points of the checklist still remain, as described in chapter 5.1.

The focus of the process is on the first four stages. This is intended to communicate more efficiently, to save time and to work more precisely in order to go through later stages which consume much time and money, without errors.

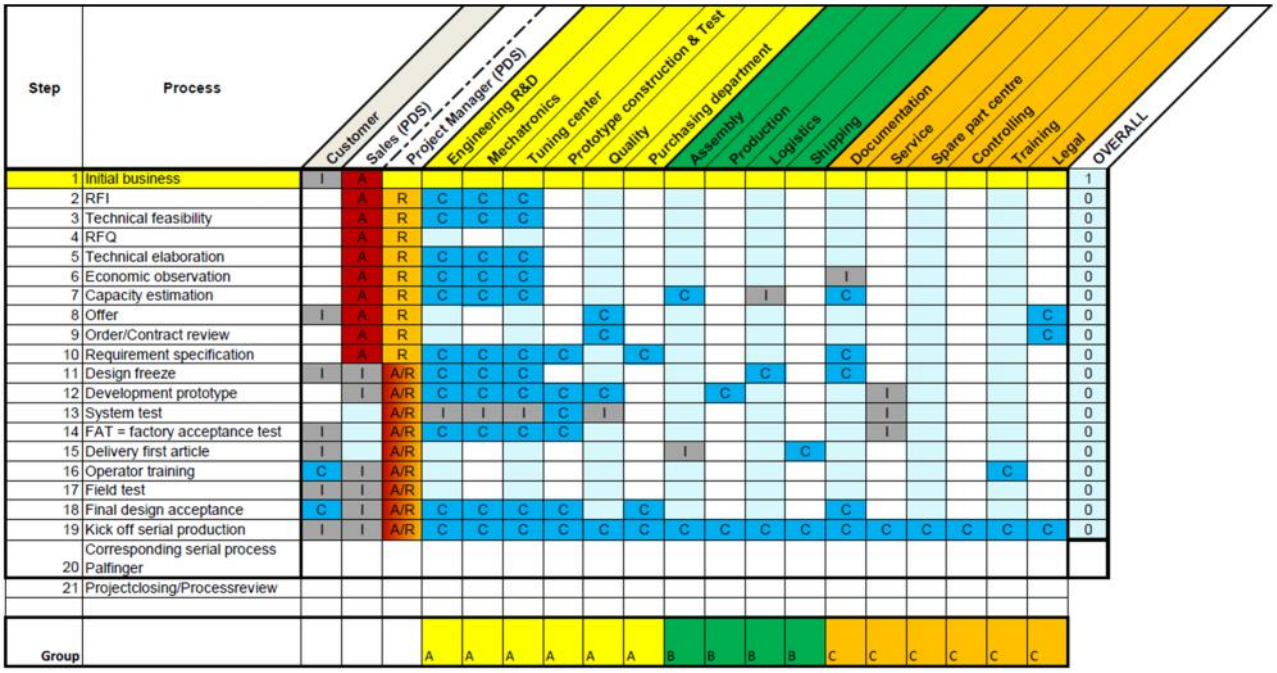
5.3 Palfinger Interfaces

A RACI model in figure 5.9 has been created to provide a detailed overview of the departments involved and the administration of the interface agreements (according to chapter 2.7.6). It serves the clarification of responsibilities and participations, all departments necessary for large projects and the customer in the process of the Palfinger Defense Solutions. Particularly in the case of cross-divisional project work and processes, it is useful and important to assign responsibility precisely.

In this model, all accountable (red), responsible (orange), consulted (blue) and informed (grey) departments / persons are marked in each individual process. The PDS division has been split up to show the accountability and responsibility precisely, with the new organisational structure.

From this model, the change of accountability from step 10 to 11 can be clearly recognized by handing over to the project coordinator. It serves the project coordinator in combination with the stage-gate process as a tool to timely inform upcoming departments about the status of things, to

clarify the responsibility and departments can use this as an overview, what has to be coordinated and done.



Step	Process	Customer	Sales (PDS)	Project Manager (PDS)	Engineering R&D	Mechatronics	Tuning center	Prototype construction & Test	Quality	Purchasing department	Assembly	Production	Logistics	Shipping	Documentation	Service	Spare part centre	Controlling	Training	Legal	OVERALL
1	Initial business	I	A																		1
2	RFI		A	R	C	C	C														0
3	Technical feasibility		A	R	C	C	C														0
4	RFQ		A	R																	0
5	Technical elaboration		A	R	C	C	C														0
6	Economic observation		A	R	C	C	C							I							0
7	Capacity estimation		A	R	C	C	C			C		I		C							0
8	Offer	I	A	R					C											C	0
9	Order/Contract review		A	R					C											C	0
10	Requirement specification		A	R	C	C	C	C		C				C							0
11	Design freeze	I	I	A/R	C	C	C					C		C							0
12	Development prototype		I	A/R	C	C	C	C	C			C			I						0
13	System test			A/R	I	I	I	C	I						I						0
14	FAT = factory acceptance test	I		A/R	C	C	C	C							I						0
15	Delivery first article	I		A/R						I			C								0
16	Operator training	C	I	A/R															C		0
17	Field test	I	I	A/R																	0
18	Final design acceptance	C	I	A/R	C	C	C	C		C				C							0
19	Kick off serial production	I	I	A/R	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0
20	Corresponding serial process Palfinger																				
21	Projectclosing/Processreview																				
Group					A	A	A	A	A	A	B	B	B	B	C	C	C	C	C	C	

Figure 5.9: RACI

The coloring of the divisions indicates a grouping of the interface agreements. The groups were sorted according to their key function in the process in three groups and thus were provided with a uniform interface agreement. In this agreement there are, as in table 6 shown, broken down thematic areas and respective examples.

Topics	**Interface Agreement**	*Examples*
Subject of agreement	Project cooperation	
In which **type** (flow of information)	E-mail	
In which **amount**	Monthly	
At which **place**	Specific document management system	
At which **time**	Twice a year	
In which **quality**	Written/oral	
Additional **specifications**	Escalation Stages	

Table 6: Interface agreement, broken down by topics and examples

5.4 Speed process for smaller projects

Due to the fact that the Palfinger defense solutions not only processes large projects, but also deals with a large number of small projects, it is possible to reduce the standard process PDS by a speed process. Which projects are classified as large and small can be found in the Linteratur, chapter 2.7.4 project classification.

The project coordinator can also himself initiate a speed process even by means of risk assessment, at low costs or low time spent on the project. Such as a minor modification of the product, simple tuning center tasks or known modifications of similar products.

For this purpose, the first three stages of the standard Stage-Gate-Process PDS were summarized as shown in figure 5.10, and two-gates were hidden. Simultaneously with the summary of the stages the tribunal is also presented in a speed process through the project team.

The criteria and results of the individual gates remain intact, but the hidden gates have to be taken into account of the project coordinator independently.

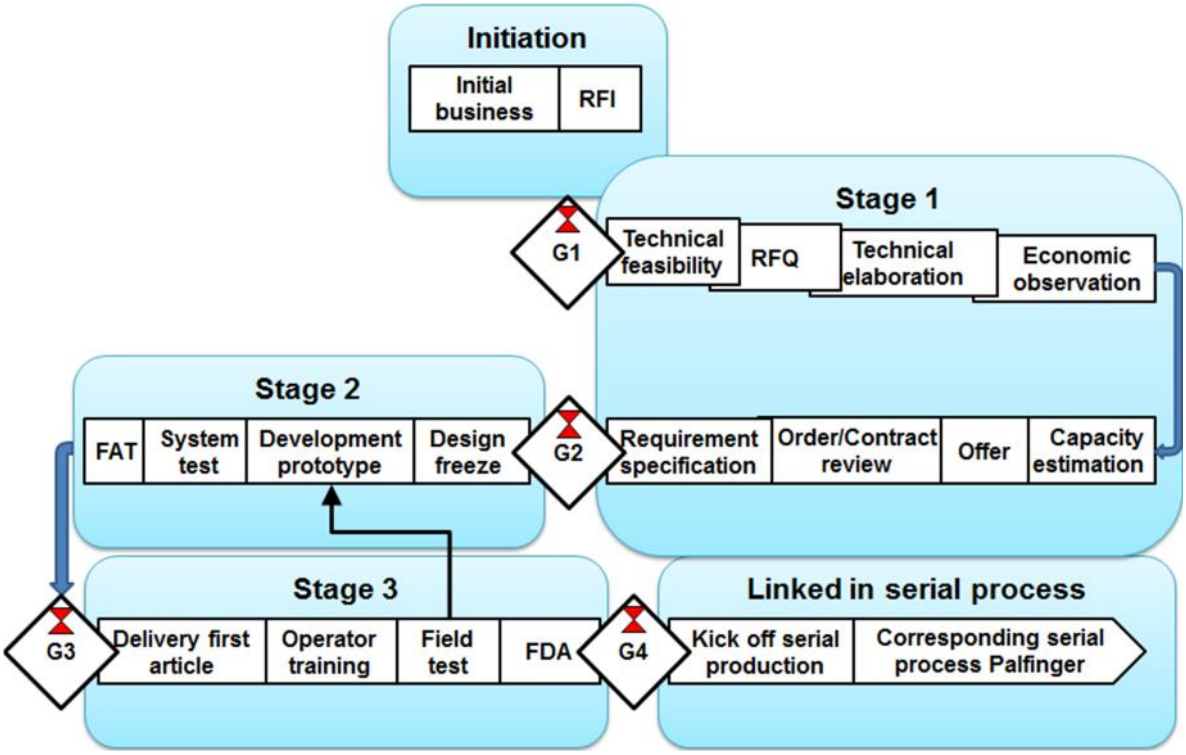


Figure 5.10: Speed Process

6 Discussion

The Master Thesis has shown that a project can be planned based on the pure statements of the employees but is not related to the real situation. Thus, the initial situation in the department of the Palfinger Defence Solutions, based on the project maturity, was incorrectly classified. The consequences for this master work were the creation of two different questionnaires, which gave a more precise view into existing structures of the PDS.

Considerations of the applied literature, therefore, could not be arranged at the outset to be fully comprehensible. If, however, the view of the whole project is thrown, the radical re-evaluation of the single business steps can be recognized by reengineering as described and listed in chapter 2.1.

Not only the organisational structure has been changed, but also the orientation for the future has been worked out. A mix of project management and process management was also observed. The uniqueness as a mark for project business and a recurring sequence for process management could thus be demonstrated. By defining the core process with the implementation of Cooper's methods, a transition between the project and process management was mastered. The advantages thus achieved in the master thesis are reflected in a time- and thus cost-reduction. In addition, the Palfinger Defence Solution can also generate more customer proximity.

The development process was not only designed for the PDS but also for the customer. The customer can now be shown in a comprehensible and understandable way the possibilities and advantages in the cooperation with the company Palfinger. Especially in the case of new customers, who have no previous knowledge of a business processing or initiation, the business organisational procedure can be brought to the customer in a simple step.

First steps towards economic and time-saving processing between the PDS and the customer were set. If possible, an additional configuration of an individual process for the respective customer could speed up the process with the PDS. The idea for innovative project design and processing shows a wealth of possibilities. From the project management tool for the project coordinator, to a document management system (similar to SharePoint) for the customer, this allows him to keep track of the latest steps of his product.

For the future, a particular focus should be placed on the measurability of the entire system. Up to now, first steps only exist in the literary part of this master thesis and must be tested in practice. The basic idea comes from the project management. An improvement can only be achieved by evaluating the project, from the beginning of the problem presentation to the project goal and, if necessary, beyond it. Points for the measurability of the project business could take place on the basis of the success factors according to Cooper (2002) or by evaluating quality & success according to Meyer & Reher (2015). The management is ultimately responsible for the extent to which the project team of the department is measured. However, it is undisputed, what you cannot measure, you cannot improve (Geyer & Ronzal, 2002, p. 245). Therefore, for a further development of the project business and the process, company-internal criteria should be defined and standardised. To sum up, the process makes it possible to measure the project business in a targeted manner according to company-internal criteria, and at the same time to evaluate it after success. This makes it possible to detect, analyse and, if necessary, improve weaknesses at an early stage.

Through the targeted first-time construction of such a process for project business in the PDS, the areas with the need for action were made transparent and disclosed. Every process requires continuous further development, which is made possible by application and experience. The foundation stone for an efficient and functional project management was laid. Now it needs a dedicated continuation for a profitable application in the future.

7 Conclusion

The present investigation was carried out for improvements in the project business of Palfinger Defence Solutions, especially in the field of order initiation and settlement. Scientific support was provided by Univ.-Prof. Dipl.-Ing. Dr.techn. Stefan Vorbach and Ass.Prof. Dipl.-Ing. Dr.techn. Christiana Müller from the institute of General Management and Organisation at Graz University of Technology. The investigation took place on the suggestion of Mr. Sebastian Schindwald and Mr. Franz Thaller of the company Palfinger.

The subject of the investigation was to inspect the internal operations during the initiation, the internal calculation and the handling of project transactions and to optimise them economically in a further step. Furthermore, a process specifically for the department Palfinger Defence Solutions should be implemented and the special process criterion should be identified. With the help of a questionnaire, based on two case studies of completed projects, an overview of the current process maturity and the project business could be obtained. For the process finding, the initial situation was assessed by means of a written survey of the departments involved in the projects. During the evaluation of the results, there were deficits in the areas of responsibility, including their hirachies, in project work and project communication between the affected departments. These risk factors ultimately lead to deadline delays and calculatory imponderables during project processing. The result steered the work in a new direction than previously assumed. This has shown that it would be sensible to carry out the order transfer and order processing with the help of a stage gate process. However, such a model requires the appropriate basic structures in a department. After the evaluation of the actual state, the organisational structure of the Palfinger defence solutions department was changed from the ground up, with the aim of creating a suitable framework for functioning information flows and a functioning project management. The newly integrated project coordinator now acts as an information provider and process supervisor in order to give life to the process. The next step was to raise a core process for the project business of the department. Despite the project character, continually recurring process steps have emerged in the initiation of business and business processing. These were, as is customary in process management, combined into a core process. The RACI model has been able to provide a solution to the exact role allocation and distribution of responsibility in this process. In this way, all departments involved in the project business can be specifically assigned in the respective process step. Responsibility and the departments to be informed in the various process steps are also clearly presented. Given this knowledge base, the process could be refined by a stage gate model. The gates for the necessary criteria and the allocation of the process steps in the stages ensure a controlled project procedure. The weaknesses, filtered from the questionnaire, could be transferred to a third generation by targeted adaptation of the stage gate process.

The question now arises, how exactly does Palfinger manage in the future to control the spontaneous customer changes, which have so far had a considerable deadline delay at the end of the project? Can a targeted communication be established and a functioning project management take place? Here the idea of the gates with milestone character and with combined claim management starts to work. The gate with a milestone character also acts as a fixed date for the customer, which serves as an orientation for the customer, until when he can still make changes which do not lead to a time delay. This also ensures compliance with the delivery date and tranches. Targeted communication can be controlled by the project coordinator and is intended to ensure through interface agreements and a clarification of the services to be provided. Functional and coordinated project management can be ensured by means of the Stage-Gate-Process as a plan of procedure and enables transparency and measurability of the projects in the Palfinger Defence Solutions department. In addition, a smooth transition of the stages and possible fuzzy gates brings the necessary flexibility into the Stage-Gate-Process of large projects. In order not to increase the time required for small project orders by observing the process criteria and gates, a speed process was set up. This enables the PDS department to carry out small projects by means of its own risk estimation and evaluation. The application will show how this process can be used in practice.

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9 Appendix 1

Fragebogen zur Prozessreife -
Palfinger Defence Solutions

[1]

I. Allgemeine Auskunft

1. Aus welcher Abteilung der Fa. Palfinger kommen Sie?

Produktmanagement	☐
Konstruktion	☐
Versuch/ Musterbau	☐
Mechatronik	☐
Palfinger Defence Solutions	☐
Tuningcenter	☐
Montage Köstendorf	☐
Montage Lengau	☐
Fertigung	☐
Einkauf	☐
QM Lieferant	☐
Kundendienst	☐
QM	☐
Controlling	☐
Rechtsabteilung	☐
Service	☐

[1] http://i.imgur.com/MrfKGOh.jpg

2. Über wie viele Jahre Berufserfahrung bei der Fa. Palfinger verfügen Sie?

☐ 1-2 Jahre

☐ 3-5 Jahre

☐ 6-10 Jahre

☐ >10 Jahre

☐ k.A.

3. Waren Sie direkt /indirekt an den Projekten „Blowfish“ und/oder „Hägglunds“ beteiligt?

<u>Blowfish</u>

direkt	indirekt	unbeteiligt
☐	☐	☐

<u>Hägglunds</u>

direkt	indirekt	unbeteiligt
☐	☐	☐

2

2 https://www.google.at/imgres?imgurl=http%3A%2F%2F4.bp.blogspot.com%2F-4xHxhdT5Xo0%2FVA1ZEvb8LzI%2FAAAAAAAABHQ%2FuhVzHV9_I4Y%2Fs1600%2Fcv90%252Beng%252B3.jpg&imgrefurl=http%3A%2F%2Fwarfaretech.blogspot.com%2F2014%2F09%2Fcv90-combat-engineering-vehicle.html&docid=51NLwAx4HNm9MM&tbnid=21qubr01KiHjIM%3A&w=1600&h=1037&safe=off&bih=673&biw=1366&ved=0ahUKEwiyvbSWiJHOAhXMkCwKHelZDwAQMwhVKCYwJg&iact=mrc&uact=8#h=1037&w=1600

II. Allgemeine Einschätzung zu den Projekten „ Blowfish“ und „Hägglunds**“ vor Vertragsabschluss**

1. Wie schätzen Sie ganz allgemein den Informationsfluss der Kundenanforderungen ein?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

2. Wurden die Kundenanforderungen vor Projektannahme detailliert bearbeitet?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

3. Wie gut gelingt es die militärischen und technischen Normen in den Kundenanforderungen zu berücksichtigen?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

4. Wurden diese Anforderungen auf technische Realisierbarkeit geprüft?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

5. Stehen für militärisch technische Anforderungen die notwendigen Fachbereiche zur Verfügung?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

6. Wurde der Vertrag vor Freigabe von allen für den Auftrag zuständigen Personen auf mögliche Abweichungen geprüft?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

7. Werden rechtliche Rahmenbedingungen vor Auftragsannahme von der zuständigen Fachabteilung geprüft?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

8. Sind die benötigten Ressourcen (Personal, Budget, Einrichtungen etc.) in den jeweiligen Abteilungen ausreichend vorhanden?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

9. Wie gut gelingt die Zusammenarbeit zwischen allen am Auftrag beteiligten Personen und Abteilungen?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

III. Allgemeine Einschätzung zu den Projekten „ Blowfish“ und „Hägglunds**“ nach Vertragsabschluss**

1. Wurden Auftragsinhalt und Umfang der Projekte genau genug beschrieben, um die Dauer der Projekte realistisch abzuschätzen?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

2. Ist die Projektabwicklung von 2010-2016 tendenziell…

☐ deutlich besser geworden

☐ geringfügig besser geworden

☐ unverändert geblieben

☐ eher schlechter geworden

☐ deutlich schlechter geworden

3. Anhand welcher Merkmale wird eine mangelnde Prozessreife deutlich…

☐	Produkt entspricht nicht den Kundenerwartungen
☐	Aufgrund von Qualitätsproblemen
☐	Betriebswirtschaftliche Ziele (Gewinn, Umsatz, etc.) werden nicht erreicht
☐	Die nachgefragten Stückzahlen / Absatzmengen können nicht geliefert werden
☐	Kommunikation zwischen Abteilungen

a. Weitere Merkmale zur mangelnden Prozessreife?

4. Treten bei der Projektumsetzung nach Vertragsabschluss nicht vorhergesehene Probleme auf, die die technische Abwicklung und Kostenkalkulation des Projektes wesentlich beeinflussen?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...keine Probleme

5. Wie lang dauert es bis nach dem Projektabschluss alle im Projekt vereinbarten Ziele erreicht werden bzw. alle offenen Punkte abgearbeitet sind:

k.A.	sofort	<3 Monate	3 bis 6	6 bis 12	>12 Monate
☐	☐	☐	☐	☐	☐

6. Um die Prozessreife zu verbessern würde ich für folgende Verbesserung in der Projektentwicklung sorgen:

Verbesserungspotential

Führung & Management

Anmerkungen	

Projektorganisation

Anmerkungen	

Projektmanagement

Anmerkungen	

Qualität

Anmerkungen	

Ressourcen

Anmerkungen	

Information & Kommunikation

Anmerkungen	

Kundenorientierung

Anmerkungen	

7. Wie ist die derzeitig durchgängige Organisation von Projekten zu beurteilen?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

8. Wurden alle Abteilungen rechtzeitig über kommende Projekte informiert?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

9. Konnte die vorab erstellte Stundenkalkulation eingehalten werden?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

10. Wo sehen Sie mögliche Probleme in der Stundenkalkulation?

Anmerkungen	

11. Wurde der Design Freeze rechtzeitig durchgeführt?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend, rechtzeitig
6...sehr zufriedenstellend

12. Verfügen Sie über ausreichende Ressourcen, um die Projekte zeitgerecht fertigzustellen?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend, ausreichende Ressourcen
6...sehr zufriedenstellend

IV. Anlaufmanagement

1. Wie schätzen Sie ganz allgemein das Anlaufmanagement bei der Überführung in die Serie ein?

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

1...nicht zufriedenstellend
2...wenig zufriedenstellend
3...eher nicht zufriedenstellend
4...eher zufriedenstellend
5…zufriedenstellend
6...sehr zufriedenstellend

2. Wie gut waren die folgenden Unternehmensbereiche auf den Serienstart in der Vergangenheit ihrer Meinung nach vorbereitet?

Cooporate Service (Bedienungsanleitung, Schulung, Dokumentation, Seriensoftware, etc.)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐
IT-Services (Datenverfügbarkeit, Parameter, Software, etc.)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐
Qualitätsmanagement (Prüfprozesse, System Know how etc.)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐
Logistik (Ersatzteilkonzept, Teile Verfügbarkeit, Lieferfähigkeit etc.)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐

Lieferanten (Qualität, Kapazität etc.)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐
Kundendienst (Service, Schulung, Dokumentation etc.)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐
Entwicklung (Änderungen, Serienbetreuung etc.)	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐

1….unzureichend / 5…. ausreichend / 6….sehr gut

3. Um die Prozessreife zu verbessern würde ich für folgende Verbesserungen im Anlaufmanagement sorgen:

Führung & Management

Anmerkungen	

Projektorganisation

Anmerkungen	

Projektmanagement

Anmerkungen	

Qualität

Anmerkungen	

Ressourcen

Anmerkungen	

Information & Kommunikation

Anmerkungen	

Schulung

Anmerkungen	

4. Welche wichtigen Erkenntnisse aus den letzten Jahren wurden aus vergangen Projekten gewonnen?

Anmerkungen	