Collaborative Project Management

RECOMMENDATION
Collaborative Project Management (CPM) Reference Model; PSI 1-1 Version 3.0
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Abstract

This Recommendation focuses on project management (PM) across companies. The document describes the project management tasks within the product development process (PDP) in the automotive industry that extend across the borders of partner enterprises, and focuses on time management, activity management and communication management. It covers the processes, roles, methods, information, language and culture in collaboration projects. The Recommendation explicitly excludes project management within the enterprises involved. The recommendation is published in two parts. Part 1 contains the reference model and Part 2 contains the data model for exchanging project data. Figure 1 illustrates the scope of the Recommendation.

Preamble

Throughout the value creation chain in the development of automotive products, activities are constantly being undertaken to decrease the development time and increase the quality of the project and the product. Simultaneous engineering and collaboration with partners are the methods of choice to fulfill these requirements. There is still considerable room for improvement within the project management profession, especially with respect to the management of projects across partner enterprises.

The main tasks in the field of project management are time management and activity management and efficient communication within a project. For this reason, the CPM (Collaborative Project Management) task forces decided to focus on these areas of knowledge as laid down in the PM BoK® Guide (Project Management – Body of Knowledge).

Initial situation

The task of engineers during the product development process is changing from the design of a product and the design of respective production tools to the management of complex implementation strategies. The exchange of product data and project management data is crucial to meet these new challenges. Standards such as ISO 10303 -214 and the PDM schema already exist for exchanging product data in the automotive sector. Methods for managing projects have been defined in the companies and have also been broadly standardized at a high level with initiatives such as like PM BoK®, VDA 4.3, DIN 69900 ff, APQP, etc. But no committee or standard has addressed the issue of exchanging project data in the automotive industry until the ProSTEP iViP Workgroup “CPM” was established. Collaborative Project Management (CPM) is the solution for handling complex development partnerships.

¹ The focus was set by the work group regarding to high priority themes in there view.
This Recommendation is aimed at business management and people bearing responsibility for project management. People in charge of product management, process management and information technologies are also encouraged to make use of this document.

During the initial preparatory phase, the team defined the terms of reference as follows: “Optimization of project management across partner enterprises in the product development process of the automotive industry, focusing on the areas of time, activity and communication management”.

The most common standard used for project management in the automotive industry was taken to form the basis for the activities. The PMI Standard, documented in the PM BoK (A guide to project management – Body of Knowledge) and VDA 4 Part 3 (Sicherung der Qualität vor Serieneinsatz / Teil 3: Projektplanung - Q uality assurance prior to series deployment / Part 3: Project planning) form the basis for this Recommendation. Other standards such as APQP, AIAG (Automotive Project Management Guide) or DIN 69900 ff were also taken into consideration.

The Recommendation relates to a relationship between two partners. In practice, however, network structures will be found. However, since project management demands that each interface between different companies must be the subject of an agreement, it is recommended that the current Recommendation is employed at each of these interfaces.

The resulting joint procedural model allows the current level of outlay for complex and time-consuming harmonization to be reduced considerably and also permits the effectiveness of the agreements to be significantly improved.

Objectives

The aim of this Recommendation is to improve collaborative work in project management.

The results which can be expected are:

- A common understanding of documentation between suppliers or development partners and OEMs during project activities, focusing on the areas of time, task and communication management.
- Exchange of project information such as schedules and activity lists via neutral interfaces between OEMs and suppliers.
- Synchronization of coupled processes enabling cross-enterprise, multi-project reporting and control with up-to-date project information.
- Consideration of project changes and the consequences to the supplier as well as to the OEM.

The potential benefits are:

- Improved control of project schedules and milestones on the supplier side as a result of improved transparency.
- Facility for suppliers to maintain common schedules and to record schedule changes.
- Enabling of cross-enterprise, multi-project reporting and control on the OEM side.
- Cross-project management of tasks and activities agreed on in meetings.
- Standardization of project documentation by using common formats and tools.
- Standardized processes and methods for the exchange of project definitions, content and scope as well as engineering targets.

OBJECTIVES
Recommendation Structure

The Recommendation is published in two parts. Part 1 contains the Reference Model for the exchange of project data. Part 2 is focused on the data model for the exchange of project data (cp. Figure 2). As supplementary documents a usage guide (How to use the reference model?), implementation guide (How to use the data exchange model?) and field reports are available (cp. Figure 2).

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The Annex contains a glossary and a list of abbreviations.

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1 General specification

Processes generally describe sequences of activities within an enterprise which create value or which support the value creation activities. They are supported by the established methods and tools of (business) process management and are actually carried out within the framework of operational project management. Although the technical processes within individual companies have by now been recorded and described in considerable detail, it is still necessary to formulate an approach to process modeling within the context of cross-enterprise networks. This will take particular account of the individual technical procedures and individual methods and tools used for process and project management by the individual partners. This document describes such an approach for use in projects where the work structures extend beyond the borders of the individual companies.

1.1 Derivation of the project management approach

A project process can be viewed from two angles:
1. Product-oriented processes specify and create the product that forms the subject of the project. Product-oriented processes are generally defined in terms of the product life cycle. The part of the product life cycle under consideration here is the product development process (PDP).2
2. Project management processes describe, organize and round off work on the project.

These two process levels constantly interact during the course of a project. The PDP synchronizes activities between the two process levels and project management provides the processes for bringing the project to a successful conclusion. This current Recommendation deals with project management processes. It is based on the PMBoK® Guide published by the Project Management Institute (PMI). The PMBoK® Guide divides project management processes into five groups:

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2 The focus was set by the work group
These individual project groups are partially dependent on each other; the deliverables from one group form the input for the next. This underlying concept from the PMI formed the basis on which further definition was carried out.

The processes are described by:
- their inputs (documents or deliverables which can be documented),
- tools and methods which use these inputs and
- their deliverables (documents or deliverables from the processes which can be documented).

During the planning phase of a project, activities are defined which lead to synchronization points and milestones. After these have been jointly agreed, they are binding for both partners. It is therefore necessary to analyze
- which activities can only be processed internally by either of the partners (internal),
- which activities can be jointly processed (common),
- which activities affect both partners and lead to milestones in the interaction chain.

This task is dealt with in this current Recommendation.

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3 See Annex A: Glossary
1.2 Process transparency

The objective of managing product development processes (PDPs) is to handle the processes involved in high levels of product complexity while taking account of the increasing pressure of competition. To achieve this, process development processes are structured and standardized wherever possible.

The structure of PDPs is individually mapped at the OEM and supplier by phases, milestones and hierarchical description levels. In this context, significant differences can be observed even at a high level of abstraction when considering the individual development phases and milestones. See Figure 5.

As a rule, the PDP is described on 3-5 levels, which are often based on the product structure, e.g. the entire vehicle, (system) modules, functional groups, components, parts with part numbers. Thematic sub-processes such as the development of electrical/electronic systems or integration of the entire vehicle are then created for these levels.

The structure and dynamics of the PDPs reflect the corporate objectives and specific project issues, the methods employed, support systems and the knowledge base within an enterprise. All these elements are decisive competitive advantages and are therefore treated in strict confidence.

PDPs are wholly or partially instantiated in order to handle product development projects. Depending on the organizational structure and the specific project management method, the objective nowadays is to support each level of the PDP by internal project management. Cooperative product development processes are not taken into account in this context. The CPM method therefore supports project management for product development processes across the boundaries of enterprises and between all the partners involved. To achieve this, it is necessary to coordinate both the technical processes and the project management processes in order to deliver optimum results with respect to the project objectives. Because the potential for optimization within a cooperative venture can only be leveraged across the entire processes, it is necessary to ensure a minimum level of process transparency. This minimum of transparency must permit the project partners to identify the section of the process that affects them and the associated events that are relevant to them and to organize their planning accordingly.

Figure 5: Comparison of the development phases of different OEMs
2 Structure and benefits of the CPM reference model

2.1 Structure of the CPM reference model

The CPM reference model covers all the elements that impact on a project which are necessary for handling cross-enterprise projects. A distinction is made between the base model and the application model. The base model is necessary for a fundamental understanding of the CPM approach, but does not in itself offer any concrete support in terms of the use of methods or tools.

The fundamental elements of the base model are generally valid for collaboration between partners and are particularly applicable to all cross-enterprise projects (CPM projects). Before each CPM project, steps must be taken to ensure that the project partners have come to a common understanding with respect to the base elements.

The second part of the reference model describes the application model (see section 4). The application model covers all the concrete elements required for planning and controlling a CPM project. These are part of the project agreements and must be adapted or created to suit the current project framework. Unlike the base model, the application model is a (non-linear) procedural model comprising internetworked elements. All the elements have relationships with each other and are networked with each other on the basis of the information represented in these relationships. Thus, for instance, every event within a project is linked to the necessary information objects, roles, concrete workflows, etc. The information processing sequence from one element to another is not prescribed.

The starting point can be anywhere within the application model, for instance focusing on any aspect of project management such as the assignment of roles. Likewise, it is not necessary for the application model to be completely described or for it to be worked through completely in order to provide efficient support for a project. All the elements of the application model on the one hand represent planning objects and on the other hand describe the concrete workflows of the planning processes. Methods for operational support of the entire project flow are stored in each element. All the methods together form a methods toolbox which can be extended flexibly. In addition, the methods can be supported by tools (e.g. a communication matrix). See also Section 5.

![Figure 6: CPM reference model](image-url)
The following description will illustrate how to use the application model. At the start of the project, for instance, the project partners use the planned project path method to define the interaction chain for the planned project (see section 4.1). Both parties define the planned events within the project and agree them. This step results in a fully described interaction chain. At this point, all the planned events in the interaction chain are described in detail.

Swim lanes are then described giving the sequence of an event in concrete terms. A list of open issues and other checklists are used regularly throughout the project to check whether the proposed workflows for planning and controlling a project are being observed. A concrete role is assigned to every function within the workflow as part of the project planning and control process. Roles are assigned on the basis of the role description which must be agreed at the start of the project. A communication matrix is used to define what role has to communicate what information with what counterparty (role) at the partner and when. The communication matrix ensures that the necessary information reaches the correct recipients in the correct form. In this context, information can be tied to information objects. A typical information object is the project plan which is used to maintain all the time-related information on the project activities.

As a basic principle, the CPM approach advises to use all of these tools. It is, however, also possible to implement and apply only some of the tools (e.g. communication matrix). The CPM data exchange model provides the necessary structures for a modular rollout and contains Conformance Classes describing an expedient implementation of the tools and their interactions:

- CC1: Planned project path
- CC1 extended: Planned project path + Interaction chain + documented Handshake
- CC2: Issue list
- CC2: Issue list + documented Handshake
- CC3: Communication matrix
- CC3: Communication matrix + documented Handshake
- CC4: Planned project path + Interaction chain + Issue list + Communication matrix + documented Handshake (full CPM)

For more detailed information about the Conformance Classes see CPM data exchange model section 2.3

2.2 Benefits of the CPM reference model

The CPM reference model makes it possible to increase the quality of process management processes in a cross-enterprise environment in a very short time and with a minimum effort. Irrespective of the variety of processes which may exist now or in the future, all elements of the application model can be adapted flexibly to suit specific projects all the extremely disparate cooperation models. Benefits in terms of costs, time and quality accrue from using individual elements of the application model, from the coordinated use of several elements and, of course, from the use of all the elements. This allows the general project costs to be minimized and process times to be reduced, fosters greater adherence to the schedule and improves project quality. Considering the benefits in this way on the one hand allows you to weigh the benefits against the outlay required to use the CPM reference model and on the other reduces resistance against using the new approach.
An overview of the general benefits from using the CPM reference model can be found in section 2.2.1. This is followed by an explicit assessment of the benefits in terms of costs in section 2.2.2.

The description of the general benefits and the explicit assessment of the cost benefits provide users with the basis for taking a decision with respect to using the CPM reference model. Potential benefits in the user’s own environment can now be identified, which in turn allows a case-by-case assessment to be made as to whether there is a fundamental need to use the standard. Use of the CPM reference model is further facilitated by the fact that individual concrete benefits are integrated into the application model. This is done by assigning individual concrete benefits to each element of the application model. Throughout the model, these benefits are shown in gray boxes. An example is given in the following Table 1:

<table>
<thead>
<tr>
<th>What does CPM offer?</th>
<th>Results</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential X: ABC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A typical symptom of this is that DEF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The value of CPM in this context is as follows:

Table 1: Business value potential

The benefits listed for the elements of the application model indicate to users the precise benefits that they can expect from using single elements, a combination of elements, or all elements of the CPM application model. This further simplifies efficient use of the model, since it is possible to ask what benefit is to be achieved and then to select, adjust and use the corresponding elements each time the CPM reference model is used.

Example: Benefits from using the interaction model:
- Improved process quality
- Improved project performance
- Reduction of the outlay involved in coordinating deadlines
- Maintenance of the confidentiality of process information which delivers a competitive advantage

2.2.1 General benefits

General benefits are assigned to the entire CPM reference model and are achieved by simply using the standard.

Avoidance of costs
- Communication errors and errors when transmitting information between partners are avoided
- Errors resulting from partners having incomplete project information are avoided
- Unnecessary documents are avoided
- Completeness is ensured

Time savings
- Use of existing, proven tools and processes (it is not necessary to reinvent the wheel)
- Avoidance of outlay required for coordination between the partners
- Faster problem solving
**Improved quality**
- A common understanding of project management, control and collaboration
- Timely initiation of interaction between the project partners
- Greater achievement of objectives for all those involved
- Best possible use of human capital
- An unambiguous order is issued

**Increased efficiency**
- Process integration vis-à-vis the OEM is improved
- Internal process integration is improved

**Improved competitiveness**
- Costs and ROI
- Improved processes and time-to-delivery (speed).

The capability of becoming involved in future collaborative ventures with the OEMs and other project partners is to a large degree decisive in order to
- secure future business and maintain competitiveness,
- avoid competitors gaining an advantage and
- differentiate oneself from the competition.

### 2.2.2 Benefits in terms of costs

**Projects are handled more cost-efficiently**
The use of CPM has the advantage that processes, procedures, tools and templates can be adapted for use in future projects with only a small amount of effort after they have been created once. This reduces the initialization costs of a project.

**Costs are saved by active activity/time management**
Many projects are burdened by additional costs resulting from difficulties in defining the contents. CPM processes make it possible to establish more efficient control over the scope of the project, the activities, the schedule and changes between the partners.

**Problems are identified and resolved at an early stage and hence more cost-efficiently**
CPM includes processes for identifying and controlling problems. This means that potential problems are identified and dealt with before they actually occur. This avoids time- and cost-intensive firefighting.

**Cost management itself is improved**
The use of CPM results in a common project definition, better estimates, a greater degree of formality in budgeting and improved monitoring of the actual costs during the course of a project compared with the budget. This precision makes it possible for both partners to control costs more effectively. In addition, more information is available, making it possible to abort or completely rework a poor project.

**Coordination outlay is reduced**
A common understanding of CPM means that the amounts of time spent in coordination activities are reduced from the very start.
2.2.3 Benefits in terms of time

Projects are completed according to plan
The use of CPM has the advantage that processes, procedures, tools and templates can be adapted for use in future projects with only a small amount of effort after they have been created once. This reduces the lead time for the project, accelerates the learning curve for the project team members and saves time because it is no longer necessary to create processes and templates anew for every project (there is no need to reinvent the wheel).

Problems are solved quicker
Teams spend too much time and energy dealing with problems because they do not know how to go about solving them when they start. A process for proactively resolving open issues helps to solve problems as rapidly as possible.

If the planning is better, the solutions work better first time
Problems arising from discrepancies between the expectations of the customer and the deliverable supplied by the partner are avoided. The use of project management improves planning so that the team and the steering committee have the opportunity of ensuring that there is a common understanding with respect to the primary deliverables of the project.

Communication with customers, project members and stakeholders is improved. Expectations are fulfilled more comprehensively.
Many problems in a project are avoided by proactive communication. Furthermore, the majority of conflicts in a project do not arise as a result of any specific issue, but are caused by surprises. CPM concentrates firmly on formal and informal communication and on defined communication paths, which ensure that there are fewer surprises.

The working environment is improved
If projects are more successful, additional improvements can be identified within the project team. The customers enjoy better care, the project team is better able to manage the project, the atmosphere improves and the project team begins to adopt a more professional and self-confident manner. Staff working on problem-ridden projects often feel uncomfortable, whereas staff working on successful projects tend to be more satisfied with their work and with themselves.
3 CPM base model

3.1 Interaction model

The CPM reference model is a flexible model which can be adapted to suit any partner within a network of companies and which is capable of supporting time and activity management and the precisely defined communication structures required for collaborative project management.

The following assumptions have been made:

➡ All the partners within a corporate networks retain business and methodological authority over their own technical product development processes and the processes for planning, control and organization of product development.

➡ The technical processes are primarily characterized by the sector to which they belong, so that at least in this respect there will be similarities and common ground between the partners (sector focus: automotive). The similarities and common ground are rooted in comparable products and the associated functions and structures.

➡ Unlike the technical processes, the processes for planning and controlling product development processes and projects are largely independent of the content and the sector involved. They support technical and project processes at any level of abstraction.

➡ This neutrality and sector-independence means that all the processes for planning and controlling product development processes and projects can be chained. In this context, there is always a single lead process and one process coordinator per process.

The goal of the CPM approach is to harmonize the project management processes (time management, activity management and communication management) of all the partners involved in such a way that the individual technical processes are in a position to meet their project objectives as well as possible.

Product development processes are driven by creativity, are highly dynamic and are themselves highly complex. This is because the product functions are extremely complex and the product structures are very extensive and because the products are realized by a wide range of organizational forms and structures. Today, good methodological and IT support is available for such processes, which means that they can to a certain extent be planned and can be standardized to a limited degree. By contrast, all types of possible changes are perfectly normal. These reflect the aspects of any new product development which cannot be planned.

In the following, all technical processes will be regarded as control processes. This means that the product development processes contain all the plannable and non-plannable events and thus acts as a synchronization element for project management at each partner. Within collaborative venture, these project management events must be agreed between the partners. In CPM these binding agreements are called „Handshakes“. The CPM reference model provides a solution for all events related to planning and control. With respect to harmonizing the engineering exchange process, please refer to the VDA recommendation 4965 (ECM = Engineering Change Management), which was produced as a result of the ProSTEP iViP project of the same name (see also section 1.1).

The CPM reference model concentrates on harmonizing and coordinating all plannable and non-plannable events between the partners in a collaborative venture. This results in an interaction-driven approach that ensures that all events are updated cyclically and provides methodological support for doing so. This lean approach requires a minimum of necessary information to be shared between the partners involved and that an agreed procedure is in place to cover the occurrence of an event.
An event from a section of a process of one partner triggers an interaction cycle and transfers one or more information objects to the partner who then responds to the events in a defined manner and processes the information objects. Time, activity and communication management are seen in terms of a precisely defined set of information objects (see the following sections). After the partner has processed the event, e.g. by confirming it or by reacting in some way, the interaction cycle that has been triggered is closed by the initiator.

An event which occurs at partner A (in our example, the client) triggers an internal information cycle which results in an information object. This information object is transferred to partner B, and in this case also a separate internal information cycle is triggered to process the event received from A. The information cycle between A and B is closed when B sends the modified information object and/or a new information object to A. A then checks this object to ensure that it is an acceptable outcome for the triggering event. This exchange continues until such time has an agreement which is confirmed by both parties is reached. Whenever a receiver accepts and confirms a sender’s proposal, this handshake has to be documented. This can be done with the aid of a project management system with a CPM extension.

The sum of all interaction cycles delineate the common project management processes for collaborative product development (CPM). This collaborative project management process is extremely flexible, can be adapted in any way required, and is completely customized in that it depends entirely on the partners involved. It is established by all those involved in the events related to joint planning and control of the product planning process.

An initial approximation of the events involved is derived from the project management activities, such as the project kick-off, or from milestones for comparing development deliverables, such as in synchronization points, but above all from all types of changes, for instance changes in the product development processes or project changes.

The events themselves and how to handle the individual interaction cycles and the entire interaction processes are described and supported by this Recommendation.
3.2 Language

When it is necessary to communicate across company borders, misunderstandings are frequent, even in projects. Such misunderstandings are on the one hand the result of different (native) languages; on the other hand, however, varying definitions and usage lead not only to a failure to understand but even to misunderstandings during collaborative ventures. For this reason, a common glossary was drawn up for use in cross-enterprise projects (see Annex A).

If not all of those involved in the project speak the same language, English should be agreed as the project language.

In order to establish a common linguistic basis for collaboration in projects, the glossary and a list of abbreviations have been drawn up. These can be found in the Annex to this document.

| The use of a common language allow the following potentials for improvement to be exploited with the attendant benefits. |
| Potential 1: Misunderstandings arise as a result of leeway for interpretation |
| A typical symptom of this problem is that the partners have a different understanding of the terms used, such as exactly what is meant by a “role”. |
| The value of CPM in this context is as follows: |

<table>
<thead>
<tr>
<th>What does CPM offer?</th>
<th>Results</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Clarification of terms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Language</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Glossary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Defined project language</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Common understanding of project management</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Business value potential 1

3.3 Culture

In the context of projects, culture becomes an issue primarily in unexpected and unplanned situations. Though a common understanding or a common definition of culture is still not existent, some features of culture are nowadays kind of common sense. With respect to boundary-spanning collaboration, culture should be conceptualized as...

- consisting of diverse facets of group affiliations (e.g. nation, organization, vocational education, function)
- containing explicit (formalized rules, roles and processes) and implicit (shared meanings, behavioral patterns, shared visions ideas, etc) layers
- a system of shared meanings and formalized structures regulating behaviour in specific contexts
- generating from dynamic interaction and experience in specific contexts

The usage context of the CPM reference modell is characterized in following ways:

- the collaboration project is a product development project in the automotive industry
- which is characterized by bilateral communication (between an OEM and a supplier)
- and thereby consists of geographically dispersed and temporal work groups
- which are characterized by common goals (the product) and an interrelated course of action (CPM)
In the context of collaborative projects interactions of people with differing cultural backgrounds (functional, organizational and even national) lead to obstructions with respect to schedule, costs and quality. The culture related obstructions can be classified into four major challenges of collaborative projects:

- challenges caused by different frames of reference (language, different time zones and geographic environments)
- challenges caused by different terminologies (same terms have culture specific meanings, there is no shared understanding of implicit meanings)
- challenges caused by different understanding of working structures (e.g. different working methods, different approach to conflict resolution, different project management tools)
- challenges caused by different patterns of communication and cooperation (different levels of openness and willingness to communicate, teamwork vs. individuality, lack of trust between the partners)

The challenge of integrating different facets of culture in collaborative projects should be mastered at different levels:

- on an individual level: team members with important intercultural competences should be selected (e.g. language, openness for different ideas and working styles, ability to change perspectives)
- on a project openness organizational level: processes, rules, roles and structures should be clearly defined and negotiated in the project’s initialization phase by applying the models, methods and tools proposed by the CPM reference model
- on a team development level: measures should be undertaken to enable team development (e.g. initial meeting with all the participants of a project), to foster trust between the partners (e.g. enabling a safe communication climate), and to enable a collaborative culture for the context of the project.

### Table 3: Business value potential 2

Taking account of differing corporate cultures allows the following potentials for improvement to be exploited with the attendant benefits.

**Potential 2: Inefficient, unmotivated team characterized by differing project cultures**

Typical symptoms of this problem are as follows:

- Contacts between the teams are kept to a minimum, they do not talk with each other and little information is exchanged
- Blame always lies with the other partner

The value of CPM in this context is as follows:

<table>
<thead>
<tr>
<th>What does CPM offer?</th>
<th>Results</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work environment and processes which are more professional and visibly more efficient and foster a collaborative project culture</td>
<td>Project staff are more satisfied and more productive</td>
<td>Costs: Lower nonconformity costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time: Faster processes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quality: Better quality by common improvements</td>
</tr>
</tbody>
</table>

Table 3: Business value potential 2
4 CPM application model

4.1 Planned project path and interaction chain

As already mentioned above, the requirements of process transparency run counter to the need for maintaining the confidentiality of process and organizational knowledge in order to maintain competitiveness. This delicate balancing act requires an underlying trust in the relationship such as is the aim of cross-enterprise projects. Furthermore, one element of the overall CPM approach provides a method which allows the partners to exchange all the necessary information and only the necessary information from their own process without needing to reveal all their process knowledge. This method is known as the “planned project path” and its aim is to identify all the plannable events in a collaborative venture.

After the planned project path has been determined (see Figure 8) the events which have been identified can be passed to the collaboration partner. The partner’s knowledge of the “planned project path” method and the description of the events means that the partner is able to plan their own planned project path into the joint interaction chain (see Figure 9) where it can be agreed jointly.
All plannable events which trigger interaction cycles (CPM-Process) between the two partners are then located on the interaction chain. The interaction chain is thus the control instrument for harmonized planning and is agreed at the start of the project. During the further course of the project, it is constantly adapted and thus becomes a repository of empirical knowledge for further projects.

The use of the interaction chain principle allows the following potentials for improvement to be exploited with the attendant benefits.

Potential 3: The points of interaction between the partners/roles are unclear

Typical symptoms of this problem are that it is unclear who must do what and when. This means that parallel or competing activities are undertaken.

The value of CPM in this context is as follows:

<table>
<thead>
<tr>
<th>What does CPM offer?</th>
<th>Results</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| CPM-Processes (project events) Interaction chain | - There are opportunities for interaction and communication  
- The inputs and outputs for communication are available | Quality:  
- Interaction is initiated at the right time  
- Greater process stability is achieved  
Time/costs:  
- Unnecessary coordination meetings are avoided |
Potential 4:
- Project status is not transparent
- Stage of Maturity level is not transparent

A typical symptom of this problem is that status reports only contain information on the schedule and possibly on the budget used, but no information on whether the technical progress is as planned. The value of CPM in this context is as follows:

<table>
<thead>
<tr>
<th>What does CPM offer?</th>
<th>Results</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>- CPM-Processes</td>
<td>- Transparency</td>
<td>Costs: Deviations become obvious to the partners at an early stage</td>
</tr>
<tr>
<td>- interaction chain</td>
<td>- Facility for ad-hoc information</td>
<td>Time: Information is up to date and available without delay</td>
</tr>
<tr>
<td>- Process description</td>
<td></td>
<td>Quality: The right information can be generated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What does CPM offer?</th>
<th>Results</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>- CPM-Processes</td>
<td>- Transparency</td>
<td>Costs: Deviations become obvious to the partners at an early stage</td>
</tr>
<tr>
<td>- interaction chain</td>
<td>- Facility for ad-hoc information</td>
<td>Time: Information is up to date and available without delay</td>
</tr>
<tr>
<td>- Process description</td>
<td></td>
<td>Quality: The right information can be generated</td>
</tr>
</tbody>
</table>

### 4.2 Events/ CPM-Processes

The planned and unplanned events are listed below. In this context, planned means that it is possible to plan in advance the time at which these events will occur and unplanned means that the events may occur at any time during the course of the project. Unplanned events should, however also be handled in accordance with the procedures described below (section 5.1). The following table shows a list of the planned and unplanned events described.

<table>
<thead>
<tr>
<th>Planned events (model / tool)</th>
<th>Unplanned events (model / tool)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiate and plan project (see 4.1 / 5.1.1)</td>
<td>Project changes (see 4.2.2 / 5.1.4.1)</td>
</tr>
<tr>
<td>Enable milestone (see 4.2.1 / 5.1.2.1)</td>
<td>Perform escalation (see 4.2.3 / 5.1.4.2)</td>
</tr>
<tr>
<td>Enable synchronization point (see 4.2.1 / 5.1.2.2)</td>
<td></td>
</tr>
<tr>
<td>Close project (see 4.2.4 / 5.1.5)</td>
<td></td>
</tr>
<tr>
<td>Plan escalation procedure (see 4.2.3 / 5.1.4.1)</td>
<td></td>
</tr>
</tbody>
</table>
4.2.1 Milestones and synchronization points

The key prerequisites for the CPM processes related to milestones and synchronization points described below are as follows:

1. If the project is carried out with milestones, the joint milestones are defined in the interaction chain in the upstream planning process.
2. The interaction activities are carried out in the form of planning which is harmonized between the partners, i.e. the time and effort for defining and planning the phase up to the milestone gate is planned jointly by the partners.
3. Changes to the project plan are not seen as problems, but are from the start conceivable options resulting in variant planning which will be planned in detail as required.
4. Cyclic coordination activities are planned from the very start (see also Figure 7).
5. The project partners provide each other with feedback on the project planning, taking into account the coordination cycles. In addition, relevant information and any dependencies with respect to neighboring project activities are also exchanged.
6. A procedure for dealing with crises is established (see 5.1.4.1).
7. An open atmosphere which permits people to speak honestly has been established on the basis of measures designed to foster trust (see also section 3.3).

A milestone is an anchor point at a specific time in the project planning at which a substantial intermediate deliverable will be completed. A milestone can only be passed if the milestone requirements are fulfilled. The most important milestones are the transitions from one project phase to the next.

Two collaborating partners predefine certain topics for a common synchronization point.

At a synchronization point, a specific section of the content of a project is compared for synchronization purposes. This contrasts with a milestone, in which status of the entire project is assessed.

A synchronization point means that the status and content of partial deliverables (the progress of the work) are harmonized between the partners (e.g. the requirements specification is 90% completed).
4.2.1.1 Enabling milestones

The “Enable milestone” process describes the interaction activities between project partners in cross-enterprise projects with respect to a milestone. In this context, the point of CPM derives from the following fundamental understanding:

a. Preventive project management (increases the probability of achieving the phase deliverables at the milestone)

b. Project management at the milestone gate (insights lead to new, managed CPM Processes)

c. The purpose of the process is to ensure that the milestone will be passed positively/well\(^5\) on the basis of and with the assistance of the measures described.

The fundamental principle underlying the process at a milestone

The execution phase for the milestone gate lies between the initialization phase (at the start of the “Enable milestone” process) and the closing phase (after the milestone gate has been passed). This phase typically passes through a number of iterations with increasing levels of maturity in which the necessary requirements for passing the milestone gate are achieved technically.

The primary objective is to use project management methods to make the appropriate preparations and ensure that the engineering deliverables will be available. Seen like this, actually passing the milestone gate is a secondary issue (effectively something which happens automatically).

The section between two milestone gates is typically divided up in accordance with the PMI project management phases.

One fundamental prerequisite for passing the milestone is that the defined technical content has been achieved at the milestone gate. This content must be defined when the interaction chain is defined. The VDA Recommendation “Sicherung der Qualität vor Serieneinsatz (VDA 4.3)” (Quality assurance prior to series deployment) provides guidelines in this respect. This current Recommendation does not deal with the technical content in any further detail. In the process descriptions, technical content is treated as a black box and appears as the information object “Engineering deliverable”.

Make sure that the technical experts are given sufficient time in the project plan to harmonize these black-box information objects between the project partners in accordance with the principles above. A detailed description of the process for enabling milestones can be found in section 5.1.2.

\(^5\) “good” is taken to mean on time, in the correct quality, on budget, to specification, more efficiently for both partners, with greater transparency for both partners, on the basis of trust, in a way that engenders trust between the partners, with fewer or no errors
4.2.1.2 Enable synchronization points

The “Enable synchronization points” process describes the interaction activities between project partners in cross-enterprise projects with respect to a synchronization point. In this context, the point of CPM derives from the following fundamental understanding:

a. Preventive project management (increases the probability of achieving the deliverables at the synchronization point)

b. The aim of the process is:
   1. to detect deviations from the objectives at an early stage and hence allow them to be eliminated,
   2. to actively control the project, even in the period between milestones,
   3. to increase the reliability of planning in the project,
   4. to achieve transparency with respect to the technical progress of the project,
   5. to foster close collaboration.

Synchronization points are gates at which a partial deliverable of the project is compared and synchronized. A synchronization point therefore serves to harmonize processes which are running simultaneously at both partners at a point in time where this is deemed necessary. This allows any deviations in a particular subproject to be identified at an early stage. Alternatively, the completion of certain aspects of the project which are important to both partners can be documented. This means that a synchronization point is a further tool which can be used to achieve the goal of passing a milestone gate. A detailed description of the process for enabling synchronization points can be found in section 5.1.2.

4.2.2 (Project management) change processes

As a general principle, a change means that a new status is defined in place of an old status. Common definitions used in the context of change management generally only take account of technical changes. Furthermore, the conditions associated with collaborative ventures are hardly considered. With respect to technical changes, the ProSTEP iViP association has already been involved in drafting a recommendation, which was published as the VDA4965 Recommendation. To date, no guidelines are available dealing with project changes, and this current Recommendation covers this ground.

As described in section 1.1, changes which need to be communicated between two partners are also categorized as technical and project changes.

Both types of change (technical/project) overlap within a given company, but cross-enterprise changes are dealt with on the following two levels:

- In the case of technical changes, the ECM reference process (see VDA 4965) is to be used. This is not described any further in this document.
- In the case of project changes, this current Recommendation is to be used.

In the event of a change to the product, steps must be taken to ensure that any changes to the scope of the product are also reflected in the project planning. A change of this nature to a product may result in changes to the schedule and to the costs. The important issue in this context is whether the technical change results in a project change (schedule, costs, staffing, etc.) with respect to the partnership.

Changes are unplanned events as defined in the interaction chain. Changes to the project plan occur as a result of changes to the terms of reference, prerequisites or assumptions. This means that they are unplanned, but they are still handled within a planned process. This process is described in section 5.1.3.
4.2.3 Escalation

In business contexts, the term “escalation” is used to describe the mechanism by which particular decisions are delegated one level up in the hierarchy if no resolution can be found for a conflict situation on the existing decision level. The escalation process makes available both defined timeframes and an associated chain of management staff to whom the issue will be escalated in the event of escalation becoming necessary. Escalation is initiated either by a defined threshold condition being exceeded or directly by a particular person.

- If a threshold condition is exceeded (defined criteria), the issue is escalated to a higher instance.
- An issue can be escalated at any time by a person, namely the decision-maker in the process. The crucial factor as far as collaboration is concerned is that the decision-maker actually escalates an issue if a conflict arises that falls into the appropriate category.

When two companies enter into a collaborative venture, consideration must also be given to dealing with problems and conflicts within the framework of collaborative project management. An escalation model has been defined in order to deal with conflicts within a collaborative venture. It is aimed at both strategic and operational project management. In Figure 9, this area is highlighted by the dashed lines.

The objective is to link each of the companies’ internal steering committees in a joint escalation model. The following needs to be taken into account:

- The hierarchies in the various collaboration scenarios may have different depths. This must be taken into account appropriately when planning escalation.
- The CPM model is not a rigid framework, but instead provides proposals for a solution. How many levels of steering committee the partners choose to set up in the escalation model is a matter for themselves to decide.

In order to permit escalation during a collaborative venture, two steps must be carried out:

1. The escalation procedure itself has to be defined
2. If an escalation occurs, it has to be carried out according to the planned procedure

A detailed description of the process for planning and carrying out escalations can be found in section 5.1.4.
4.2.4 Close development project

After the defined scope of a product development project has been completed, the project must be closed. The project would generally be closed after all the agreed milestones and synchronization points have been completed along with any project changes which have been agreed to during the course of the project and after all open issues have been resolved. The objective of the “Close development project” process is to formally close out the project and ensure that any insights gained are recorded and made available for subsequent projects. This process for closing a project in a controlled manner is described in section 5.1.5.

4.3 Processes

The processes for the events described in section 4.2 are described in detail in section 5.1.

4.4 Roles

Definition of the term “role” from the PMBOK® Guide:
Role = A function to be performed by a project team member, such as testing, filing, inspecting, coding.
The CPM project team found that this definition was insufficient. Therefore, a detailed explanation of the term “role” as used in the project is given below:

“A role is described by the tasks to be completed by the role, by the expertise required by the role, by the competence granted to the role and by the responsibility borne by the role.”

<table>
<thead>
<tr>
<th>Role</th>
<th>Tasks</th>
<th>Competence</th>
<th>Expertise</th>
<th>Responsibility</th>
</tr>
</thead>
</table>

- The tasks define the activities to be performed by the role.
- The competence describes the authorization (decision-making capacity) necessary in order to complete the tasks and make decisions.
- The responsibility describes the duty of a role to complete the tasks using the competence granted to the role.
- In order to fulfill the tasks, the role must possess the necessary expertise.

Specification of the rules is not aligned with organizational structures, units or departments. The reason for this lies in the flexibility of the role-based description of workflows. Changes to the structural organization or project organization do not therefore directly impact on the workflow description.

A single person can assume several roles and switch between these roles as and when required. In other words, a role description is not a job description!
When describing workflows, roles can be compared with the roles of a screenplay: Only when the project is implemented are real people assigned to the roles (the film is casted). Before this, the roles are described only in terms of responsibility, tasks, expertise and competence.

Since it is possible for a single person to assume several roles, it is conceivable that a member of staff will switch between the various roles as the tasks are carried out in sequence. For instance, it may become necessary for a member of the computation department who is working on an activity in the role of a reviewer to revise the scheduling of the reviews, which is a task associated with the team leader (review). The member of staff thus assumes this role for a brief moment.

The chart below provides an overview of the key roles in collaboration projects. In practice, the roles listed here can be worked out in more detail. Within each of the companies, specific sub-roles can then be defined. These sub-roles then take on tasks associated with the role. All the sub-roles together, however, should cover the entire scope of the role as described below. Breaking the role down too finely is not to be recommended, as communication requirements grow disproportionately as a result. The communication matrix tool (see section 5.2.2) can be used for defining these sub-roles and the way in which the roles communicate between the collaboration partners. The roles described below cover the project management roles which need to be used in the context of collaborative ventures.

<table>
<thead>
<tr>
<th>Enterprise level</th>
<th>Partner A (coordination)</th>
<th>Partner B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervisor / manager level</td>
<td>Project steering committee member</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project manager A</td>
<td>Project manager B</td>
</tr>
<tr>
<td>Sub-manager level</td>
<td>Subproject manager A1*</td>
<td>Subproject manager B1*</td>
</tr>
<tr>
<td></td>
<td>(e.g. SE team leader)</td>
<td>(e.g. SE team leader)</td>
</tr>
<tr>
<td></td>
<td>Subproject manager A2*</td>
<td>Subproject manager B2*</td>
</tr>
<tr>
<td></td>
<td>(e.g. team leader division A)</td>
<td>(e.g. team leader division X)</td>
</tr>
<tr>
<td>Working level</td>
<td>Project member a1*</td>
<td>Project member b1*</td>
</tr>
<tr>
<td></td>
<td>Project member a2*</td>
<td>Project member b2*</td>
</tr>
<tr>
<td></td>
<td>Project member a3*</td>
<td>Project member b3*</td>
</tr>
</tbody>
</table>

* To be defined in a concrete use case

Figure 12: Overview of roles

In addition, role definitions are necessary in the product development process (technical process) in order to ensure that work progresses without hitches. The project management roles and the technical roles are generally linked at the level of subproject manager. Thus, subproject managers are named for defined work packages. They are then in particular responsible for the engineering deliverables as well as for controlling scheduling and communication for the work package. The following sections describe the roles and the associated tasks, competencies, expertise and responsibilities in the context of project management.
### 4.4.1 Project manager

**In time/activity management:**

<table>
<thead>
<tr>
<th>Process step</th>
<th>Task</th>
<th>Expertise</th>
<th>Competence</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of the activities</td>
<td>• Specify activities and milestones</td>
<td>• Knowledge of the environment in the company</td>
<td>• Authorization for creating/changing the project plan within the scope of the contract</td>
<td>Coherent definition of work packages in the context of the company</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Experience in planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definition of the activity sequences</td>
<td>• Specify activities and milestones</td>
<td>• Identifying interrelationship</td>
<td>• Authorization for creating/changing the project plan within the scope of the contract</td>
<td>• Delineation of sub-activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Experience in workflow planning</td>
<td></td>
<td>• Provide draft for cost estimation</td>
</tr>
<tr>
<td>Estimation of resource requirements</td>
<td>• Create cost estimation for the individual activities</td>
<td>• Knowledge of organization and resources</td>
<td>• Authorization for deploying the approved resources according to requirements</td>
<td>• Realistic resource requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Create project team structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimation of activity duration</td>
<td>• Work out processing time for individual activities</td>
<td>• Knowledge of organization and resources</td>
<td>• Authorization for deploying the approved resources according to requirements</td>
<td>• Create a draft schedule that will bear scrutiny</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Experience in cost estimation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of the schedule</td>
<td>• Create a detailed schedule</td>
<td>• Knowledge of scheduling and chaining activities</td>
<td>• Authorization for creating/changing the project plan within the scope of the contract</td>
<td>• Create a draft schedule that will bear scrutiny</td>
</tr>
<tr>
<td></td>
<td>• Modify resources as required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control of the schedule</td>
<td>• Monitor project progress</td>
<td>• Experience in project control</td>
<td>• Authorization for creating/changing the project plan within the scope of the contract</td>
<td>• Ensure adherence to schedule</td>
</tr>
<tr>
<td></td>
<td>• Compare planned and actual status</td>
<td>• Identification and control of risks</td>
<td></td>
<td>• Modification of schedule/resource planning</td>
</tr>
<tr>
<td></td>
<td>• Define corrective measures</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**In communication management:**

<table>
<thead>
<tr>
<th>Process step</th>
<th>Task</th>
<th>Expertise</th>
<th>Competence</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication planning</td>
<td>• Analyze communication requirements and possible tools</td>
<td>• Project progress report</td>
<td>• Authorization for defining communication relationships</td>
<td>• Definition of the basic conditions for communication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Presentation of problems and corrective measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication planning</td>
<td>• Define communication tools</td>
<td>• Knowledge of communication tools</td>
<td>• Authorization for defining communication relationships</td>
<td>• Ensure provision of a functioning infrastructure</td>
</tr>
<tr>
<td></td>
<td>• Establish methods for distributing information</td>
<td>• Lessons learned</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress reporting</td>
<td>• Collect and prepare the statuses of activities</td>
<td>• Experience in preparing reports</td>
<td>• Authorization for introducing a draft decision on corrections into the steering committee</td>
<td>• Representation of the project progress</td>
</tr>
<tr>
<td></td>
<td>• Provide reports on time, costs and quality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Draft decision documents for corrections</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stakeholder management</td>
<td>• Project progress report</td>
<td>• Experience in preparing reports</td>
<td>• Authorization for making agreements with all stakeholders</td>
<td>• Communication between the stakeholders and the project team</td>
</tr>
<tr>
<td></td>
<td>• Presentation of problems and corrective measures</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In addition to the characteristics described above, a project manager should also have the following skills:

- Assertiveness/persuasiveness
- Entrepreneurial in thinking and actions
- Communication skills
- Understanding of different cultures
- Knowledge of project management methods
- Team skills
- Ability to handle criticism and conflict
- Structured/analytical thinking and actions
- Decision-making skills
- Management competence
- Sales-oriented, customer-oriented
- Cost consciousness
- Sound technical background
- Presentation and moderation
- Quality management
- Staying power and endurance
- Risk management
### 4.4.2 Subproject manager

**In time/ activity management:**

<table>
<thead>
<tr>
<th>Process step</th>
<th>Task</th>
<th>Expertise</th>
<th>Competence</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of the activities</td>
<td>• Support when defining the relevant subproject</td>
<td>• Knowledge of the relevant field</td>
<td>• Authorization for creating/changing the project plan within their sphere of responsibility</td>
<td>• Ensure definition of the relevant subproject</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definition of the activity sequences</td>
<td>• Support for embedding the subproject in the overall project</td>
<td>• Identifying interrelations</td>
<td>• Authorization for creating/changing the project plan within their sphere of responsibility</td>
<td>• Ensure general conditions for the subproject</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimation of resource requirements</td>
<td>• Provide cost estimation for relevant subproject</td>
<td>• Knowledge of organization and resources</td>
<td>• Authorization for deploying the approved resources according to requirements within their sphere of responsibility</td>
<td>• Realistic resource requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide input for the project team structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Knowledge of organization and resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Experience in cost estimation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimation of activity duration</td>
<td>• Work out processing time for subproject</td>
<td>• Knowledge of organization and resources</td>
<td>• Authorization for creating/changing the project plan within their sphere of responsibility</td>
<td>• Realistic resource requirements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Experience in cost estimation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of the schedule</td>
<td>• Work out processing time for subproject</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Knowledge of scheduling</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control of the schedule</td>
<td>• Monitor subproject progress</td>
<td>• Experience in project control</td>
<td>• Authorization for creating/changing the project plan within their sphere of responsibility</td>
<td>• Ensure adherence to schedule</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Comparison of planned and actual status</td>
<td></td>
<td>• Escalation of any deviations to project management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Report to project manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**In communication management:**

<table>
<thead>
<tr>
<th>Task</th>
<th>Expertise</th>
<th>Competence</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution of information</td>
<td>• Notify staff of communication tools</td>
<td>• Knowledge of the communication tools used</td>
<td>• Interface between project management and subproject team</td>
</tr>
<tr>
<td></td>
<td>• Configure subproject team members</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progress reporting</td>
<td>• Prepare subproject status</td>
<td>• Experience in preparing reports</td>
<td>• Authorization for passing proposed decisions on corrections to the project manager</td>
</tr>
<tr>
<td></td>
<td>• Comparison of planned and actual status</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Change requests</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In addition to the characteristics described above, a subproject manager should also have the following skills:

- Assertiveness/ persuasiveness
- Communication skills
- Knowledge of project management methods
- Team skills
- Ability to handle criticism and conflict
- Structured/ analytical thinking and actions
- Decision-making skills
- Cost consciousness

- Excellent technical knowledge
- Presentation and moderation
4.4.3 Project team member

In time/activity management:

<table>
<thead>
<tr>
<th>Process step</th>
<th>Task</th>
<th>Expertise</th>
<th>Competence</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimation of resource requirements</td>
<td>• Provide input for cost estimation for relevant subproject</td>
<td>• Specialist knowledge in defined subproject</td>
<td>• Authorization for creating/changing the activity plan within their sphere of responsibility</td>
<td>• Realistic estimate for member’s own work package</td>
</tr>
<tr>
<td>Estimation of activity duration</td>
<td>• Provide input for estimating the processing time of the relevant subproject</td>
<td>• Specialist knowledge in defined subproject</td>
<td>• Authorization for creating/changing the activity plan within their sphere of responsibility</td>
<td>• Realistic estimate for member’s own work package</td>
</tr>
<tr>
<td>Control of the schedule</td>
<td>• Report to subproject manager</td>
<td>• Specialist knowledge in defined subproject</td>
<td>• Taking account of risks</td>
<td>• Escalation of any deviations to subproject manager</td>
</tr>
</tbody>
</table>

In communication management:

<table>
<thead>
<tr>
<th>Process step</th>
<th>Task</th>
<th>Expertise</th>
<th>Competence</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution of information</td>
<td>• Use communication infrastructure</td>
<td>• Knowledge of the communication tools used</td>
<td>• Authorization for disseminating information in accordance with the defined communication relationships</td>
<td>• Inform and be informed</td>
</tr>
<tr>
<td>Progress reporting</td>
<td>• Use communication infrastructure</td>
<td>• Specialist knowledge in defined subproject</td>
<td>• Authorization for passing proposed decisions on corrections to the project manager</td>
<td>• Preparation of own deliverables</td>
</tr>
</tbody>
</table>

In addition to the characteristics described above, a project team member should also have the following skills:
- High level of technical skill
- Sense of responsibility
- Basic knowledge of project management
- Team skills
- Ability to handle criticism
- Reliability
### 4.4.4 Project steering committee

In time/activity management:

<table>
<thead>
<tr>
<th>Process step</th>
<th>Task</th>
<th>Expertise</th>
<th>Competence</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control of the schedule</td>
<td>• Control the project schedule</td>
<td>• Knowledge of scope of the work and resources</td>
<td>• Knowledge of scope of the work and resources</td>
<td>• Ensure general conditions for the project</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Taking account of risks</td>
<td>• Taking account of risks</td>
<td></td>
</tr>
</tbody>
</table>

In communication management:

<table>
<thead>
<tr>
<th>Process step</th>
<th>Task</th>
<th>Expertise</th>
<th>Competence</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication planning</td>
<td>• Control any problems with communication requirements and possible tools</td>
<td>• Knowledge of project structure and content</td>
<td>• Authorization for defining external communication</td>
<td>• Be informed of the basic conditions for communication</td>
</tr>
<tr>
<td>Distribution of information</td>
<td>• Control communication infrastructure</td>
<td>• Knowledge of the communication tools used</td>
<td>• Authorization for defining external communication</td>
<td>• Be informed</td>
</tr>
<tr>
<td>Stakeholder management</td>
<td>• Solution of problems and corrective measures</td>
<td>• Communication skills</td>
<td>• Authorization for making decisions in the event of conflicting interests</td>
<td>• Communication between the stakeholders and the project team</td>
</tr>
</tbody>
</table>

In addition to the characteristics described above, a member of the project steering committee should also have the following skills:
- Control expertise
- Assertiveness/persuasiveness
- Decision-making skills
- Customer-orientation
- Entrepreneurial mindset
- Systematic thinking, ability to understand and manage complexity
- Set objectives
- Controlling
- Management competence
- Basic knowledge of management in project organizations
It is recommended that a multi-level approach is adopted when using the roles in a concrete project. This approach is illustrated in section 5.1.6.

The use of the role model described allows the following potentials for improvement to be exploited with the attendant benefits.

Potential 5: The qualification of the partners is not comparable on the various levels

Typical symptoms of this problem are as follows:
- Project managers have no knowledge of project management methods and are strictly technical experts
- Project managers have no commercial expertise

The value of CPM in this context is as follows:

<table>
<thead>
<tr>
<th>What does CPM offer?</th>
<th>Results</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role model including proficiency requirements (skills and expertise) for the project roles</td>
<td>Qualification requirements for project team members and their roles in the project are clearly defined and can be measured</td>
<td>Time: Loops caused by insufficient/incorrect staff skills and expertise are reduced Quality: The right skills are used in the project</td>
</tr>
</tbody>
</table>

Table 7: Business value potential 5

Potential 6: The responsibilities are unclear (e.g. with respect to handover and acceptance of work packages, escalation, decision making, awarding of a contract).

Typical symptoms of this problem are as follows:
- The project managers of the partners have entirely different decision-making authority and a different understanding of their role:
- One could be more a technical coordinator in a technical process and another is more a manager.

The value of CPM in this context is as follows:

<table>
<thead>
<tr>
<th>What does CPM offer?</th>
<th>Results</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| Role model | Task, competence and responsibilities are clear to both parties and harmonized | Time:  
- More rapid control  
- More rapid decisions  
- Lower expenditure for clarifying competencies |

Table 8: Business value potential 6
5 Methods and tools of the application model

Section 5.1 below describes the methods associated with the project management events in collaborative structures as described in section 4. The description of each includes an overview and the detailed process description. Section 5.2 then introduces possible tools/resources which can be used to help achieve the tasks described in the event descriptions.

5.1 Methods/ processes

This section deals with the methodology used to handle project management events in collaborative structures and the processes associated with this.

5.1.1 Project initiation and planning

A project must be initiated before it can start. In other words, a request is issued to define the rough framework of a project. After the decision has been made to handle the project as a collaborative venture, joint project planning is initiated and work is started on defining the interaction chain. This procedure is described in sections 5.1.1.3. The chart below shows an overview of initiation and planning.

<table>
<thead>
<tr>
<th>Objectives:</th>
<th>Ensure that the project starts correctly and that meaningful planning will allow it to progress without problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants:</td>
<td>Project manager A (coordination) Project manager B</td>
</tr>
<tr>
<td>Time:</td>
<td>At the start of the project</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project proposal, project plan</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Procedure (activities)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define the scope of the project</td>
</tr>
<tr>
<td>Draft the internal planning</td>
</tr>
<tr>
<td>Plan project in detail</td>
</tr>
<tr>
<td>Create and agree the interaction chain</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Short description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early integration of a possible partner in the initiation phase of a project greatly facilitates subsequent work. During the planning phase, steps should be taken to ensure that an interaction chain is agreed in which all the coordination points between the partners are laid down in binding form.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agreed interaction chain</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Success factors:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measures designed to foster trust can improve planning efficiency, considerably accelerate agreement of the interaction chain and enhance the quality of the deliverable.</td>
</tr>
</tbody>
</table>

Figure 13: Description – Initiation/Planning of the Project and Agreement of the Interaction Chain
5.1.1.1 Initiate project

Initiation of a collaborative project can proceed as follows:

Partner A (coordinator)

Initiate project?

yes: project brief

Define scope

Initial planning of project

no: review report

Partner B

Initial planning of project

Start project?

engineering deliverables
project request

rough: project plan

engineering deliverables

Figure 14: “Initiate project” process
### 5.1.1.2 Plan project

Before an interaction chain can be established in a collaborative project, the internal planning must be prepared to as great an extent as possible. Even during this phase of project preparation, there may be a need to coordinate certain information objects. The process chart below illustrates the significant information objects in this context.

![Diagram showing the collaborative project planning process](image)

**Figure 15:** "Collaborative project planning" process
5.1.1.3 Create interaction chain

Some of the information objects in the planning phase are triggered by the interaction chain, an example of which is shown in Figure 9. The interaction chain is a document showing planned events. This document is binding for both partners in the project. Changes to the interaction chain are dealt with using the collaborative change management mechanisms during the execution phase (see section 5.1.4). The interaction chain is established as follows:

![Diagram showing the steps to create an interaction chain for two partners, A and B.](image-url)

Figure 16: “Build project path and create interaction chain” process
The chart above could be described in detail as follows:

1. Selection of the phases and milestones in the product development process of each of the partners (strategy/vehicle development).
2. Selection of the process description level(s) for the (vehicle) project which is to be planned (development of electrics/electronics).
3. Description of the project management activities (project management processes) as per the individual project management method used.
4. Description of the partner’s own activities in the selected subprocess of the PDP (e.g. electrics/electronics - see Figure 7).
5. Definition of the objectives, activities, milestones, indicators, etc. from the project management and PDP activities as planned events in the context of collaborative project management.
6. Combination of the planned events to form the “planned project path”, which is then sent to the partner.
7. Description of the common planned events (synchronization points, milestones) by defining the CPM-Processes, the input and output information, the associated roles, the necessary work activities and the benefits, which together allow the objectives to be achieved and assessed, based on the two planned project paths (own and received from partner).
8. Handover of the proposed interaction chain to the partner to allow them to compare with their proposal and prepare an agreement.
9. Joint agreement (“handshake”) of the complete interaction chain and kick-off of the project.
10. Ongoing adjustment of the interaction chain as a result of unplanned events and documentation of decisions taken and experiences in dealing with changes which occurred.

Steps 1 to 6 in this process correspond to Conformance Class 1 (see section 2.1), whereas Steps 7 to 10 correspond to its extension, including the handshake principle to document the binding agreement on the joint interaction chain.

### 5.1.1.4 Create communication matrix

The chart below shows an overview of how to create the communication matrix.

<table>
<thead>
<tr>
<th>Objectives: Ensure adequate but minimal communication in the collaboration project</th>
<th>Participants: Project manager A (coordination) Project manager B</th>
<th>Time: Concurrent with project planning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input:</strong> Company-specific roles, assignment of roles to people, responsibility of people for topics</td>
<td><strong>Short description:</strong> The communication matrix ensures efficient communication. This matrix immediately indicates who needs to communicate with whom and on what topics. It thus avoids considerable friction loss since, if observed, it ensures that the right information is available at the right place.</td>
<td></td>
</tr>
<tr>
<td><strong>Procedure (activities)</strong> Check internal roles to ensure that they fully cover the CPM roles Assign the internal roles to the CPM roles Assign people to roles Harmonize the topics for the internal roles with the topics and roles of the partner</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Output:</strong> Complete communication matrix</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Success factors</strong> Defining the matrix as soon as possible ensures extremely efficient cross-company communication if the agreed communication paths are observed.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 17: Create communication matrix, description
The chart below shows the multi-level approach for using roles and assigning specific people to these roles.

After the roles have been defined, the corresponding people should be assigned to the roles within each partner company. Furthermore, defining the topic areas about which the various roles communicate with each other has proved to be a valuable approach. This means that everybody involved in the project can immediately see who is the correct person to consult on any given topic and how any change of contents with respect to this topic must be communicated to the partner. In this way, joint meetings can be restricted to communication topics which have not yet been defined. The communication matrix can be used as a tool to support this approach (see Figure 30).
Using the methods described in section 5.1 allows the following potentials for improvement to be exploited with the attendant benefits.

Potential 7: Different expectations with respect to the deliverables and the form of the deliverables (e.g. schedule)

A typical symptom of this problem is the following situation: “We thought you were taking care of...”

<table>
<thead>
<tr>
<th>What does CPM offer?</th>
<th>Results</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| Demonstration of the necessity of defining the scope and form of the types of deliverables when the project is initialized | Defined deliverable types (information objects) as required for collaboration | Costs: Reduction in the need for meetings  
Time: Time is saved because there is no need to discuss methods during the course of the project |

More business values for section 5.1 are documented in Potential 5 and Potential 6.

### Table 9: Business value potential 7

#### 5.1.2 Project Execution

#### 5.1.2.1 Enable milestones

Some of the information objects in the planning phase are triggered in the interaction chain, an example of which is shown in Figure 8. The interaction chain is a document showing planned events. This document is binding for both partners in the project. Changes to the chain are dealt with using the collaborative change management mechanisms during the execution phase (see section 5.1.3).

The interaction chain is established as follows:

| Objectives: Ensure that a milestone gate is passed in an orderly manner | Participants: Project manager A (coordination)  
Project manager B | Time period: Time between two milestones |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Input: Project plan or review report for the previous milestone or the project planning, feedback from tasks (maturity) or documentation of deliverables and open issues / measures from the previous phase</td>
<td><strong>Short description:</strong> A number of requirements need to be verified before a milestone can be accepted. To ensure that the milestone can be passed correctly, the agreed deliverables must be documented and the partner must confirm that they have been completed.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Procedure (activities)</th>
<th>Output: Project review report for the milestone, documented and impacted deliverables (technical); release of the next project phase, list of open issues where appropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verify the project plan after previous milestone has been passed</td>
<td>Success factors: The requirements have been met before the milestone decision meeting and have already been agreed at a technical level. Proactive measures to ensure that the gate can be passed successfully can be taken by allowing sufficient space in the common project plan for agreeing the necessary information objects at increasing levels of maturity between the partners.</td>
</tr>
<tr>
<td>Constant controlling of the extent to which the activities have been fulfilled, possibly using list of open issues</td>
<td></td>
</tr>
</tbody>
</table>
The process chart below shows in detail the process for ensuring that a milestone gate can be passed in an orderly fashion.

Figure 20: “Enable milestones” process
### 5.1.2.2 Enable synchronization points

The chart below shows an overview of the "Enable synchronization point" event:

<table>
<thead>
<tr>
<th>Objectives:</th>
<th>Participants:</th>
<th>Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronization of the partners for a specific subset of a project</td>
<td>Subproject manager A (coordinator) Subproject manager B or Project manager A / B</td>
<td>At kick-off or triggered by a control meeting or as a need is identified</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input:</th>
<th>Short description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project plan, open issue list, interaction plan, request/need for synchronization</td>
<td>Over the course of projects, project activities must be harmonized and synchronized regularly. This can be done in joint meetings or by an agreed exchange of specific information at an agreed time. The agreed times and content can be seen from the agreed interaction chain.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Procedure (activities):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Define content and time of synchronization in the interaction chain</td>
<td></td>
</tr>
<tr>
<td>Carry out synchronization (exchange deliverables or hold meeting)</td>
<td></td>
</tr>
<tr>
<td>Document the result of synchronization</td>
<td></td>
</tr>
<tr>
<td>if necessary: verify interaction plan</td>
<td></td>
</tr>
<tr>
<td>Monitor issue list</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open issue list, minutes, status report on maturity of the individual partial deliverables</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Success factors:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documented synchronization points in the interaction chain at which the partners can carry out synchronization and make any adjustments. Deviations from targets and problems in the project are revealed at an early stage, allowing proactive project control, even between milestones (determine current values, compare nominal/current values). Transparency with respect to the technical progress supports problem-free handling of the project.</td>
</tr>
</tbody>
</table>

Figure 21: Synchronization point description
The process chart below shows in detail the process for ensuring that synchronization points are handled correctly. 3 possible events caught be the starter of this CPM Process: “Project start”, “issue from a periodical meeting” or “a request for reconciliation”.

Figure 22: “Enable synchronization points” process
5.1.3 Change processes

5.1.3.1 (Project management) change processes

The chart below shows an overview of how to handle a project change to the process model:

<table>
<thead>
<tr>
<th><strong>Objectives:</strong></th>
<th>Control of project changes to the project</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participants:</strong></td>
<td>Project manager A (coordinator)</td>
</tr>
<tr>
<td></td>
<td>Project manager B or Subproject manager A / B</td>
</tr>
<tr>
<td><strong>Time:</strong></td>
<td>Need for change identified in the current project</td>
</tr>
<tr>
<td><strong>Input:</strong></td>
<td>Need for organizational (PM) change which could be triggered by a technical change</td>
</tr>
<tr>
<td><strong>Procedure (activities):</strong></td>
<td></td>
</tr>
<tr>
<td>Initiate a change (request)</td>
<td></td>
</tr>
<tr>
<td>Clarify and agree the scope of the change</td>
<td></td>
</tr>
<tr>
<td>Incorporate and carry out the changes</td>
<td></td>
</tr>
<tr>
<td>Document and communicate the changes</td>
<td></td>
</tr>
<tr>
<td>Close change issue</td>
<td></td>
</tr>
<tr>
<td>if necessary: update interaction chain</td>
<td></td>
</tr>
<tr>
<td><strong>Output:</strong></td>
<td>Updated project planning including interaction plan or updated communication matrix</td>
</tr>
<tr>
<td><strong>Short description:</strong></td>
<td>Changes can be of a purely organizational nature or could be triggered by technical necessity</td>
</tr>
<tr>
<td>Project changes may include:</td>
<td></td>
</tr>
<tr>
<td>- Changes to the project plan in the event of impact on the interaction chain</td>
<td></td>
</tr>
<tr>
<td>- Changes to the role assignment if the communication matrix is changed</td>
<td></td>
</tr>
</tbody>
</table>

Figure 23: Change management, description
Figure 21 provides an overview of change management during collaboration between the coordinator and the participant:

![Diagram of change management process]

Figure 24: Change management during collaboration
5.1.3.2 Project team change (role change)

Staffing changes, whether by choice or by uncontrollable events, can affect the rest of the project plan. If staffing issues are liable to disrupt the project plan, such as causing the schedule to be overrun or the budget to be exceeded, a change request can be initiated.

- In project management, a role change does not mean a change to a different role profile but a change of the person associated with the role in the project.
- For collaborative project management, only changes of roles within the CPM role model are relevant (see also section 5.2.2).
- A role change is document-driven, which means that it is connected to the change management process.

![Figure 25: Role change process](image)

Potential 8: Changes to the project are not processed in a structured manner or explicitly controlled

Typical symptoms of this problem are as follows:
- Changes are made on demand
- Changes are not announced to all those affected
- Changes are not documented
- Project staff access different statuses of the work in hand

The value of CPM in this context is as follows:

<table>
<thead>
<tr>
<th>What does CPM offer?</th>
<th>Results</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| Process description  | Structured changes to project planning | **Costs:** Lower outlay for changes  
**Time:** Fast-track change process  
**Quality:** Structured change process ensures completeness (nothing is forgotten) |

Table 10: Business value potential 8
5.1.4 Escalation processes

5.1.4.1 Planning escalation

Escalation planning comprises four key steps:

**Step 1: Creation of an escalation matrix**

When two or more companies collaborate, it is necessary to clarify how many levels the escalation model must have and how many people occupy each level of the matrix.

For instance, steering committees could be set up on the operational level to deal with specific technical topics. These would exist alongside a top-level steering committee which would deal with issues which could not be resolved by the steering committees on operational level or which would be involved in the event of problems which endanger the success of the project.

**Step 2: Escalation criteria**

The following items must also be defined in addition to the escalation matrix and the people involved:

- What triggers escalation (root cause analysis)?
- How urgently must the problem be addressed? (prioritization).

There are various types of triggers, for example:

- Product-specific triggers (conflicting technical objectives)
- Project-specific triggers (conflicting objectives with respect to deadlines, costs, resources)

On the basis of the triggers, the problems must be weighted to define the priority at which a given problem will be escalated to a given level. Table 11 shows an example of a weighted list of criteria:

<table>
<thead>
<tr>
<th>Escalation criteria</th>
<th>Escalation level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Steering committee</td>
</tr>
<tr>
<td><strong>Product-specific</strong></td>
<td>Requirement not met</td>
</tr>
<tr>
<td></td>
<td>Problem</td>
</tr>
<tr>
<td></td>
<td>...</td>
</tr>
<tr>
<td><strong>Project-specific</strong></td>
<td>Schedule overrun</td>
</tr>
<tr>
<td></td>
<td>Cost overrun</td>
</tr>
<tr>
<td></td>
<td>...</td>
</tr>
</tbody>
</table>

Table 11: Example of a list of criteria for escalation
**Step 3: Specification of the escalation procedure**

The tool to carry out the escalation is the issue list. The following escalation procedures are available:

1. When triggering an escalation, the original issue is closed. A new escalation issue is created and pursued further. The corresponding decision is documented in the escalation issue and, if necessary, a new issue will be created according to the decision.

2. When triggering an escalation, the existing issue remains open, an escalation issue is created in addition and pursued further. The decision of the escalation is documented in the escalation issue, and the work on the original issue will continue according to that decision.

In the planning of the escalation, an agreement about the approach to be used has to be made. The simultaneous use of both methods is not recommendable. Since the issues are linked with each other, the traceability of the chain of communication is ensured at both procedures. (see also Implementation Guide)

**Step 4: Define general rules for escalation**

- The corresponding partner must always be informed if (before) an issue is to be escalated to the next level.
- If the conflict (problem) has been resolved, the roles (people) affected must be informed and the results must be documented.
5.1.4.2 Perform escalation

Escalation is triggered in a running process as a result of a conflict of objectives. An attempt is made to resolve the problems in a conflict resolution meeting on the same level. If this is unsuccessful, the conflict is prioritized in accordance with the criterion catalog. After this, the issue must be escalated to the appropriate instance. This instance then assesses the necessity for the escalation and can, if necessary, reject it or continue to deal with it. Once the top escalation level has been reached, the conflict must be resolved in a meeting. After this, the people involved on operational level must be informed about the decision taken. The operational level then derives the measures which need to be taken and, where appropriate, initiates the change processes (see 5.1.4). Figure 23 shows an overview of the escalation process:

<table>
<thead>
<tr>
<th>Objectives:</th>
<th>Participants:</th>
<th>Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control of the project if problems arise</td>
<td>As per the defined escalation matrix (see 5.1.5.1)</td>
<td>When problems occur which cannot be solved at operational level</td>
</tr>
</tbody>
</table>

**Input:**
Conflict in the project

**Procedure (activities):**
- Report problem / describe conflict
- Discuss resolution of the conflict
- Prioritize problems / select escalation level
- If necessary, initiate next escalation level

**Output:**
Decision with respect to further measures

**Success factors:**
Defined escalation structure with fixed timeframe and criteria

Figure 26: Execute escalation, description
Figure 24 shows the escalation processes in the form of swim lanes. The loop *Identify problem – Discuss resolution of the problem – Prioritize problem – Select escalation level* forms the actual escalation process. After this loop has been passed, care must be taken to ensure that the information flow is maintained on the lower levels.

* EskalationsBoard (e.g. Steering Circle, Steering Committee etc.)
### 5.1.5 Close development project

The chart below shows an overview of how to bring a project to an orderly conclusion in collaboration scenarios.

<table>
<thead>
<tr>
<th>Objectives:</th>
<th>Participants:</th>
<th>Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Learn lessons for the future from projects</td>
<td>All those involved in the project</td>
<td>Agreed project close</td>
</tr>
<tr>
<td>- Clear project conclusion with handover and discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- also, draw positive conclusions (= best practices)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input:</th>
<th>Short description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliverable documents, review reports</td>
<td>A project should always formally be declared as complete and the reason should be given (e.g. successful conclusion, handover to plants, cancellation).</td>
</tr>
</tbody>
</table>

**Procedure (activities)**

- Finish open activities
- Review the project (lessons learned)
- Complete the documentation
- Formal conclusion

**Output:**

- Final report

**Success factors**

The defined conclusion of the project is part of the project planning and is requested by the superordinate management levels.

Figure 28: Close development project, description
The process chart below shows in detail the process for ensuring that a project is brought to an orderly conclusion.

**Figure 29: “Close development project” process**
5.2 Tools

This section contains suggested tools for use in collaboration scenarios. They should be used in all relations between two partners. If this is done, all the stipulations which have been jointly made together allow support of network structures.

The following sections explain the purpose of the tools and illustrate one possible implementation on the basis of a section of the template. A proposal for how to proceed can be found in the Usage Guide.

Please note:
➡ Each tool can be used independently.
➡ Each tool can be used with or without a project management system.

There are different possibilities how to handle the tools, dependent on your project and system environment. For instance it is easy to use office applications for the communication matrix or the issue list, without connection to your IT system for project management. If you decide to implement the CPM tools in your existing project management environment and care for the connection between the tools, you take advantage of a central information database.

5.2.1 The “issue list” tool

The issue list below is used to monitor minor deviations from the original plan which affect both partners and also, where appropriate, to monitor activities which were not explicitly included in the project planning. It is to be used as a standard piece of work equipment and should be maintained constantly at the joint coordination meetings (e.g. at synchronization points or at control meetings). Maintaining a common list has proved to be a successful approach, as the effort involved in maintaining and administering several lists grows exponentially and is hence extremely difficult to monitor. If a system-based solution is chosen, consideration must be given to the various access rights. If a manual solution is chosen, it makes sense to maintain the overall list in a project office. In this case, the individual meetings each report the status of their part of the list.

The content of the common issue list shown here should be synchronized with the internal issue lists of each of the project partners. Extract from the template showing the possible implementation:

<table>
<thead>
<tr>
<th>ID</th>
<th>Related interaction task</th>
<th>topic</th>
<th>issue title</th>
<th>Description</th>
<th>Source (e.g. status meeting)</th>
<th>Partner A</th>
<th>Partner B</th>
<th>Deadline</th>
<th>Traffic signal</th>
<th>Partner A</th>
<th>Partner B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 30: „Issue list” template

Other attributes are also possible in addition to the ones shown, e.g.:
➡ Prepared on
➡ Prepared by
➡ Support
➡ Priority
➡ Action
➡ Comment
➡ Last changed
➡ Improvement status
### 5.2.2 “Communication matrix” tool

The communication matrix can be used to document who assumes what roles in collaboration projects. The tool both maps company-internal roles to the CPM role model and also assigns people to the defined roles. Furthermore, it defines who communicates with whom on what topic. It is structured as follows:

![Communication matrix](image)

**Figure 31: Communication matrix**
### 5.2.3 “Interaction plan” tool

The milestones and synchronization points which are relevant to collaboration are selected from each of the partners’ project plans and documented as the planned project path for each partner. The jointly agreed interaction points (milestones/ synchronization points) are then documented in the interaction chain. The interaction plan is structured as follows:

#### Project name: CPM Chassis New Sedan

<table>
<thead>
<tr>
<th>Version (date/time):</th>
<th>January 27, 2006, 12:16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribute to:</td>
<td>Project Teams A + B, Management A + B</td>
</tr>
</tbody>
</table>

#### Partner A

<table>
<thead>
<tr>
<th>Period</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type (MS / sync. point)</td>
<td>MS</td>
<td></td>
<td>Sync. point</td>
</tr>
<tr>
<td>Trigger in project plan</td>
<td></td>
<td>Project start</td>
<td>Feature list</td>
</tr>
<tr>
<td>Content</td>
<td>Kick-off</td>
<td>Feature list created</td>
<td></td>
</tr>
<tr>
<td>Input</td>
<td>Marketing evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deliverable</td>
<td></td>
<td>Project plan A</td>
<td>Feature list</td>
</tr>
<tr>
<td>Role responsible</td>
<td>Project manager A</td>
<td>Technical coordinator</td>
<td></td>
</tr>
<tr>
<td>Transfer: Meeting / Doc</td>
<td>Doc</td>
<td>Doc</td>
<td></td>
</tr>
</tbody>
</table>

#### Interaction chain

<table>
<thead>
<tr>
<th>Agreed trigger</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type (MS / sync. point)</td>
<td>MS</td>
</tr>
<tr>
<td>Content</td>
<td>Kick-off</td>
</tr>
<tr>
<td>Input</td>
<td>Released project order</td>
</tr>
<tr>
<td>Deliverable</td>
<td>Confirmed project plan</td>
</tr>
<tr>
<td>Role Responsible</td>
<td>Project manager A + B</td>
</tr>
<tr>
<td>Transfer: Meeting / Doc</td>
<td>Meeting</td>
</tr>
</tbody>
</table>

#### Partner B

<table>
<thead>
<tr>
<th>Period</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type (MS / sync. point)</td>
<td>MS</td>
<td></td>
<td>Sync. point</td>
</tr>
<tr>
<td>Trigger in project plan</td>
<td>A1.5.4</td>
<td>A3.2.7</td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td>Kick-off</td>
<td>Feature list approved</td>
<td></td>
</tr>
<tr>
<td>Input</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deliverable</td>
<td>Project plan B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Role responsible</td>
<td>Project manager B</td>
<td>Team member, specifications</td>
<td></td>
</tr>
<tr>
<td>Transfer: Meeting / Doc</td>
<td>Doc</td>
<td>Doc</td>
<td></td>
</tr>
</tbody>
</table>

---

Figure 32: Interaction plan
Using the tools described in section 5.2 allows the following potentials for improvement to be exploited with the attendant benefits.

Potential 9:
- There is no common documentation
- Project management information is not comparable/comprehensible
- Superfluous effort for documentation, because each person wishes to see their form used

Typical symptoms of this problem are as follows:
- Each partner has their own schedule with differing structures and levels of detail
- Each company has their own status report and list of open issues
- Each partner creates their own records
- Schedules are not comparable/compatible

The value of CPM in this context is as follows:

<table>
<thead>
<tr>
<th>What does CPM offer?</th>
<th>Results</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Templates for common project management</td>
<td>- Uniform Project documentation</td>
<td>Costs:</td>
</tr>
<tr>
<td>- Standardized information objects (necessary scope)</td>
<td>- information which can be exchanged</td>
<td>- No outlay for generating the most important control documents</td>
</tr>
<tr>
<td></td>
<td>- Defined scope of documentation</td>
<td>- No unnecessary documents are created, maintained and changed</td>
</tr>
<tr>
<td></td>
<td>- Documents that can be used immediately</td>
<td>Time:</td>
</tr>
</tbody>
</table>

Costs:
- No outlay for generating the most important control documents
- No unnecessary documents are created, maintained and changed

Time:
- Faster project initialization
- Time is saved because documents no longer have to be defined and agreed a second time

Quality:
- No errors resulting from discrepant information

Table 12: Business value potential 9

Potential 10:
- The same topic has to be discussed with many different contact persons
- Information is passed on to the incorrect contact person and is not deemed to have been passed on

Typical symptoms of this problem are as follows:
- Many unnecessary meetings at all levels
- The project manager is only ever at meetings or on their way to meetings
- Information processes falter and information gets bogged down

The value of CPM in this context is as follows:

<table>
<thead>
<tr>
<th>What does CPM offer?</th>
<th>Results</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication matrix</td>
<td>Defined communication relations are available</td>
<td>Costs:</td>
</tr>
</tbody>
</table>

Costs:
- Lower outlay for harmonizing information
  (often in person with attendant travel costs)

Time:
- Fewer coordination meetings
- Fewer misunderstandings
- Less friction loss in communication

Table 13: Business value potential 10
Annex A:
Glossary and abbreviations
Table of contents

1 Glossary .................................................. 60
2 Abbreviations .......................................... 64
3 Process diagram legend .............................. 65
## 1 Glossary

<table>
<thead>
<tr>
<th>English</th>
<th>English definition</th>
<th>Deutsch</th>
<th>Definition deutsch</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>activity</td>
<td>A component of work performed during the course of a project.</td>
<td>Aufgabe (PMI: Vorgang)</td>
<td>Ein Komponente der Arbeiten, die im Verlaufe eines Projektes durchgeführt werden muss.</td>
<td>PMBoK®</td>
</tr>
<tr>
<td>activity list</td>
<td>A documented tabulation of activities that shows the activity description, activity identifier, and a sufficiently detailed scope of work description so project team members understand what work is to be performed.</td>
<td>Aufgabenliste (PMI: Vorgangsliste)</td>
<td>Eine dokumentierte tabellarische Aufstellung von Aufgaben, die die Beschreibung der Aufgaben, die Aufgabenkennung sowie eine hinlänglich detaillierte Beschreibung von Art und Umfang der Arbeit beinhaltet, damit die Projektteammitglieder verstehen, welche Arbeit durchgeführt werden muss.</td>
<td>PMBoK®</td>
</tr>
<tr>
<td>application model</td>
<td>The CPM application model covers all the concrete elements of relevance for planning and controlling a CPM project. These elements are part of the project agreement and have to be adapted or set up to suit the current project framework.</td>
<td>Anwendungsmodell</td>
<td>Das Anwendungsmodell umfasst alle konkreten Elemente, die für die Planung und Steuerung eines CPM-Projektes benötigt werden. Sie sind Teil der Projektvereinbarung und müssen individuell an den jeweiligen Projektrahmen angepasst bzw. aufgesetzt werden</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td>base model</td>
<td>The reference model is made up of a base model and an application model. The base model contains the elements which remain constant, irrespective of the specific collaboration project in hand.</td>
<td>Basismodell</td>
<td>Referenzmodell setzt sich zusammen aus Basismodell und Anwendungsmodell. Die Elemente des Basismodells sind immer gleich, unabhängig vom konkreten Collaboration Projekt.</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td>change request</td>
<td>Requests to expand or reduce the project scope, modify policies, processes, plans, or procedures, modify costs or budgets, or revise schedules. Requests for a change can be direct or indirect, externally or internally initiated, and legally or contractually mandated or optional. Only formally documented requested changes are processed and only approved change requests are implemented.</td>
<td>Anänderungsantrag</td>
<td>Anträge zur Erweiterung oder Verringerung des Projektinhalts und –umfangs, zur Änderung der Politik, Prozesse, Pläne oder Verfahren, zur Änderung von Kosten oder Modifizierung von Terminplänen. Anänderungsanträge können direkt oder indirekt, extern oder intern initiiert werden und können gesetzlich oder vertraglich vorgeschrieben, aber auch optional sein. Nur formal dokumentierte beantragte Änderungen werden bearbeitet, und nur genehmigte werden implementiert.</td>
<td>PMBoK®</td>
</tr>
<tr>
<td>English</td>
<td>English definition</td>
<td>Deutsch</td>
<td>Definition deutsch</td>
<td>Ref.</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>---------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>checklist</td>
<td>Every gate (milestone) has a checklist. It contains an overview of the minimum</td>
<td>Checkliste</td>
<td>Zu jedem Gate (Meilenstein) gibt es eine Checkliste. Sie enthält eine Übersicht mit</td>
<td>VDA 4.3</td>
</tr>
<tr>
<td></td>
<td>requirements which must be satisfied to pass through a gate.</td>
<td></td>
<td>den Mindestvoraussetzungen, die zum Durchlaufen eines Gates (Meilensteins)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>erfüllt sein müssen.</td>
<td></td>
</tr>
<tr>
<td>communication</td>
<td>A process through which information is exchanged among persons using a common</td>
<td>Kommunikation</td>
<td>Ein Prozess, in dem Informationen zwischen Personen ausgetauscht werden, die ein</td>
<td>PMBoK</td>
</tr>
<tr>
<td></td>
<td>system of symbols, signs, or behaviors.</td>
<td></td>
<td>gemeinsames System aus Symbolen, Zeichen oder Verhaltensweisen verwenden.</td>
<td></td>
</tr>
<tr>
<td>communication matrix</td>
<td>The communication plan (see PMBoK) describes who receives what information</td>
<td>Kommunikationsmatrix</td>
<td>Der Kommunikationsplan (s. PMBoK) beschreibt, wer, wann, von wem welche Information</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td></td>
<td>is exchanged between the project partners within an interaction cycle.</td>
<td></td>
<td>in welcher Form erhält. Dazu gehört auch eine Beschreibung der Eskalationswege.</td>
<td></td>
</tr>
<tr>
<td>engineering deliverables</td>
<td>All engineering deliverables from the product development process (see Figure 2)</td>
<td>Technische Ergebnisse</td>
<td>Alle Engineering-Ergebnisse aus dem Produkt-Entstehungs-Prozess, die nicht dem</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td></td>
<td>that are not part of the project management process, but which have to be</td>
<td></td>
<td>Projektmanagement zuzuweisen sind, aber für die Überprüfung der Zielerreichung</td>
<td></td>
</tr>
<tr>
<td></td>
<td>available in order to check that the requirements for gates or</td>
<td></td>
<td>vorliegen müssen. Hier als „Black box“ angezeigt.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>synchronization points are fulfilled.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>In this document, they are seen as a black box.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>escalation</td>
<td>Interaction between roles of a higher level of decision competence. The persons</td>
<td>Eskalation</td>
<td>Interaktion zwischen Rollen der nächst höheren Verantwortungs-Ebene der beteiligten</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td></td>
<td>who are to be involved are planned in the escalation matrix.</td>
<td></td>
<td>Personen werden in der Eskalationsmatrix geplant.</td>
<td></td>
</tr>
<tr>
<td>gate (see also milestone)</td>
<td>Each gate serves as a standardized checkpoint for project-related control</td>
<td>Gate (siehe auch Meilenstein)</td>
<td>Standardisierter Checkpunkt für die projektbezogene Steuerung von Produzent-</td>
<td>VDA 4.3</td>
</tr>
<tr>
<td></td>
<td>for the product development process. Whether or not a gate is passed depends on</td>
<td></td>
<td>stehungsprozessen. Das Durchlaufen eines Gates ist von der Erfüllung der Mindestvo-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>whether the minimum conditions which have been listed in the checklist for each</td>
<td></td>
<td>raussetzungen abhängig, die in der Checkliste für das entsprechende Gate aufgeführt</td>
<td></td>
</tr>
<tr>
<td></td>
<td>relevant gate have been satisfied. Gate is used here as a synonym for quality</td>
<td></td>
<td>sind. Gute ist hier synonym zu quality gate, Meilenstein oder Meilensteingate.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>gate, milestone or milestone gate.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>handshake</td>
<td>Documented binding agreement</td>
<td>Handshake</td>
<td>Dokumentierte verbindlche Vereinbarung</td>
<td></td>
</tr>
<tr>
<td>information object</td>
<td>Information that has to be transferred between the project partners within an</td>
<td>Informationsinhalt</td>
<td>Informationen, die in Interaktionszyklen zwischen den Projektpartnern ausgetauscht</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td></td>
<td>interaction cycle.</td>
<td></td>
<td>wird.</td>
<td></td>
</tr>
<tr>
<td>interaction chain</td>
<td>List of all common milestones and synchronization points</td>
<td>Interaktionskette</td>
<td>Summe aller gemeinsam vereinbarten Meilensteine und Synchronisationspunkte.</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td>interaction plan</td>
<td>Subset of planned project paths of both partners and the common interaction chain.</td>
<td>Interaction plan</td>
<td>Summe aus den Planerischen Projektfadern beider Partner und der gemeinsamen</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Interaktionskette</td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>English definition</td>
<td>Deutsch</td>
<td>Definition deutsch</td>
<td>Ref.</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------</td>
<td>---------</td>
<td>--------------------</td>
<td>-----</td>
</tr>
<tr>
<td>interaction cycle (CPM Process)</td>
<td>An interaction cycle is started by an event/trigger and describes the sequence of activities necessary between partners to harmonize their project plans with respect to this point. The sequence of activities may be iterative.</td>
<td>Interaktionszyklus (CPM Prozess)</td>
<td>in Interaktionszyklus wird ausgelöst durch ein Ereignis/Auslöser und beschreibt den ggfl. mehrfach zu durchlaufenden Ablauf zwischen zwei Partnern, um ihre jeweiligen Projektplanungen in diesem Punkt abzugleichen.</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td>issue list</td>
<td>List of tasks to be performed by each partner as agreed between the partners.</td>
<td>Offene Liste</td>
<td>Liste aller Aufgaben für jeden Partner, die zwischen den Partnern vereinbart wurden.</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td>milestone</td>
<td>Within a project schedule, a milestone marks the completion of a work package or phase, typically marked by a high level event such as completion, endorsement or signing of a deliverable, document or a high level review meeting. Typically a milestone is associated with some sort of decision that outlines the future of a project. The CPM milestones are checkpoints that has been agreed on the interaction chain.</td>
<td>Meilenstein</td>
<td>In einem Projektterminplan sind die Meilensteine besondere Checkpunkte innerhalb der Bearbeitung der Aufgabenfelder dar. Bis zu einem Meilenstein sind die in den Checklisten dargestellten Aktivitäten abzuschließen. An diesem Checkpunkt werden die festgelegten Arbeitsergebnisse auf ihre Erfüllung überprüft. Die Ergebnisse sind Voraussetzung für die Freigabe der nachfolgenden Arbeiten. Die CPM Meilensteine sind Checkpunkte, die auf der Interaktionskette vereinbart wurden.</td>
<td>VDA 4.3</td>
</tr>
<tr>
<td>issues</td>
<td>Activities and/or actions to be taken care of that come up during the runtime of a project and/or in a project meeting. The issues will be tracked in the issue list.</td>
<td>Offene Punkte</td>
<td>Zu erledigende Aufgaben und/oder Maßnahmen, die sich im Laufe der Projektabwicklung und/oder aus Projektbesprechungen ergeben und in der Offenen Punktleiste festgehalten werden.</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td>planned project path</td>
<td>Sum of milestones and synchronization points from the internal project plan which are relevant for the cooperation with the partner.</td>
<td>Planerischer Projektverlauf</td>
<td>Summe der Meilensteine und Synchronisationspunkte aus dem internen Projektplan, die für die Zusammenarbeit mit dem Partner Relevanz haben.</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td>project</td>
<td>A project is a temporary endeavor undertaken to create a unique product, service, or result.</td>
<td>Projekt</td>
<td>Ein Projekt ist ein zeitlich begrenztes Vorhaben, zur Schaffung eines einmaligen Produktes, einer Dienstleistung oder eines Ergebnisses.</td>
<td>PMBoK®</td>
</tr>
<tr>
<td>product development process</td>
<td>A disciplined and defined set of tasks, steps, and phases that describe the normal means by which a company repetitively converts embryonic ideas into salable products or services.</td>
<td>Produkt-Entstehungs-Prozess</td>
<td>Definierte Anzahl von Aufgaben, Vorgängen und Phasen, welche das standardisierte Vorgehen bei der Entwicklung von marktfähigen Produkten oder Diensten beschreibt.</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td>English</td>
<td>English definition</td>
<td>Deutsch</td>
<td>Definition deutsch</td>
<td>Ref.</td>
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<td>------------------------</td>
<td>----------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>project management</td>
<td>Project Management is the application of knowledge, skill, tools and techniques to project activities to meet project requirements.</td>
<td>Projektmanagement</td>
<td>Projektkompetenz ist die Anwendung von Wissen, Fertigkeiten, Werkzeugen und Methoden auf Projektvorgänge, um die Projektanforderungen zu erfüllen.</td>
<td>PMBoK®</td>
</tr>
<tr>
<td>project schedule</td>
<td>The planned dates for performing schedule activities and planned dates for meeting schedule milestones.</td>
<td>Projektterminplan</td>
<td>Die geplanten Termine, um Vorgänge auszuführen und Meilensteine zu erreichen.</td>
<td>PMBoK®</td>
</tr>
<tr>
<td>role</td>
<td>Defined function to be performed by a member of a project team. The same team member can assume different roles.</td>
<td>Rolle</td>
<td>Eine definierte Funktion, die von einem Projektteammitglied auszuführen ist. Ein Teammitglied kann mehrere Rollen annehmen.</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td>synchronization point</td>
<td>Points within project reports or control points at which specific deliverables/knowledge must be available or at which a product must have achieved a certain level of maturity. If deficiencies are identified in individual processes, measures must be agreed to ensure that the objectives are nevertheless met.</td>
<td>Synchronisationspunkt</td>
<td>Projektberichts- bzw. Steuerungspunkte, an denen bestimmte Ergebnisse/Erkenntnisse vorliegen, bzw. Produktreifegrade erfüllt sein müssen. Für evtl. vorhandene Defizite einzelner Prozesse sind Maßnahmen zur Sicherstellung der Zielerreichung zu vereinbaren.</td>
<td>PSI 1-1</td>
</tr>
<tr>
<td>time management</td>
<td>Knowledge area that determines the activities required to create the project results and specifies their sequence. The project schedule is developed in accordance with the working hours or duration of the activities. Compliance with the schedule is monitored.</td>
<td>Zeit-/Terminmanagement</td>
<td>Zeit-/Terminmanagement ist der Bereich der Projektplanung, der die Aktivitäten zur Erstellung der Projektresultate bestimmt und deren Reihenfolge festlegt. Unter Berücksichtigung der Arbeitszeiten oder Dauer der Arbeiten wird der Projektterminplan erstellt. Die Einhaltung des Terminkonzepts wird überwacht.</td>
<td>PMBoK®</td>
</tr>
<tr>
<td>Trigger</td>
<td>A trigger is a defined event that initiates an interaction cycle. (CPM-Process)</td>
<td>Auslöser/Ereignis</td>
<td>Ein Ereignis ist ein definiertes Vorkommnis, das einen Interaktionszyklus auslöst. Es beschreibt das Eintreten eines bestimmten Zustands. (CPM-Prozess)</td>
<td>PSI 1-1</td>
</tr>
</tbody>
</table>

Notes on the “Reference” column:
The “Ref.” column indicates the source of the definition. The following are possible sources: from the PMBoK®; VDA 4.3 (from VDA Recommendation 4.3); PSI 1-1 (term defined while drafting this Recommendation).
In case of a specific collaboration project the Glossary needs to be extended with specific terms. Further readings are available in PMBoK® Guide.
2 Abbreviations

**AIAG**  
Automotive Industry Action Group

**APQP**  
Advanced Product Quality Planning

**CPM**  
Collaborative Project Management

**DIN**  
Deutsches Institut für Normung e.V.

**ECM**  
Engineering Change Management

**ISO**  
International Organization for Standardization

**IT**  
Information Technology

**OEM**  
Original Equipment Manufacturer

**PDM**  
Product Data Management

**PDP**  
Product Development Process

**PLM**  
Product Life Cycle Management

**PM**  
Project Management

**PMBOK® Guide**  
Project Management - Body of Knowledge (published by the PMI)

**PMI**  
Project Management Institute, Inc.

**PSI**  
ProSTEP iViP e.V.

**SE**  
Simultaneous Engineering

**VDA**  
Verband der Automobilindustrie e.V.
3 Process diagram legend

- **Role**
- **Trigger**
- **Information object**
- **Activity**
Annex B:
Scenarios in Collaboration Projects
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1 Scenarios in collaboration projects

The following sections describe a selection of possible scenarios for cross-enterprise collaboration between two partners in order to illustrate the use of this current Recommendation. There are, of course, further business cases in addition to the scenarios described here, but space does not allow these to be described in this document. The following scenarios were selected to act as examples:

- Partners of equal authority
- General contractor and customer
- Module/system supplier and customer
- Component supplier and customer

These scenarios are intended to represent the majority of collaborative ventures in the automotive industry. They make no claim to completeness. Instead, they are intended to illustrate possible types of interaction between two partners. It was also decided not to describe a scenario with a parts supplier and a customer, as the effects of collaborative project management are negligible in such a scenario.

The scenarios relate to a relationship between two partners. In practice, however, network structures will be found. However, since project management demands that each interface between different companies must be the subject of an agreement, it is recommended that the current Recommendation is employed at each of these interfaces. The resulting joint procedural model allows the current level of outlay for complex and time-consuming harmonization to be reduced considerably and also permits the effectiveness of the agreements to be significantly improved.

1.1 Partners of equal authority

1.1.1 Brief description

Two OEMs decide to develop a product jointly until it is ready for series production. As many of the OEMs’ components/modules as possible should be used in order to save development and production costs. General responsibility lies with neither of the partners; instead, such responsibility is shared equally wherever possible. This also results in common responsibility for geometrical and functional aspects. The responsibility for integration into production lies with each of the partners in order to allow the brand-specific attributes to be implemented in the vehicles.

Practical example:
The German car manufacturer A (CM-A) and the French car manufacturer B (CM-B) have decided to jointly develop a vehicle which meets the requirements of both the German and the French car markets. Both partners take care to use as many jointly developed parts as possible in order to keep the costs for this niche-market vehicle as low as possible and hence permit an attractive pricing policy which will allow it to penetrate a market already occupied by other brands. The brand-specific attributes such as specially designed headlights or radiator grilles are the responsibility of the individual manufacturers.
1.1.2 Assumptions/ terms of reference

Alongside a schedule for the project, the scope of deliverables has already been defined (e.g. in the form of specifications) as has the budget for this scope of deliverables. The foundation for a collaboration of this type is formed by the common interest in pressing forward a special development which will be successful on the market. Since the small quantity involved does not justify development by either of the individual parties, the tasks are shared by the partners involved.

Practical example continued:
CM-A and CM-B are planning the one-off vehicle project in order to launch a jointly developed sports coupé in order to recover lost market share in the relevant market. The vehicle project is designed to run for 5 years with each partner taking the primary responsibility for developing one module, with the individual strengths of each of the car manufacturers being exploited in this context.
1.1.3 Use of the CPM reference model

In the scenario described, the objective is to use the reference model which was established in the context of the CPM initiative fully and intensively, since it is to be employed across the entire product development process. The unusually long timeframe, the extended scope and the considerable complexity of the “product” demand considerably greater outlay, both in project management and in the complexity of the role distribution and the communication paths, which may even need to be distributed according to

- phases
- modules or components
- specific regional requirements.

The following procedure and sequence are suggested when setting up the project between the module supplier and the component supplier:

1) Definition of a communication matrix (see section 5.2.2 of the Recommendation) between the partners (headword: definition of roles, see section 4.4 of the Recommendation).
2) Definition of a common, uniform language (headword: glossary, see Annex A of the Recommendation).
3) Description of a planned project path (see section 4.1 of the Recommendation) between the partners involved (common milestones and synchronization points).
4) Description of the processes (see section 5.1 of the Recommendation), i.e. initiation, changes, escalation, enabling of milestones, enabling of synchronization points, closure of the development project.
5) Use or adaptation of existing templates/checklists (see section 5.2 of the Recommendation).
6) Definition of common documents to be maintained.

1.1.4 Benefits

Savings of at least 10% in terms of time and cost can be achieved by using those aspects of the CPM model described. These savings are the result of the frontloading described during project initiation, i.e. the communication matrix, interaction chain, templates/checklists and the glossary.

Ensuring the stability of regulated processes in the event of planned and unplanned events (e.g. escalation activities) can also result in optimization in terms of time and costs of at least 20%.

The reduction in change management which results from the functioning, regulated processes of the CPM model and appropriate communication means that savings of up to 35% in terms of costs and time can be achieved in this area.

---

1 Benefit Values are estimations from the experts involved in preparation of this recommendation.
1.2 General contractor and customer

1.2.1 Brief description

An OEM commissions a supplier as a general contractor in order to develop a module or system on their own responsibility. The OEM only controls progress of the project using predefined gateways. The series development of a derivative as handed over to the development service provider also includes responsibility for all functional and geometrical aspects and project control for the derivative. Responsibility for production-related aspects still lies with the customer, i.e. the OEM.

Practical example:
Car manufacturer A (CM-A) commissions a module supplier B (MS-B) to develop a vehicle derivative on the platform of the lead vehicle of a model already developed by the OEM. When development of the convertible has been completed, MS-B hands over the developed derivative to CM-A at a defined time. The latter then continues development until the vehicle is ready for series production and produces it. All the activities necessary up until this defined time are entirely in the responsibility of MS-B, i.e. in their role as general contractor.

1.2.2 Assumptions/terms of reference

Alongside a schedule for the project, the scope of deliverables has already been defined (e.g. in the form of specifications) as has the budget for this scope of deliverables. In addition, the customer has defined the scope of the lead vehicle which must be taken over by the general contractor.

Practical example continued:
The “Convertible” vehicle project of the car manufacturer CM-A is to be developed and made ready for series production within a period of 3 years. The front of the lead vehicle and further modules from the chassis and floor panel are to be taken over. During development of the convertible, various specifications made by CM-A have to be taken into account. Thus, for instance, the derivative must not exceed a given weight and must exceed all statutory safety requirements. In addition, it must be possible to open and close the top within 20 seconds.

1.2.3 Use of the CPM reference model

In the scenario described, the objective is to use the reference model fully and intensively, since it is to the employed across the entire product development process. The unusually long timeframe, the extended scope and the considerable complexity of the “product” demand considerably greater outlay, in project management also. The following procedure and sequence are suggested when setting up the project between the module supplier and the component supplier:

1) Definition of a communication matrix (see section 5.2.2 of the Recommendation) between the partners (headword: definition of roles, see section 4.4 of the Recommendation).
2) Definition of a common, uniform language (headword: glossary, see Annex A of the Recommendation).
3) Description of a planned project path (see section 4.1 of the Recommendation) between the partners involved (common milestones and synchronization points).
4) Description of the processes (see section 5.1 of the Recommendation), i.e. initiation, changes, escalation, enabling of milestones, enabling of synchronization points, closure of the development project.
5) Use or adaptation of existing templates/checklists (see section 5.2 of the Recommendation).
6) Definition of common documents to be maintained.
1.2.4 Benefits

Savings of at least 10% in terms of time and cost can be achieved by using those aspects of the CPM model described. These savings are the result of the frontloading described during project initiation, i.e. the communication matrix, interaction chain, templates/checklists and the glossary.

Ensuring the stability of regulated processes in the event of planned and unplanned events (e.g. escalation activities) can also result in optimization in terms of time and costs of at least 20%.

The reduction in change management which results from the functioning, regulated processes of the CPM model and appropriate communication means that savings of up to 35% in terms of costs and time can be achieved in this area.

1.3 Module/system supplier and customer

1.3.1 Brief description

A module/system supplier is commissioned by an OEM to supply a module/system. Furthermore, the OEM also prescribes a specific component supplier for the scope of deliverables to be provided by the module supplier, but does not commission this component supplier directly. Responsibility for all functional and geometrical aspects and project control for the entire system/module lie with the module supplier. Control of the component supplier is also the responsibility of the module supplier.

Practical example:

A module supplier of standard engines is to use an engine management unit from a particular component supplier as specified by the contracting OEM. The specification and scope of the component to be used are subject only to negotiations between the module supplier and the component supplier (although the specification comes from the OEM).

1.3.2 Assumptions/terms of reference

Alongside a schedule for the project, the scope of deliverables has already been defined (e.g. in the form of specifications) as has the budget for this scope of deliverables. The OEM prescribes the component supplier to be used. The module supplier has no influence over this decision.

Practical example continued:

The engine project has a planned duration of one year and module supplier A (MS-A) is to use an engine management unit from component supplier B (CS-B). The OEM has further stipulated that the engine management unit must not exceed a price of 500, as this is the maximum price that can be justified to the end customer if the unit has to be replaced during servicing. The specification available for the standard engine which is to be supplied (e.g. cubic capacity, performance, injection pressure, maximum power consumption of the engine management unit) must be adhered to and monitored by MS-A.
1.3.3 Use of the CPM reference model

In the scenario described, the reference model which was established in the context of the CPM initiative can be fully used. The following procedure and sequence are suggested when setting up the project between the module supplier and the component supplier:

1) Definition of a communication matrix (see section 5.2.2 of the Recommendation) between the partners (headword: definition of roles, see section 4.4 of the Recommendation).
2) Definition of a common, uniform language (headword: glossary, see Annex A of the Recommendation).
3) Description of a planned project path (see section 4.1 of the Recommendation) between the partners involved (common milestones and synchronization points).
4) Description of the processes (see section 5.1 of the Recommendation), i.e. initiation, changes, escalation, enabling of milestones, enabling of synchronization points, closure of the development project.
5) Use or adaptation of existing templates / checklists (see section 5.2 of the Recommendation).
6) Definition of common documents to be maintained.

1.3.4 Benefits

Savings of at least 10% in terms of time and cost can be achieved by using those aspects of the CPM model described. These savings are the result of the frontloading described during project initiation (empirical values).

Ensuring the stability of regulated processes in the event of planned and unplanned events (e.g. escalation activities) can also result in optimization in terms of time and costs of at least 15%.

The reduction in change management which results from the functioning, regulated processes of the CPM model and appropriate communication means that savings of up to 30% in terms of costs and time can be achieved in this area.

1.4 Component supplier and customer

1.4.1 Brief description

A component supplier is commissioned by a module/system supplier to provide a component for the system/module that is being manufactured. Responsibility for the correct functioning of the component itself lies with the component supplier. Responsibility for functional and geometrical aspects of the complete system to be supplied lies with the customer, i.e. the module or system supplier. The latter assumes overall responsibility for coordinating the project in terms of both technical issues and project management issues. The component supplier is informed of the activities they are expected to perform and the scope of deliverables and has no possibility of exerting any influence over these aspects.

Practical example:

A supplier of loudspeakers is to supply components for an entertainment system which is to be installed in a vehicle and has been commissioned from a system supplier. The loudspeaker supplier has no influence on the way in which the overall entertainment system is made up. They merely have to comply with the specification as received from the system supplier. The loudspeakers to be supplied are already part of the existing product portfolio, so that no further interaction is necessary.
1.4.2 Assumptions/terms of reference for the scenario

Alongside a schedule for the project, the scope of deliverables has already been defined (e.g., in the form of specifications) as has the budget for this scope of deliverables.

Practical example continued:
In a project lasting three months between the loudspeaker supplier A (LS-A) and the system supplier B (SS-B), LS-A is to provide loudspeakers for the new entertainment system being produced by SS-B. An individual combination of loudspeakers is put together on the basis of the existing standard products. The available budget of 1,000 for the loudspeaker components must not be exceeded. The components selected must meet the specifications (8 loudspeakers, 200 Watts max. output).

1.4.3 Use of the CPM reference model

Use of the CPM model is restricted to use of the communication matrix (see section 5.2.2 of the Recommendation) in order to clearly assign the tasks for this scenario. In addition, it is possible to stringently map fundamental questions such as

➡ Who has to deliver what and when?
➡ What happens if the component supplier does not deliver or delivers late?

using the planned project path discussed in the model (see section 4.1 of the Recommendation) and by describing the escalation process (see sections 4.2.3 / 5.1.4 of the Recommendation).

1.4.4 Benefits

On the basis of estimations by the ProSTEP CPM project group and experience across all phases of a project, savings in terms of costs and time in the region of less than 10% can be expected. These effects can be achieved as a result of

➡ clear communication,
➡ avoidance of problems as a result of defined processes and activities.
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1.1 References to other committees

The following other committees deal with the topic of collaboration or project management:

- **AIAG:** Automotive Project Management Guide
- **PMI (Project Management Institute):** including PMI Automotive Special Interest Group
- **GPM:**
  - Automotive PM
  - DIN-Norm 69901 Update
- **German Ministry of the Interior:** V-Model XT
- **ProSTEP iViP:** Collaborative Project Management (CPM)
- **University Osnabrück:** Comparative Market – Analysis of Project Management Systems
- **VDA-QMC:**
  - Electronic Communication supply chain; WG-QDX
  - Standard for the transmission of electronic quality data
  - Coverage the stage of maturity for new items in the supply chain
- **OEM committee:** VDA 4961 (Cooperation models und SE check list), VDA 4965 (Engineering Change Management), ...

*Figure 1: References to other committees*

1.2 References to standardization publications

- **VDA 4 Part 3:** Verband der Automobilindustrie e.V.: Sicherung der Qualität vor Serieneinsatz/ Teil 3: Projektplanung (Quality assurance prior to series deployment/ Part 3: Project planning); ISSN: 0943-9412 (German/ 1998)
- **VDA 4961/2** Cooperation models and SE checklist for the coordination of data logistics in SE projects; December 2001
- **DIN 69900 ff** – Project controlling; project network techniques; concepts (German/ 1987)
- **ISO 10006** – Quality management systems- Guidelines for quality management in projects (English/ 2003)