Deliverable DA1.4.1

Framework for the Establishment and Management Methodology

Work package – A1.4

Leading Partner: IPK / DFKI

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Version 1.0
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1 Summary

ATHENA project A1 focuses on providing Enterprise Modelling (EM) solutions to enable enterprises to act interoperable. To this end, A1 will deliver extendable languages comprehensive enough to express the different concepts, contents, functions, contexts and views necessary to represent both enterprises’ knowledge and enhanced platforms for developing, operating, reusing, managing and governing collaborative enterprises. Furthermore, methodologies are needed to apply these languages to model, operate, manage and govern all kinds of enterprises, as will be verified by the selected ATHENA test-cases. Besides languages and modelling methodologies approaches for establishment these concepts in collaborative enterprises are needed. According to the DoW, the objective of this work package is the development of an approach for “user-centric model driven collaborative enterprises”. The initial requirements of WP A1.2 are a basis for the development.

This Document will define a new approach for establishment of collaborative enterprises based on aspects of adaptability, maturity and participation.

The approach takes advantage of aspects of the Capability Maturity Model, already successfully applied to software engineering. They are applied for modelling of collaborative enterprises, in a safe and efficient mode, and independently from modelling methodologies or tools. Based on an Enterprise Interoperability Maturity Model (EIMM) assessment, companies will be guided to choose the right concepts for improving their capabilities, by taking into account actual market and enterprise challenges. The approach will also be used for planning and implementing new enterprise concepts in short and mid term perspectives. Here the integration of today missing aspects like organisational capabilities and skills will allow an easier and more sustainable application of EM.

A specification of a morphologic method box which will contain best practices for concepts of Role and Involvement, Qualification, Control and Information, Techniques and Tools as well as Procedures, will help enterprises to select their individual approaches for modelling in order to increase their capabilities for interoperability.

Use cases will indicate how existing modelling methods can be improved by applying the new approaches.
2 Introduction

In the last couple of years, enterprise modelling has become a very important success factor. Modelling is a matter of handling views and of balancing parameters and values calculated by engineers from different disciplines, who collaborate and come up with the best choice by mutual agreement. Nowadays, an enterprise has to be flexible and adaptable to new market situations, i.e. global markets and trade, alliances and business communities, new concepts of cooperation and collaboration, maturing technologies and standardization and new approaches to industrial computing. Enterprise models have the goal to reduce the complexity and give a representation of the structure, activities, processes, information, resources, people, behaviour, and goals of an enterprise and the dependencies between them. Especially for collaboration between enterprises enterprise models are helping to understand each other, to plan, implement and to support interaction.

Today, the user of enterprise models has to deal with several problems:

- First, too much time is needed to create a complete model, and, when finished, the developed model does not reflect the reality in a proper way anymore.
- Second, the models often don’t fit the users’ requirements, e.g. the model is not detailed enough or the level of formalization is not appropriate.
- Third, it is often not possible to use the modelling results to support the daily business of employees, because the users most of the time do not have the skills to read the models properly and to deduce the implications for their work.

Collaborative enterprises face additional problems when using the enterprise modelling and willing to interoperate seamlessly within a networked organisation. Enterprise modelling approach is different for each enterprise, depending on its current practices, systems, knowledge and culture. Thus, enterprises need to understand how to improve the way they use enterprise modelling in order to improve and leverage their capability and ability to interoperate, i.e. their current enterprise interoperability maturity and the path to improve it. However, the path to adopt an enterprise modelling approach towards interoperability is not obvious.

In the ATHENA WP 1.4, approaches will be elaborated in order to solve these problems.

One objective of the WP 1.4 is to deliver a framework that will enable companies, to get the greatest effect out of enterprise modelling based on the maturity of their organization.

After the maturity assessment, the important parameters which have impact on the enterprise model, design and implementation will be determined.

Taking into consideration the appropriate specification of the modelling parameters and the dependencies between these a methodology will be deduced. This methodology is based on five concepts (Role & Involvement Concept, Qualification Concept, Control & Communication Concept, Techniques & Tools Concept and Procedure) in order to meet the users’ modelling requirements.

The goal is to provide an Enterprise Modelling Approach that satisfies together the following conditions:

- Reduction of the time to adopt an Enterprise Modelling approach towards interoperability,
- Satisfaction of the users’ requirements concerning Enterprise Modelling (Enterprise Model with sufficient level of detail and level of formalization),
- Support of the daily business of employees especially for interaction between each other.

Another objective of the framework is to enable companies to evaluate their current enterprise interoperability maturity level. The framework will describe discrete levels of interoperability improvement based on the successive adoption of good enterprise modelling practices in the different enterprise dimensions (process, organisation, product, systems, etc.).
The requirements coming from WP A1.2 (WD.A1.2.1) partially reflect these problems and wishes of collaborative enterprises related to enterprise modelling (see enclosed table). These requirements are addressing problems of "normal" enterprises as well but for collaborative enterprise these issues are much more important in order allow fast and easy model driven collaboration.

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<td>EM should be easy to use and should demand a low level of resources for the definition of models</td>
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<td>L_38</td>
<td>Easy understandable and customized modelling process</td>
<td>EM should aim to an easy understandable and customized modelling process to be widely applicable</td>
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<td>L_39</td>
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In the next chapter the framework for establishment enterprise modelling will be introduced. The framework will support a new procedure for implementing enterprise modelling into collaborative companies. Based on the achievements for improving software development processes by using the CMM (capability maturity model); an adapted concept for maturity levels in the domain of enterprise modelling will be proposed.

In chapter four the services which have to be included into the MPCE are described.

In chapter five it is reviewed if and in which way the four steps of the framework improve real use cases scenarios in different industries.
3 Framework for the Establishment and Management Methodology

The objective of the framework in this chapter is to provide the user a recommendation how to deliver a model-based collaboration, concerning the different levels of collaboration and their optimisation. It shall provide an assistance in capturing the collaborative processes of the company with the support of one of several adequate modelling approaches. And further it shall support the selection of an adequate methodology into an enterprise model and establish this model in the company. This model shall assist to achieve an efficient operation and management of collaboration processes. Figure 1 gives a review on the whole framework.

Figure 1: Model-based collaboration maturity framework

It consists of four parts:

1) **Collaboration processes and Maturity**: The basis is given by the collaborative activities of the company (definition see in WD.A2.1.). In order to identify the correct project approach, the maturity assessment has to be performed. Using the maturity model for enterprise modelling that is described in the following section, the result of the first step is supposed to be the maturity level of the company for participating in a collaboration. The maturity level must focus on management issues as well as technological issues. Management must be aware that introducing collaborative EM technology will demand changes in their organization. It introduces an advanced form of knowledge management, and many new processes that must find responsible owners and groups of new and old categories of performers and participants.

---

**NOTE**: The wanted level of maturity in a given department for a given modelling task is not necessarily 4 or 5. The level of maturity depends on the specific As-Is situation and the strategic goals of a given organization.
2) **Deducing the Modelling Approach and the Methodology** This step contains the procedure how to deduce an adequate modelling approach and methodology depending on:

- the enterprise task
- on the defined maturity level of the company
- the maturity level that is needed in order to participate to the collaboration process or to improve the collaboration processes.

In this part the modelling parameters have to be specified (e.g. the right level of granularity) as well as the support level of the Model Generated Workplace have to be determined.

3) **Modelling the Enterprise and Model Generated Workplace (MGWP) application**: The result of this part is an enterprise model that follows from applying the specific modelling approach and methodology from previous part. Based on the defined model the MGWP can be generated (resp. configured). The MGWP is an application that provides a model based flexible front-end for supporting the daily business of people in different roles in the enterprise, according to the collaboration processes (e.g. operating a process or manage and control a process).

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**NOTE:** Although the EIMM is part of the model-based collaboration maturity framework it can also be used separately to measure the maturity level.

This holistic framework includes two levels of implementation (Organisational and Collaboration Instance).

- **Organisational level**: The purpose is to improve the overall ability of the enterprise to interoperate with others. The approach is to apply the EIMM (Enterprise Interoperability Maturity Model) to assess the current status of the enterprise process areas and to define an improvement path that will raise the maturity of the enterprise for collaboration. When the enterprise reaches higher maturity levels, it is able to establish collaboration with external entities in a faster, more effective, and more efficient manner, and to make use of the full potential of enterprise modelling approaches.
- **Collaboration instance level**: The purpose is to define the adequate enterprise modelling approach to establish collaboration in a specific context. The approach is to characterise the collaboration, identify the model requirements based on that characterisation, and derive the appropriate enterprise modelling recommendations for that requirements.

The following table defines Purpose, Establishing Methodology Approach and Results for each level.

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<td>Define the best enterprise modelling approach to establish collaboration in a specific context</td>
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Table 1: Levels of implementation

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### 3.1 Application of the framework

The application of the framework is not limited neither to the branch of a company nor to their experience of using enterprise models in daily business.

In this subchapter two applications will be introduced.

The first one deals with the different situations a certain organisation is faced according to the application of enterprise modelling in order to improve capabilities and competitiveness in general. Here three types of EM users will explained and described how they can use the framework independent from the actual enterprise challenge, which have to be tackled.
For the second one, specific interoperability challenges for companies will be taken into account in order to explain how the establishment approach could be used.

3.1.1 Enterprise Situation for applying the establishment approach

In order to simplify the application of the framework we propose to categorize the organisational appliance area members into three groups. It allows each user to predefine criteria, based on his group’s specific requirements, for deducing the Modelling Approach and Methodology or exclude specifications. Moreover, it simplifies the identification of the supporting services in chapter 4. The allocation of the services has to take into account the fact that the different user groups may require different support by the MPCE. The integration of the Model-based collaboration maturity framework into the MPCE will be realised during the second period of the A1-project. The identified user groups are the following:

1) **Newcomer**: Users of this group do not have any or only minor experience of using models for supporting their daily business. Furthermore, in this group exists a kind of insecurity or scepticism how enterprise models could support and improve their work. The establishment framework will ensure a fast start for organising business according to the current business needs. The most important point is to spend less effort and resources to implement a first enterprise model in order to improve the business. The EIMM assessment as well as the deducing approach will support this kind of activities.

2) **Experienced Beginner and Advanced Modeller**: There are two main objectives of using models in this cluster. The Experienced Beginner use them as reference models either i.e. to describe specific procedures within the company or to illustrate organizational structures in order to have an overall master plan and to know what should be improved in the next periods. The deducing approach will give this company the right concepts for doing this in an efficient manner. The Advanced Modeller are well acquainted with applying enterprise models in their daily business. The EIMM assessment ensures sustainability of the model. The morphologic box which includes adapted partial concepts and methods will provide optimised tools for improving the business according to the model.

3) **Knowledge Capturer**: In this group the application of the framework aims on at gathering implicit knowledge that is hidden within the company. The idea is to use models to discover i.e. additional business areas for the company that could not be identified just by interviewing employees. The reason for this is that the employee are not aware of implicit knowledge.

The level of experience of a group contains their level specific know-how as well as the knowledge of the level below (c.f. Figure 2).

![Figure 2: Level of Experience of the user groups](image-url)
3.1.2 Specific Enterprise Challenges

The establishment approach is today defined in a very generic manner. This will allow the application of this concept for a lot of different purposes. This means the approach will become more important when adopting special needs. In the following some specific items for deriving the approach are explained:

- **Interoperability Assessment (IAS)** for Supplier or Supplier Network Participants: As already announced, as a possible service of the EIC, the IAS can be derived from the EIMM assessment. A lot of suppliers (especially in the automotive sector) are challenged by serving to a multitude of OEM’s, because of different specifications in terms of processes, IT-systems, documents and organisation. Today, even mid sized companies don’t know how to serve a second customer. Here, an interoperability assessment including specific items for the sectors can really help to identify risks and gaps. On the other hand an adapted deducing approach would help these companies in order to increase their capabilities for collaboration.

- **Implementing Industrial Reference Models**: For several sectors it exists a lot of already known and applied reference models which are defining frameworks, terms of reference and sometimes best practice approaches. The companies have to take into account these reference models in order to be compliant with business partners and to harmonise their processes and environments. For being compliant to these reference models companies need very deep definitions of their own business and have to change their processes and infrastructure. Here are some examples:
  - ITIL: IT infrastructure library – For IT Service Companies
  - eTOM: enhanced Telecom Operation Map – For Telecommunication Service Provider
  - SOX 404: Sarbanes-Oxley Act – For financial risk management and IT and enterprise governance – required for being listed in the stock exchange
  - S(V)COR: Supply (Value) Chain Operation Reference Model – For supplier as well as for OEM. S(V)COR defines terms and rules in supply chains

By applying the establishment approach companies can support the implementation of such a reference model in a controlled way. Therefore the EIMM should be adopted according to the specific needs. For the other elements of the entire establishment approach there is no change required.

- **Support for Certification**: A lot of reference models of the above explained challenge e.g. ITIL are a basis for several sector specific and sector independent certifications. As well there are some overall certification specification like ISO 9000. For a certification according to a certain standard (like ISO 9000, ISO TS 16949, ITIL, CMII, etc.) today companies spend a lot of money on documentation and aligning their real processes, rules and structures according to the standards and specifications. The establishment framework will support the process of certification preparation and bring these activity inline with the overall business activities. The EIMM itself will be applicable for most of the standards in order to measure the company situation according to the specific standard requirements. Today many companies are forced to being conform with several standards. Here the establishment framework saves resources and money for enterprise management and governance.

NOTE: It is possible to use the EIMM detached from the framework but not vice versa. This means in order to get valid results it is necessary to run trough all four steps of the framework!

3.2 Procedure to apply the framework

To achieve the different levels of the framework the following procedure, consisting of 5 steps, has to be performed and will guide the user through the whole process. In order to ensure a useful result, we propose an iterative procedure to be able to tackle problems that have been introduced on a earlier step.

![Procedure to apply the framework](image_url)
Short description of each step:

1 Analyse As-Is Situation of the company
   • **Objective:** The main target of this step is the definition of the as-is maturity level of the company.
   • **Prerequisite:** To perform the Maturity Assessment it is necessary to know the targets of the project.
   • **Result(s):** The output of this step is the definition of the actual maturity profile of the company.
   • **Needed services:** The support of this step from the Collaborative Modelling Platform (WP A1.5) can be an environment to choose and fulfil the maturity parameters in order to identify the maturity level automatically.

2 Deduce To-Be situation
   • **Objective:** At the end of this step the to-be maturity profile of the company must be defined.
   • **Prerequisite:** The as-is maturity profile is needed.
   • **Result(s):** The to-be maturity profile expressed in the corresponding values of the parameters.
   • **Needed services:** Environment to handle the new values of parameters.

3 Identify Gaps
   • **Objective:** The gaps between the As-Is and To-Be maturity profile must be defined.
   • **Prerequisite:** The defined as-is and to-be maturity levels.
   • **Result(s):** A list of rated and prioritised differences between as-is and to-be situation.
   • **Needed services:** An environment to handle the gaps analysis: choose, rate and prioritise.

4 Derive model requirements
   • **Objective:** Based on the defined gaps, the needed values of the parameters of the model-based collaboration have to be defined.
   • **Prerequisite:** Results of step 1-3
   • **Result(s):** In the end, the values of the parameters of the model-based collaboration should be clearly defined.
   • **Needed services:** A technique and an environment to deduce the values of the modelling parameters according the maturity gaps.

5 Derive the Target specific modelling approach
   • **Objective:** The adequate specific modelling methodology must be defined.
   • **Prerequisite:** A generic establishment framework. Rules for selection of components and customizing a specific establishment methodology.
   • **Result(s):** The user will receive a specific modelling approach that is based on his requirements.
   • **Needed services:** A technique and an environment for customizing a specific modelling approach.

3.3 Collaboration processes and Maturity Assessment by using the EIMM

Many customer groups, enterprises and user categories are not yet ready for the use and value harvesting that would be possible with EM facilitated working solutions. These are issues concerning i.e. the use of enterprise models, the level of competence and skill in performing corporate business, in communicating with suppliers, customers and other stakeholders, in using IT, in sharing their knowledge.

This section describes an approach to assess the maturity level of a company concerning the use of enterprise models as well as the capability of these models to enable the company to be part of a collaboration. The basic idea behind this approach is the CMM¹.

Within IT-development, there is a long tradition of classifying maturity of an organisation according to different levels. Usually maturity is judged based on how the work is performed, also known as process maturity. Processes allow to gather knowledge, recognize improvement opportunities, align practices to business objectives, and measure performance. However, processes are complemented with two other key elements: the people (with appropriate skills, training and motivation) and the tools and technology. In IT maturity models, processes are classified according to a scale of capability levels

¹ [http://www.sei.cmu.edu/cmm/](http://www.sei.cmu.edu/cmm/)
describing an evolutionary improvement path. An example of these kind of levels is illustrated in the following (Krogstie, 2000).

- Not recognized: This rating indicates that this process is either not performed or only partially performed even when it is acknowledged that it should.
- Ad Hoc: This rating indicates that the process is performed on a ‘memory basis’ each time.
- Repeatable: This rating indicates how consistently a unit has implemented the process. A ‘repeatable’ process is given when a function or task must be performed as a set of steps consistently used by the people involved in the process.
- Deployed: This rating indicates that the process has been formally documented, communicated and is consistently used across all affected organisational units.
- Metrics and Continuous Improvement: This rating indicates that a defined process is controlled using metrics and quantitative techniques. This means that the process has associated quantitative objectives and that their achievement is controlled and improved based on measured data. Process performance is measured based on process metrics which are used as the basis for continuous improvement.
- Business Results: This rating indicates that a process must not only be measured and improved, but the process and its measurements and improvements can be shown to contribute to the overall strategic goals and objectives of the organization. Additionally, innovation is also considered a key factor for process improvement.

Capability maturity models focus on different disciplines that an organization can address to improve its business. Focusing on the discipline of becoming a collaborative enterprise, the appropriate practices can be organized in an Enterprise Interoperability Maturity Model (EIMM). An EIMM would consist of best practices that address the establishment of mature collaborative enterprises through the improvement of enterprise modelling and operation in the various enterprise dimensions.

Defining an EIMM involves identifying:

- The main Areas of Concern on which an enterprise needs to work and improve in order to seamlessly interoperate with others.
- The maturity levels that describe the improvement path for each Area of Concern, so that the ability of the enterprise to collaborate with others improves once the Areas of Concern are on a higher maturity level.

When applying a maturity assessment for enterprise modelling, we need to examine indicators that allow to judge an organization’s relative ability to use approaches for representing enterprise knowledge within the organization to improve organizational and personal performance. The traditional way of achieving this ability is to use languages for enterprise modelling, i.e. structure the knowledge representation around graphical (typically two-dimensional) diagrams. Additionally, enterprise modelling practices need to be extended to approach interoperability, this is, to facilitate collaboration with others.

The following six Areas of Concern can be identified for an EIMM:

- **Business Strategy and Processes.** This Area of Concern covers the identification, specification, execution, improvement and alignment of business strategy and processes. For the purpose of interoperability, this includes and pursues the improvement of collaborative processes, for several units within the organization as well as for external entities.
- **Organisation and Competences.** This Area of Concern covers the identification, specification, enactment and improvement of the organizational structure, including the knowledge and skills of the identified players. For the purpose of interoperability, this includes the identification of external entities to collaborate with, the specification of the topology of a networked organization, and its deployment and improvement.
- **Products and Services.** This Area of Concern covers the identification, specification, design of the organisation’s products and services, its quality characteristics and the life-cycle strategy. For the purpose of interoperability, this includes the identification of new opportunities and specification of the same aspects for new products and services that make use of networked technologies for its delivery: e-Products and e-Services.
- **Systems and Technology.** This Area of Concern covers the identification, specification, design, construction/acquisition, operation, maintenance and improvement of enterprise systems. This includes the establishment of links and traceability to enterprise models, at best self-controlled. For the purpose of interoperability, this includes research and evolution of enterprise systems to apply innovative technologies that foster interoperability.
• **Legal Environment, Security and Trust.** This Area of Concern covers the identification of legal, security and trust requirements due to the collaboration with external entities, and the provision of solutions to manage these aspects which are a key for interoperability.

All of the previously identified Areas of Concern are directly affected by aspects of an all embracing sixth Area of Concern, which is:

• **Enterprise Modelling.** This Area of Concern covers the specification, construction, application and improvement of the enterprise models. This includes support activities such as the identification of appropriate meta-models and languages, methodologies, infrastructure, organization (people and skills), etc. for enterprise modelling. Additionally, it deals with the interoperability of enterprise models.

![Figure 4: Areas of Concern for the EIMM](image-url)

Using a five level\(^2\) maturity scale, the following maturity levels can be identified:

• **1 Performed:** Enterprise modelling and collaboration is done, but in an ad-hoc and chaotic manner. The organization collaborates with external entities (suppliers, administration, customers), but the relationships are not planned thoughtfully. Collaborative tasks and processes usually exceed budget and schedule, their past success (usually based on the people) cannot be repeated, and the potential of the technology is not used properly.

• **2 Modelled:** Enterprise modelling and collaboration is done in a similar way each time, the technique has been found applicable. Defined meta-models and approaches are applied, responsibilities are defined, people understand the enterprise model and know how to execute it, and network technologies are used to collaborate.

• **3 Integrated:** The enterprise modelling process has been formally documented, communicated and is consistently in use. The organisation uses a defined methodology and infrastructure for enterprise modelling, the different dimensions are integrated among themselves and the model is traceable to the enterprise systems, there is a knowledge base used to improve the models, and business collaboration is facilitated through interoperability technologies, use of standards, and externalisation of part of the enterprise models.

• **4 Interoperable:** Enterprise models support dynamic interoperability and adaptation to changes and evolution of external entities. The workplaces of the people are seamlessly adapted to the enterprise model. Results (for organizations and persons involved) and process metrics are defined as a basis for continuous improvement.

• **5 Optimising:** Enterprise models allow the organisation to react and adapt to changes in the business environment in an agile, flexible and responsive manner. Enterprise systems are systematically traced to enterprise models and innovative technologies are continuously researched and applied to improve interoperability. The use of enterprise modelling can contribute to reach the overall goals of the organization, unit, or persons involved.

\(^2\) Note that a level 0 does not exist. An organisation that does not fulfil the requirements for level 1 is considered to be immature with respect to collaborative enterprise modelling.
The EIMM defined as a set of Areas of Concern and a set of maturity levels provides the means to determine the current ability of an enterprise to collaborate with external entities and to specify the path to improve this ability. It provides an organisational context for more specific and technical improvements. As a third dimension, the EIMM takes into account the targeted organisational units for which a maturity level needs to be assessed, or which need to be improved, in order to achieve a certain maturity level.

<table>
<thead>
<tr>
<th>Areas of Concern</th>
<th>Target Units of Modelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Strategy &amp; Processes</td>
<td></td>
</tr>
<tr>
<td>Organisation &amp; Competences</td>
<td></td>
</tr>
<tr>
<td>Products &amp; Services</td>
<td></td>
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<tr>
<td>Systems &amp; Technology</td>
<td></td>
</tr>
<tr>
<td>Legal Environment, Security &amp; Trust</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 5: The three dimensions of the EIMM**

Each Area of Concern will be defined by a set of goals and objectives related to interoperability and collaboration issues. The level of interoperability and collaboration maturity for each Area of Concern will be defined by the presence or absence of maturity indicators. These are typical practices and work-documents, which have to be in place to achieve a determined maturity level. The specific goals and objectives of each Area of Concern, together with their indicators are described in the next section. In order to achieve a certain maturity level, each of the indicators needs to fulfil the threshold values or states that are specified for the respective maturity level. At the same time they illustrate the To-Be status that has to be realized if a company wants to reach the next maturity level.
3.3.1 The EIMM parameters

The parameters of the EIMM will be defined per Area of Concern, covering all five maturity levels, and following a common structure as outlined in Figure 6.

![Diagram of EIMM parameters]

Figure 6: Structure of EIMM parameters

Each Area of Concern is defined by a set of goals and objectives. The level of maturity that is reached in each of the Areas of Concern is assessed by examining a specific set of indicators which is related to each maturity level. The indicators basically consist of practices and work documents. The existence of the required work documents and the performance of required practices per maturity level allows to judge whether the respective maturity level has been achieved or not.

3.3.1.1 Enterprise Modelling

3.3.1.1.1 Goals & Objectives

1) The modelling techniques and technologies that are to be used in the organization will be specified and communicated. This includes the specification of the modelling languages, methodologies, tools and standards that have to be applied when modelling particular knowledge structures, which are part of the overall and holistic Enterprise Model.

2) Appropriate tools and tool support will be provided for all modelling languages, methodologies and standards that are used in the organization.

3) A configuration management system will be provided and responsibilities will be defined, in order to facilitate versioning of models and model elements. Further the system provides easy management of access and modification rights as well as model ownership.

4) The model and modelling requirements regarding the target field, scope, level of formalization, completeness and granularity for each Area of Concern will be defined and communicated in the organization.

5) Initial training on modelling techniques and tools will be provided to all employees and stakeholders involved in developing, maintaining or using the Enterprise Model or parts of it.

6) The holistic Enterprise Model of the organization, will be composed of the views, knowledge and solutions evolving from the different Areas of Concern and coherently and consistently reflect the correlation and attributes of the organization’s processes, products, resources and ICT infrastructure, and business relationships.
3.3.1.1.2 Indicators

In this chapter the maturity levels will be explained:

<table>
<thead>
<tr>
<th>Maturity Level</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Performed</td>
</tr>
<tr>
<td>Level 2</td>
<td>Modelled</td>
</tr>
<tr>
<td>Level 3</td>
<td>Integrated</td>
</tr>
<tr>
<td>Level 4</td>
<td>Interoperable</td>
</tr>
<tr>
<td>Level 5</td>
<td>Optimised</td>
</tr>
</tbody>
</table>

**Level 1**

1) **Practices**
   - Isolated and individual use of modelling techniques, applying low level modelling or graphical tools (e.g. MS Visio) mostly for the purpose of illustration.

2) **Work Products**
   - Schematic diagrams of processes, products, or organizational structures, primarily limited to the scope of a project or department.

**Level 2**

1) **Practices**
   - Definition of an expert group in the organization, which is responsible for identifying, understanding, defining, and divulging the standards, meta-models, methodologies and the infrastructure needed for specifying the basic Enterprise Model of the organization.
   - Provision of initial training on defined modelling techniques and tools to all employees involved in developing, maintaining, or using the Basic Enterprise Model or parts of it.
   - Definition of models that reflect the views, knowledge and solutions of the different enterprise domains and Areas of Concern.

2) **Work Products**
   - Standards, templates, meta-models and modelling tools for modelling the knowledge structures of the different domains and Areas of Concern.
   - Basic Enterprise Model (possibly not including all Areas of Concern and with a low level of formalization)
   - Training material on modelling tools and techniques
   - Knowledge and comprehension of the basic Enterprise Model of the organisation among all employees

**Level 3**

1) **Practices**
   - Formal documentation, dissemination and consistent usage of the enterprise modelling process and its associated artefacts, like meta-models, templates and tools.
   - Formal specification of the integrated Enterprise Model, covering all organizational domains and Areas of Concern and establishing traceability to the enterprise systems and ICT infrastructure.
   - Publication of parts of the enterprise model.
2) Work Products
   Modelling guidelines and directives
   (Exchangeable) Enterprise Model
   Definition of external interface(s) of the Enterprise Model.

Level 4

1) Practices
   Formalization of the integrated Enterprise Model to the semantic completeness level and
   execution perspective
   Definition and monitoring of (quantitative) model and modelling metrics (e.g. number of
   variants)
   Based on quantitative monitoring data the integrated Enterprise Model is continuously being
   updated to reflect the changes and evolution that take place in the business environment, to
   increase the efficiency of (business) processes and to improve its exchangeability and
   comprehensibility.

2) Work Products
   Metric definitions
   Metric monitoring reports
   Change requests/records for Enterprise Model (or parts of it)

Level 5

1) Practices
   Continuous observation and evaluation of emerging and innovative modelling techniques,
   technologies and methodologies, concerning their improvement potential and the
   appropriateness/feasibility to be included in the organization’s modelling directives and
   guidelines.
   Continuous monitoring of the effectiveness of the integrated Enterprise Model concerning its
   support for achieving the organization’s overall strategic goals & objectives.

2) Work Products
   Evaluation reports (EM languages, techniques, technologies, methodologies)
   Evaluation reports on the strategic alignment of the integrated Enterprise Model

3.3.1.2 Business Strategy & Processes

3.3.1.2.1 Goals & Objectives
   1) The organization’s strategy concerning business interoperability and collaboration, as well as
      electronic business and commerce, will be defined and communicated in the organization.
   2) The collaborative processes in the enterprise, network, community and global knowledge
      spaces will be formally specified and communicated in the organization.
   3) The collaborative processes will be quantitatively measured and continuously improved, in
      order to allow flexible and agile adaptation to changes in the business environment and to
      enhance their interoperability.

3.3.1.2.2 Indicators

Level 1

1) Practices
   Definition of collaborative processes on a per project/department basis, primarily concerning
   the Enterprise and Network knowledge space.

2) Work Products
   (Informal) definitions/descriptions of collaborative processes
   Definition of process interfaces (roles, responsibilities, in- and output) for a limited target field
   (project, department)
Level 2

1) Practices
   Definition of the collaboration and e-business/commerce strategy on a per project/department level and possibly but not necessarily covering all four knowledge spaces.

2) Work Products
   Strategy definition(s) for limited enterprise scope

Level 3

1) Practices
   Formal definition of the organization’s strategy concerning business interoperability and collaboration, as well as electronic business and commerce, covering all four knowledge spaces.
   Formal definition of all collaborative processes and their interfaces
   Formal specification of the business data that is to be exchanged with internal and external collaborators.
   Dissemination of strategy and collaborative process definition in the entire organization.

2) Work Products
   Formal enterprise strategy definition concerning interoperability and collaboration, electronic business and commerce
   Formal interface specifications (data, roles, responsibilities, etc.) of collaborative processes
   Awareness and comprehension of interoperability and collaboration business strategy by all employees

Level 4

1) Practices
   Definition of quantitative performance indicators associated with the collaborative processes
   Establishment of adequate control mechanisms and quantitative control of the performance indicators for collaborative processes
   In case of collaboration between different organizations, definition of a common approach for the specification of collaborative processes, with the objective to facilitate, coordinate and automate the exchange of business data.
   Definition of translation mechanisms (Ontology) for potential different modelling languages used in collaborating organizations.

2) Work Products
   Performance indicator specification
   Performance monitoring reports of collaborative processes
   Ontology definition (generic standard, domain specific, or collaboration specific)

Level 5

1) Practices
   Continuous alignment and adjustment of business strategy and collaborative processes, based on performance data.
   Dynamic adaptation of collaborative processes through feedback and improvement proposals by employees that are directly involved in definition and/or execution.

2) Work Products
   Performance analysis
   Objective/Performance matrices
   Adjusted strategy and/or process definitions
   Improvement proposals issued by employees
3.3.1.3 Organisation & Competences

3.3.1.3.1 Goals & Objectives
1) The technical resources needed to support collaborative processes and their interoperability will be defined and provided.
2) The skills concerning model knowledge and usage of all parties (including organization-external stakeholders) involved in defining, managing and executing collaborative processes will be assessed and monitored.
3) Training will be provided where needed, in order to ensure appropriate skill levels concerning model knowledge and usage among all stakeholders.
4) Incentive systems will be established which promote and help to ensure a high level of support throughout all employees and stakeholders who use and integrate enterprise models in their daily work practices.

3.3.1.3.2 Indicators

Level 1
1) Practices
Informal definition of responsibilities concerning definition, ownership, maintenance and execution of collaborative processes, primarily on a project/department scope
Individual and uncoordinated use of modelling tools for defining collaborative processes of limited scope (project/department level)
Uncoordinated and on demand transfer of modelling (and modelling tools) knowledge between peers

2) Work Products
Schematic diagrams of organizational structures, primarily limited to the scope of a project or department

Level 2
1) Practices
Analysis of interoperability requirements of the organization
Identification of external collaborating entities (other departments, other organizations) and their relation to the organizational structure (hierarchy).
Establishment of agreements on common business objectives with collaborating partners.
Definition of clear agreements of authorities for each role or job description with the objective to facilitate interoperability between them

2) Work Products
Interoperability requirements definition
Business agreements with collaborators
Responsibility profiles

Level 3
1) Practices
Definition of the operative structure (organizational functions, departments, etc.) of the networked, federated, or virtual organization
Definition of the governing structures and rules (policies, decision-taking rules, etc.) of the networked, federated, or virtual organization
Definition of the topology (e.g. supply chain, peer to peer, star, etc.) of the networked, federated, or virtual organization
Formal specification of the organizational structure, using the standard modelling methodology defined for the organization
Assessment and monitoring of employees’ skill levels concerning interoperability issues.
Definition and execution of a training plan aiming at establishing the required employee skill and competence level regarding interoperability issues (enterprise modelling, business collaboration, interoperability architectures, technologies and services, information security,
etc.)

2) Work Products
   Formal organization charts (structure, governance, topology)
   Skill database
   Training plan
   Training courses

**Level 4**

1) Practices
   Establishment of a common knowledge repository, which integrates knowledge structures of all federated, networked or collaboration partners
   Definition and monitoring of quantitative indicators (e.g. throughput between departments, training hours, number of employees with specific qualification, etc.) associated to the organizational structure and skill base.

2) Work Products
   Common repository of knowledge structures
   Performance indicator definition
   Performance indicator monitoring reports

**Level 5**

1) Practices
   Dynamic restructuring of the organization structure and/or topology, based on the analysis of performance indicator data, in order to address changes and/or new requirements in the business environment (this may include exclusion of partners or affiliation of new partners)

2) Work Products
   Analysis of performance indicator data

3.3.1.4 Products & Services

3.3.1.4.1 Goals & Objectives

1) All new products and services that make use of collaborative processes or networked technology for their design, production, or delivery will be formally defined and specified by using appropriate modelling techniques and technologies.

2) The organization will continuously evaluate and integrate new and innovative practices and technologies, in order to facilitate the establishment and operation of electronic business relationships and trade channels.

3) The quality of the products and services will be continuously monitored, quantitatively controlled and improved, in order to adapt them to changing business needs, particularly those related to collaborative product and service design and engineering, and to electronic product and service delivery.

3.3.1.4.2 Indicators

**Level 1**

1) Practices
   Isolated offering of products or services via internet (without online payment facilities)
   Collaborative product or service development/delivery between intra-organizational departments

2) Work Products
   Web-based product or services portfolio
Level 2

1) Practices
   Identification of new market opportunities using networked technologies (i.e. internet)
   Realization of market analysis for e-products and e-services
   Product and services specification using standard modelling techniques of the organization
   Definition of processes for collaborative product and services design and development

2) Work Products
   E-market analysis
   Models of products and services
   Process models of collaborative product and service design and development

Level 3

1) Practices
   Formal specification of all products and services using the standard modelling technique of the organization
   Formal specification of all collaborative product and service design and development processes, both between organization-internal and external entities
   Automatic and online accounting for all electronically delivered products and services

2) Work Products
   Formal models of all products and services
   Formal process models for all collaboratively designed and/or developed products and services
   Web shop

Level 4

1) Practices
   Definition of quantitative quality indicators for all collaboratively designed and/or developed, or electronically delivered products and services
   Quantitative quality control of all collaboratively designed and/or developed, or electronically delivered products and services
   Integration of new e-business practices with corporate applications (e.g. order tracking)

2) Work Products
   Product and services quality indicators definition
   Product and services quality assessment records

Level 5

1) Practices
   Continuous improvement of product and services quality, based on the analysis of quantitative quality indicators.
   Continuous evaluation, identification and implementation of improvement opportunities for e-business, e-commerce and collaborative product and service design and development, based on the analysis of changes in the business environment and electronic marketplace (e.g. intelligent online marketing, customised product and services portfolio)

2) Work Products
   Quality analysis records
   Improvement proposals and plans
   Customer profiles
3.3.1.5 Systems & Technology

3.3.1.5.1 Goals & Objectives

1) The existing enterprise system architecture will be formally defined and specified using appropriate modelling techniques and technologies.

2) The requirements for enterprise systems and technologies regarding their support for collaboration and interoperability will be derived from the enterprise model and formally documented. Traceability of system requirements to the enterprise model and vice versa will be established.

3) A Collaboration and Interoperability Technology Council (CITC) will be established, which continuously evaluates the technical and economical risks and opportunities of emerging integrating and innovative technologies, that are suitable for improving the support for collaborative processes and enterprise interoperability, into the existing enterprise system architecture.

4) Based on the recommendations and directives of the CITC, an enterprise system architecture will be developed, which allows agile and flexible adaptation to changing business needs and environments.

3.3.1.5.2 Indicators

Level 1

1) Practices
Uncoordinated use of Information and Communication Technologies (ICT) for data and information exchange between organization-internal and external entities
Use of databases/repositories for shared data storage/retrieval on a per project/department level

2) Work Products
Phone, Fax, internet connections
e-mail accounts
Databases

Level 2

1) Practices
Identification and specification of the interoperability requirements for the organization’s ICT systems
Modelling of the existing ICT system infrastructure using the standard modelling technique of the organization
Standardised and coordinated use of basic network technologies for data and information exchange

2) Work Products
ICT system interoperability requirements specification
Model of the ICT system infrastructure

Level 3

1) Practices
Formal specification of the ICT systems infrastructure using the standard modelling technique of the organization
Establishment of an agile and flexible ICT system infrastructure using standardised and open interoperability technologies and paradigms (e.g. WS, SOA, MDA)
Integration of interoperability requirements derived from the overall EM of the organization into the existing ICT system infrastructure
Establishment of traceability of system requirements to EM and vice versa
Establishment of external access to specific interoperability services and functions, based on requirements derived from overall EM
2) Work Products
ICT systems interoperability requirements definition
PIM and PSM of the ICT systems infrastructure
Specification of externally accessible ICT systems interface(s)

Level 4

1) Practices
(Partial) Integration of federated, networked, or collaborating partner’s ICT system infrastructure
Definition of quantitative performance indicators for interoperability related ICT services and functions
Analysis of performance indicators for interoperability related ICT services and functions
Establishment and implementation of specific network technologies to support organization topology (e.g. VPN, P2P)

2) Work Products
Common knowledge repository
Distributed private (access restricted) network architecture
ICT systems performance indicator definition
ICT systems performance analysis records

Level 5

1) Practices
Establishment of a Collaboration and Interoperability Council, that continuously evaluates and recommends integration of innovative interoperability technologies into the existing ICT system infrastructure
Integration of innovative interoperability technologies and improvement of existing technologies based on performance analysis, with the objective to improve the organization’s real-time collaboration capabilities and its ability to rapidly adapt to changes in the business environment
Establishment of secure mechanisms for remote access, in order to allow access to work-related information for all employees, independent of the location and time-zone they are situated in.

2) Work Products
Technology evaluation reports
ICT systems infrastructure change recommendations and requests

3.3.1.6 Legal Environment, Security and Trust

3.3.1.6.1 Goals & Objectives
1) One or more information security policies will be defined and communicated among all stakeholders (organization-internal and –external). The information security policies will specify the level of information and data confidentiality/privacy, integrity, availability and accountability, for their particular field of application.
2) The legal and security requirements of the interoperability supporting technologies, the products and services delivered via network technologies, the electronic commerce and business channels and the networked organization structures will be analysed. Solutions to fulfil these requirements will be proposed and provided.
3) The organization will adopt a proactive risk prevention approach, based on the quantitative control and monitoring of security aspects and the enforcement of the defined security policies.
4) The establishment of trust relationships will be supported by means of digital identities and certifications, as well as by bilateral or multilateral inspections to ensure the security, dependability and competency of all stakeholders involved in a business relationship.
3.3.1.6.2 Indicators

**Level 1**

1) **Practices**
   Establishment of basic information access control mechanisms (account login)

2) **Work Products**
   - System user accounts
   - User rights definition

**Level 2**

1) **Practices**
   - Definition and application of the Information Security Management (ISM) policy of the organization
   - Definition of the privacy policy of the organization

2) **Work Products**
   - Firewalls, Intrusion detection, Anti Virus
   - Privacy Policy
   - ISM policy

**Level 3**

1) **Practices**
   - Security risk analysis and provision and application of security risk prevention practices
   - Analysis and fulfilment of regulatory laws and legislation applicable in the enterprise and network space and concerning e-business and e-commerce
   - Establishment of ISM policy enforcement on all operational and technical support levels
   - Integration in and support of ISM policy by ICT systems infrastructure

2) **Work Products**
   - Access control mechanisms (i.e. ICT systems infrastructure)
   - Legal requirements analysis
   - Integrated ISM policy support

**Level 4**

1) **Practices**
   - Definition of quantitative ISM policy enforcement indicators
   - Analysis and fulfilment of regulatory laws and legislation applicable in the community and global space and concerning e-business and e-commerce
   - Analysis of ISM policy enforcement indicators
   - Analysis and fulfilment of security requirements of all interoperability and collaboration services (e.g. Web Services)
   - Performance of bilateral and multilateral inspections with federated, networked and collaborating partners
   - Application of digital identities and certifications

2) **Work Products**
   - ISM policy enforcement indicators definition
   - Quantitative analysis of ISM indicators
   - Inspection reports
   - Digital identities and certifications
Level 5

1) Practices
Continuous analysis of ISM indicators and development of proactive risk prevention strategies.
Continuous analysis of regulatory laws and legislation applicable to the enterprise, network, community and global space and according adaptation of ISM policies.

2) Work Products
Risk and legal requirements analysis reports
Risk prevention strategies

3.3.2 Application of the EIMM

The Enterprise Interoperability Maturity Model (EIMM) aims to support the establishment of a systematic approach for introducing Enterprise Modelling (EM) in a twofold manner. It serves both: for obtaining a “snapshot” of the current level of readiness of an organization to interoperate and collaborate with others, and for developing a “roadmap” that helps to lead an organization to higher levels of interoperability and collaboration maturity when there is a perceived need for this.

3.3.2.1 Maturity Assessment

When used for assessing the maturity of an organization concerning interoperability and collaboration, the application of the EIMM leads to a set of maturity profiles which give a clear indication on the maturity levels of the assessed Areas of Concern and organizational units.

The EIMM as an assessment tool is a versatile instrument that allows to flexibly define the scope of a maturity assessment by selecting both, the Areas of Concern and the Organizational Units that are to be assessed. This allows to assess an entire organization over the full range of Areas of Concern, or, on the other end, to assess only a specific Area of Concern in a single organizational unit. While the first approach would lead to a general maturity level profile for the entire organization, the latter would result in a maturity level profile in a specific Area of Concern for a delimited division or department of the organization.

A maturity profile is produced by examining the indicators for each Area of Concern and maturity level that is in the scope of the assessment\(^3\). If all (or a reasonable majority) of the indicators related to a determined Area of Concern and maturity level can be verified, the respective maturity level for this Area of Concern is reached. The resulting maturity profile represents in its finest granularity the maturity of a specific Area of Concern (Profile per Area of Concern), Organizational Unit (Profile per Organizational Unit), or of all the Areas of Concern for the entire organization (Combined Profile). Furthermore, an aggregated level of maturity for any of the three types of profiles can be calculated by taking the lowest maturity level found in the profile (single cube in Figure 7) as the highest overall – or aggregated – maturity level.

The assessment results form the starting point for the introduction and establishment approach of using enterprise modelling as essential means for achieving progress in enterprise collaboration and interoperability. The resulting maturity profile, which depicts the As-Is situation of an organization, greatly facilitates the elaboration of a gap analysis with respect to a projected To-Be situation. The results of the gap analysis will then be used to define the focus of the modelling approach to be adopted, in order to achieve a user-centric, model-driven collaborative and interoperable organization.

Combined maturity profiles (ref. Figure 7) are best suited for analysing the To-Be situation of an entire organization, or as an entry criteria for potential federated, networked or collaboration partners. Specific maturity profiles per Area of Concern or per Organizational Unit on the other hand are likely to be used as means to verify that the projected progress has been achieved in determined areas, or to focus modelling efforts on a specific Area of Concern or Organizational Unit, respectively.

\(^3\) Note that the scope of an assessment might be limited to a specific subset of the maturity levels (e.g. only up to level 3) and/or the Areas of Concern.
Figure 7: Different possible sets of Maturity Profiles resulting from an EIMM assessment

3.3.2.2 Roadmap for Improvement

The EIMM can also be used as a roadmap that defines the necessary steps to reach higher levels of collaboration and interoperability maturity. When applying the EIMM in this manner it is possible to derive concrete actions to be performed from the goals, objectives and practices defined for each maturity level, in order to improve in a specific Area of Concern or in a particular Organizational Unit. This enables an organization to perform discreet improvement initiatives in delimited areas according to its financial and resource potential, or its needs and requirements concerning collaboration and interoperability.
3.4 Deducing the Modelling Approach and the Methodology

Based on the maturity assessment and the set of possible modelling parameters the modelling approach and the methodology will be determined. First the modelling parameters will be identified and based on that the mapping method for deriving specific parameters to define the specific concepts for modelling:

- Role & Involvement Concept,
- Qualification Concept,
- Control & Communication Concept,
- Techniques & Tools Concept and
- Procedure

will be explained.

3.4.1 Parameters of modelling collaborative enterprises

The different parameters of the model-based collaboration maturity framework describe the different aspects that have to be considered in order to get an appropriate result. The parameters take into account model specific as well as user specific issues.

The following sections define the proposed modelling parameters and their different specifications. The dependencies between the parameters are described in the following chapter.

3.4.1.1 Scoping Business Modelling

This parameter focuses on the level of the collaboration. Depending on this level the defined models have different scopes.

**Management Level:** Collaborations on this level only take place on a strategic level. This means that the involved partners only define common strategic goals which they want to achieve together but they do not define how to work together. The models only illustrate these strategic aspects.

**Process Level:** Collaborations on this level are characterized by the attempt of the partners to align their process with each other. This process adjustment only takes place on the model level. That means the models aren’t supported by IT, yet.

**IT Level:** Collaborations on this level aim for a holistic approach. The objective is the alignment of the processes for the different partners and the IT-support of all processes.

3.4.1.2 Level of Formalization

This parameter refers to the perspective of the model. The idea is to focus the different requirements for the model that can be deduced from the scope.

**Business Analyst Perspective:** No formalization required

**Process Perspective:** The model depicts the different dimensions (e.g. process-dimension, organisational dimension) of the collaboration. The required level is semi-formal and the designed models are preconditions for the IT-implementation on the third level.

**Execution Perspective:** High level of formalisation, the model is supposed to reflect the IT implementation supporting the collaboration.

3.4.1.3 Model Completeness

The dimension „Model Completeness“ aims at supporting the user to achieve an accurate visualisation of the interested aspects. It concerns the following three perspectives:

**Pragmatics:** The relationship between the object system and the user. The actual intentions of the user is captured by the model.

**Syntax:** The formal or structural interrelation of the model objects. The model is using the defined modelling language correctly.

**Semantics:** The relation between the model objects and the subject to which they apply. The model is valid and completely related to the goals of modelling.
3.4.1.4 Model Granularity

The dimension “Model Granularity” focuses on the level of detail of the collaboration that should be regarded. There has been made a differentiation between:

**Activity (similar words are: Function and Task):** The activity is regarded as the smallest part of a collaboration where the involved partners work together. On this level a resource allocation, e.g. human resources, IT-infrastructure should take place as well as the used and produced data and documents, input and output services etc.

**Work Process:** The work process describes the order and the dependencies between the activities. The allocation of resources etc. on this level is possible in the same way as on the activity-level. In contrast to the view of an activity, it is not the description of a singular activity that is of interest, but rather the purpose which a function serves within a process.

**Value Chain:** The Value Chain gives a top level view on a business process and describes the process by means of connected parts. Every part is an encapsulated unit representing a relevant and self-contained work process.

3.4.1.5 Dependencies between the Modelling Parameters

In order to define well specified parameters it is important to identify the relationships between them. Therefore, the objective of this section is to clarify dependencies that have to be taken into account. E.g. if the “Level of Granularity” is defined as “Value Chain” then the “Level of Formalization” cannot be “Execution Perspective”. The reason for this exclusion is the thought that the IT-based execution of functions implies a very detailed description. In contrast to this, the application of value chain diagrams aims at summarising functions or processes to a broader level to give a general overview.

On other hand the parameters are dependent on one driving parameter - “Scoping Business Modelling”. The values of the remaining parameters can be derived from this parameter.

The dependency of the parameters has three characteristics:

- necessary,
- possible, but not necessary and
- not possible.

The characteristic necessary describes the minimum request to fulfil the conditions of the main parameter.

If the conditions are fulfilled along with other parameter values, it means possible, but not necessary. Thereby additional effort can arise.

The characteristic not possible means that these parameter values do not fulfil the conditions of the main parameter.
In Figure 8 an overview of the dependencies between the parameters is given:

<table>
<thead>
<tr>
<th>Level of Formalization</th>
<th>Model Completeness</th>
<th>Model Granularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scoping Business Modelling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mgmt. Level</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Proc. Level</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>IT Level</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**Legende:**
- X necessary
- X possible, but not necessary
- X not possible

### 3.4.2 The structuring elements for the establishment methodology

The structuring elements, which are introduced here, serve the fulfilment of requirements of the establishment methodology. The adherence of these basic components should help to elaborate a (specific) proceeding to establish enterprise modelling. These principles are based on the requirements of the establishment methodology (see chapter 2 and Deliverable D2.3 Report on UEML (Needs and Requirements). UEML, Thematic Network - Contract n°: IST-2001-34229, 2003, www.ueml.org).

The following elements have to be taken into account to define the establishment methodology:

- Role & Involvement Concept,
- Qualification Concept,
- Control & Communication Concept,
- Techniques & Tools Concept and
- Procedure
3.4.2.1 Role & Involvement Concept

The establishment of enterprise modelling should be performed as a project in general. With help of the role concept the several roles in the project team are defined. According to the involvement concept the project team will be put together. In the role concept it must be indicated which functions every single role has and which capabilities and skills are required. By the specification of a role concept the Establishment Methodology becomes principally independent of the organization. With the instantiation of the Establishment Methodology separate roles are assigned to the employees of the enterprise. In the involvement concept is indicated, who mainly realises every single role: an executing employee, a managerial employee or an external expert. In order to include the process participants in the enterprise modelling the involvement concept has to be interdisciplinary and hierarchy spanning.

The role concept contains the following roles:
- Promoter,
- Project Manager,
- Multiplier,
- Model Administrator,
- Project Administrator,
- User,
- Coach and
- Moderator.

The task of the Promoter consists of strategic aims and settings of tasks on which the project team can orientate itself, to formulate and to support the project team.

The responsibility of the Project Manager is the general management of the project and, first of all, the time and costs controlling. Another task is the organisation of the communication within and about the project, its goals and results in the enterprise.

The Multipliers are the carrying members in the project. Their function is the generation and analysis of the enterprise model, the development of possible solutions according to the improvement potentials as well as the communication of the project within the enterprise. After some time the Multipliers will be acquainted with enterprise modelling and will take over the role of internal advisers.

Figure 9: Structuring elements for the Establishment Methodology

Among other things during the development of the Establishment Framework and its elements the concepts of the software engineering, i.e. "V-Modell XT®", are considered as well as concepts of the users involved in implementation and roll out of IT systems.

In the following the elements are described and a proposal for their specific design is made.
They have to combine expertise with the possibility of networking inside the enterprise. Thus they take up the knowledge and pass it into the enterprise and to the users.

The *Model Administrator* fulfills the task of the technical administration of the model.

The *Project Administrator* is responsible for a smooth organizational flow of the project, i.e. the coordination of the session appointments and the allocation of the infrastructure (e.g. session rooms and equipment).

The *Users* support the project in content and participate at the elaboration of the as-is-situation and analysis of the enterprise model. They are also involved in the determination of improvement potentials and elaboration of solutions.

The task of the *Coaches* consists in the identification and transfer of the necessary method knowledge.

The *Moderator* takes care of the modelling methodology, supervises the systematic and gives assistance to the modelling process.

According to the complexity of the modelling scope and the size of the enterprise the project team consists of two project managers and several multipliers. In addition, one of the *Multipliers* takes over the role of the *Model Administrator* and another fulfills the role of the *Project Administrator*. The external experts stand by the project team as an advisory capacity and take over the roles of the Coach and the Moderator. Some roles, e.g., those of the Model Administrator, can pass from one person to the other during the project. At the beginning of the project it may be useful that this role is performed by external experts and later on, after appropriate trainings, taken over by one or two project members, predominantly *Multipliers*.

In this way the enterprise has, after the first modelling project, a core team who is skilled and trained in enterprise modelling. This team may be a kind of internal consultant and owner of the enterprise model in following modelling projects. The relations of the roles between the organisational units are always specific and can only be indicated exemplary. However, it must be paid attention to the fact that all hierarchy levels and all departments are represented in the project team. A possible organisational role attribution is specified in the following table.

<table>
<thead>
<tr>
<th>Role</th>
<th>Organisational Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoter</td>
<td>leading staff member; highest management level</td>
</tr>
<tr>
<td>Project Manager</td>
<td>leading staff member; highest management level</td>
</tr>
<tr>
<td>Multiplier</td>
<td>executive staff member; highest or middle technical/executive level</td>
</tr>
<tr>
<td>Model Administrator</td>
<td>executive staff member; highest or middle technical/executive level</td>
</tr>
<tr>
<td>Project Administrator</td>
<td>executive staff member; highest or middle technical/executive level</td>
</tr>
<tr>
<td>User</td>
<td>whole staff</td>
</tr>
<tr>
<td>Coach</td>
<td>external expert</td>
</tr>
<tr>
<td>Moderator</td>
<td>external expert</td>
</tr>
</tbody>
</table>

Table 1: Table 2: Roles for the Establishment Methodology

### 3.4.2.2 Qualification Concept

In the *qualification concept*, tasks must be indicated for the analysis of the needs and to build-up the knowledge according to the scope of business modelling. The concept is derived from the demands of skills and knowledge of the involved person in the role concept. A main component of the qualification is an introduction to the process oriented point of view and a training in the modelling method selected for the project and the appropriate modelling tools. The target group for the training results from the role concept. The intensity of the training depends on the complexity of the selected modelling method and modelling tools, the motivation of the staff members as well as their willingness and ability to participate. Technical as well as group-dynamic aspects have to be considered during the
elaboration of the qualification concept. Further contents and arrangements, e.g. group development workshops may be planned and executed. The qualification concept is divided in two parts: basic qualification and special qualification.

The basic qualification contains intensive training, it is usually organized as a work shop. The aim is to train the project staff members in autonomous enterprise modelling. In the trainings the method and the proceeding of enterprise modelling are provided application-oriented. With the help of exercises experiences with the modelling tool are made. Important aspects of the qualification concept are the transfer of methods for model analysis as well as the identification, evaluation and prioritisation of improvement potentials to redesign the enterprise structure and processes. This knowledge forms the basis for the autonomous optimisation of the enterprise processes and empowers the employees in order to increase the efficiency of the processes and to elaborate well-founded solutions. Besides, the multipliers can be trained in how to apply enterprise models to special problem areas e.g.: model based determination of IT requirements, process oriented adaptation and adjustment of IT systems or how to support the financial controlling and cost accounting with an enterprise model.

The specific qualification is executed in several short and target-oriented trainings during the project. They are organised according to the feedback and the needs of the multipliers in the running modelling project. These trainings deal with detailed application of the modelling method and tools as well as the techniques of gathering the as-is-situation like interviews or methods how to elaborate solutions in a team. Recognizing the needs as well as a fast and point-exact knowledge transfer is an important task of the Coach and is an essential component of the qualification concept.

3.4.2.3 Control & Communication Concept

The control concept defines which deciding points or milestones the project has and who has the disciplinary decision-making authority and who has the decision-making authority about the contents. In the run-up to the development of the control concept, during the definition of the aim of the project, the influencing factors (like environmental factors and corporate culture as well as the EIMM level) and the size of the conflict potential must be considered according to the specific project goal. Principally the concept design should let the employees involved in the project determine the project goals themselves as well as review and decide on the intermediate results independently. The participation of all employees of an enterprise in the project might be desired, but is hard to realise. For this reason the decisions are still made by the project team but the ideas and proposals of the entire staff should be considered. The realization of this control concept must be based on an effective and efficient communication in the project. Therefore, in the communication concept should define how the information exchange is regulated in the project, which mechanisms are available and which tools are used. These information have impact on some elements of the techniques and tools concept, because the necessary communication tools must be available in time.

The management of the project takes place in two levels: on one hand related to time and costs and, on the other hand, related to the contents. The control concerning the contents of the project is realised by the project participants - multipliers. They schedule the proceeding, determine the work packages in the project and are responsible for the examination of the results according to the milestones.

As an initial task a target definition workshop with all project partners and the enterprise management is executed at the beginning of the project. In this workshop the aims of the project are adjusted and manifested. The results of this session serve as a guiding rule during the project and are relevant for the project management.

The communication in the project is based on the regular meetings on the spot as well as on the remote communication. So the coach is also available to the multipliers between the trainings and the sessions on the spot for questions concerning the modelling method, the tools and the proceeding. The coach and the moderator have access to the developed models and can give their hints individually when required and independently on the team sessions. Another element of the communication concept is the organization of the information flow between the project team and the users of the enterprise model – namely to the rest of staff. One of the possibilities is the publication of the modelling results and the contact data of the multipliers in a medium that is accessible for all users. The users should inform themselves at any time about the modelling contents and progress and they should give their feedback to the multipliers when required.
3.4.2.4 Techniques & Tools Concept

In the **techniques and tools concept** must be indicated which methods and tools in the respective activity are available and under which conditions they are used. This information has an impact on the qualification concept, because the project participants must be able, or must be enabled, to use the methods and tools that are necessary in the project. The core of the concept contains the modelling approach and the corresponding tools. The approach and the tools should be very easy to understand, used intuitively and be user-friendly. These qualities have a positive effect on the investments in time and thereby also on the costs of the qualification.

Several elements of the **techniques and tools concept** are used by different roles. The modelling approach and the tools are used, first of all, by Multipliers and external experts. E.g. a Web-Process-Assistant is provided for the users. The Web-Process-Assistant is based on the enterprise model and is user oriented and offers a view of the model adapted to their needs. With this view the users have the same information status as the multipliers and can take part in the modelling, by giving their feedback to the multipliers, without having special modelling know-how. The concept consists of tasks for the analysis of the situation and for the decision on the application of methods, techniques and tools. These decisions have impact on the duration and the expenses of the project. If the enterprise has already documented its processes, it has to be checked, how far this documentation is usable for the first enterprise model drafts. In the next step interviews with the process partners can be executed and the models can be specified and particularised. Instead of interviews a workshop can be executed in if the models are described sufficiently through the evaluation of the documents. As a rule a variably proportioned mix of the diverse methods is used according to the project phase. For example, at the beginning of the project the structure of the enterprise model can be build in a workshop, then the model is filled in on the basis of documents with contents and afterwards it will be specified and completed in the workshops or interview. To realize the communication concept the following tools can be used:

- In order to support the coaching a telephone hotline is established and has to be available during defined hours and is maintained for the duration of the project.
- A central e-mail account is installed to which all external experts have access. For the internal project members similar e-mail distribution functionalities have to be established. This can also be supported by a holistic collaborative project environment.
- For the exchange of big amounts of data an account on a FTP server has to be established for exchanging models.
- In case of using a central model repository on the user side, the external experts need access with special user rights.

3.4.2.5 Example Procedure for applying the Establishment Methodology

The **procedure** combines the above-mentioned concepts and contains an exact sequence of phases and descriptions of individual activities. In the description of the phases several concept elements should be specified and should be related to each other. The proceeding strategy of the establishment methodology is based on the phase model and contains the following phases:

1) Project and target definition,
2) Basic qualification and definition of the overall enterprise model architecture of the enterprise,
3) Description of the basic concepts and the overall enterprise model architecture and planning of work packages,
4) Coaching during the enterprise modelling,
5) Moderation of the enterprise modelling and
6) Implementation of the enterprise modelling.
7) Management of Improvement

In the following the phases are explained shortly.
1) Project and target definition, Ideally, 

the project and its target result from a continuous improvement process and is pushed by the employees. In this phase the project has to be defined and conformed to the strategy of the enterprise. The results of this work step have to be agreed objectives, a work plan and a designated project team. The important role of the enterprise management is to promote the project and its intention. Further external advisors may be involved to support the definition of the targets and promote the project. During this phase all employees are informed about the project and the project participants- multipliers – will act as direct contact persons and their contact data should be published.

2) Basic qualification and definition the overall enterprise model architecture of the enterprise

After the aims and the project team are determined, a workshop will take place to introduce the participants to the process oriented approach, the modelling approach and corresponding tools. Reference projects should be provided to explain the modelling approach. Based on this knowledge simple tasks are assigned to practise first practical applications. Further a common definition of an overall enterprise model according to the POP* meta model will be explained to ensure a common understanding of the basic structure of the enterprise and its top level processes. These results will provide a basis for the further course of the project. Project staff and enterprise management will create the overall enterprise model and the project management should use the main processes to plan the work packages according to the structure of the processes.

3) Description of the basic concepts and the overall enterprise model architecture and planning of work packages

In this phase the enterprise model created in phase 2 will be described more detailed and further principles of enterprise modelling will be provided. During these activities the participants will gain further experiences how to use the tool and the modelling procedure. In the second part of this phase the course of the project will be planned and the detailed model will be used to define responsibilities of the project members. Phase three can also be arranged in a workshop.

4) Coaching during the enterprise modelling

During this phase the multipliers are trained continuously and provided with comments on already existing models (Relevancy, Formalization, Completeness and Granularity) as well as on further modelling procedures. Learning by doing is the key-note of this phase and the coach will not be present all the time. Therefore communication rules should be determined and communication tools should be made available in order to answer arising questions promptly. At the same time regular meetings should be arranged to identify and if necessary satisfy the needs of the multipliers. If required, additional trainings e.g. in techniques of as-is analysis can be performed.

5) Moderation of the enterprise modelling

This stage includes regular project meetings of the entire project team, in which the work statuses are represented and adjusted as soon as the further planning is determined. The Coach takes over the role of the Moderator who does not "interfere" in the enterprise modelling, but if needed points out gaps, inconsistencies of the modelling or nonconformity in the work scheduling. The content-related representation and evaluation of the results is carried out by the members of the project staff. In these meetings the content-related progress of the project with its time and cost frame is synchronized. Based on these results the further procedure is planned among the team.
6) Implementation of the enterprise modelling

As soon as the enterprise model has reached specific maturity the results of the modelling are disseminated to the entire staff. If required, introducing trainings are carried out, with the aim to provide the results and to encourage of active responses. This phase needs specific tools which let form the communication of the modelling results quickly and efficiently and which do not have any specific requirements on the knowledge of the enterprise employees (e.g. Process Assistant).

7) Management of Improvement

The application of the Establishment Methodology is not supposed to be a unique process. This means that the company should always try to evaluate the different Areas of Concern and analyse if their actual level and the deduced tasks are still corresponding to the defined objectives. If not, it is necessary that the company redefines the different parts of the Establishment Methodology to guarantee its benefit. By doing so, the company will be able to follow a continuous improvement process.

If these phases are placed onto a time axis, they do not follow strictly one after another, but will overlap and run in parallel (Figure 10).

![Figure 10: Example procedure for applying the Establishment Methodology](image)

In general the elements of the establishment framework as well as the procedure model can have other specification. The establishment framework can therefore be represented as a morphologic box (Figure 11). With the help of this structure a suitable establishment concept can be formed according to the results of the maturity assessment and the modelling parameters.
### 3.4.3 Mapping method

This chapter explains the procedure how to determine an adequate modelling approach and a methodology depending on the current situation of the enterprise, the enterprise strategy as well as defined maturity level of the company and the maturity level that is needed on the modelling parameters in order to execute or to improve model based collaboration processes.

Enterprise modelling is an effective approach and can be used to solve different problems. To increase the efficiency and the effectiveness of the enterprise modelling, the modelling methodology must be derived systematically from the problem definition. In general the problem areas can be classified as follows:

- Challenges coming from outside
  - Strategic (e.g. Plan new business opportunities)
  - Operational (Do transition from current situation)
- Challenges coming from inside (EIMM Assessment)

An enterprise task is defined appropriate to these areas. This task gives requirements for the modelling. On the other hand, the general situation of the enterprise (EIMM Assessment) has a strong influence on the modelling. Both sources of impact must be considered for the definition of the modelling task. Besides, the modelling task is described with the help of the modelling parameters. The values of these parameters depend on the enterprise task as well as on the maturity of the enterprise. Afterwards based on the values of the modelling parameters and on the maturity of the enterprise the suited modelling approach for the establishment framework is customized. This procedure is represented in Figure 12.

---

**Figure 11: Establishment Framework as a Morphologic Box**
Challenges coming from Outside

- **Strategic**
  - e.g. Plan new business opportunities

- **Operational**
  - Do transition from current situation

Define Enterprise Task

Deduce Modelling Task / Parameter

Deduce Modelling Approach and Methodology

Challenges coming from Inside (EIMM Assessment)

### Areas of Concern

- Enterprise Modelling
- Business Strategy & Processes
- Organisation & Competences
- Products & Services
- Systems & Technology
- Legal Environment, Security and Trust

<table>
<thead>
<tr>
<th>Areas of Concern</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise Modelling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Strategy &amp; Processes</td>
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<tr>
<td>Organisation &amp; Competences</td>
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<td>Products &amp; Services</td>
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<td>Systems &amp; Technology</td>
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<tr>
<td>Legal Environment, Security</td>
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<tr>
<td>and Trust</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 12: Deducing of Modelling Approach and Methodology

The specific influences of the enterprise maturity which have an impact on the Modelling Task and on the Modelling Approach and Methodology result from the as-is maturity level as well as from the to-be maturity level. The influences of the as-is maturity level have to be considered in each modelling project. Whether the to-be maturity level plays a role, depends on the intention to change the maturity level of one or several areas of concern which should be planned in the enterprise task.

3.4.3.1 Definition of Enterprise Task

Based on the results of the EIMM Assessment and the momentary strategic and operational situation of the enterprise a problem definition takes place. Considering the problem definition, a description of the enterprise task is made which contains:

- the aims
- general conditions as for example time and costs restrictions as well as
- the conditions from the EIMM Maturity Level.

If this enterprise task can be solved with the help of enterprise modelling, requirements for the modelling task are derived from the description of the enterprise task (Figure 13).
An Enterprise Task contains:
- a goal / objectives
- basic conditions like time and costs
- conditions from the level of EIMM

Figure 13: Definition of Enterprise Task

3.4.3.2 Deducing of Modelling Task / Parameter

The modelling task is determined by the values of the modelling parameters. These values on one hand are determined by the requirements for the modelling task and, on the other hand by the maturity level of the enterprise.

If the requirements from the enterprise task and influences of the enterprise maturity are identified and are listed, the value of the driving modelling parameter "Scoping Business Modelling" (cp. Chapter 3.4.1.5) is determined for every requirement and every influence. As a next step the rating table is evaluated whereupon multiple strategies of prioritising can be applied (Figure 14). As a result the value of the modelling parameter "Scoping Business Modelling " must be fixed.

Then with the help of the parameter matrix (cp. chapter 3.4.1.5) the values of the remaining modelling parameters are derived. Thereby, the rule that only the relations with the restriction "possible" are considered (Figure 14) is applied. The results of this step are the values of all modelling parameters which are summarized in the Set of the Modelling Parameters. For example, if the parameter “Scoping Business Modelling” has the value “IT Level” the following values for remaining parameters arise from the dependence table inevitably:
- “Level of Formalization” is equal to “Execution Perspective”,
- “Model Completeness” has value “Semantic” and
- Model Granularity” is equal to “Activity”.

Figure 14: Evaluation of the rating table
3.4.3.3 Deduction of Modelling Approach and Methodology

In this step the elements of the Establishment Frameworks are configured. By the specification of roles, qualification and control measures, tools and communication rules in a modelling project will be described the modelling approach and methodology explicitly.

The customising of the Establishment Frameworks is executed on one hand according to the Modelling Parameters and, on the other hand, according to the results of the EIMM Assessment. For both cases own customising rules are defined.

During the customising according to the maturity level of the enterprise for each Area of Concern in EIMM and each level transition the relevant elements of the Establishment Framework must be defined. Also during the customising according to the Modelling Parameters for each Set of the Modelling Parameters the relevant elements of the Establishment Framework must be defined. Afterwards the several combinations are brought together. The result is a specific Establishment Methodology which is adapted to each enterprise task and the maturity level of the enterprise Figure 15.
Customising rules driven by EIMM Assessment

**Areas of Concern (EIMM)**

- Role B
- Role C
- Role D

**Areas of Concern (EIMM)**

- Training A
- Training C
- Training D

- Element B
- Element C
- Element D

- Tool A
- Tool C
- Tool D

**Specific Establishing Methodology**

- Phase 1
- Phase 2
- Phase ...
- Phase n

**Figure 15: Deduction of Modelling Approach and Methodology**

During the customising of the Establishment Framework and especially while bringing together the different configurations the following problems can appear and have to be solved in following research:

- Static dependence - the separate elements of the Establishment Framework may depend on each other (e.g. contents of the communication concept cause some parts of the tool concept).
- Dynamic dependence - the elements of the Establishment Framework may cause a different temporal succession of the phases in the Establishment Framework.

These dependences must be kept in mind during the customising and possible conflicts have to be solved.

The principle of the customising is the same for all rules: according to the general conditions (EIMM Assessment and Set of the Modelling Parameters) fitting instances of the generic Establishment Framework are selected. In the following the exemplary customising rules are described shortly.

During the customising according to the EIMM Areas of Concern specific instances of the elements of Establishment Framework have to be indicated for every area, for every element of the Establishment Framework and for every level transition. (Figure 16).

**The EIMM Areas of Concern**

- Enterprise Modelling
- Business Strategy & Processes
- Organisation & Competences Products & Services Systems & Technology Legal Environment, Security and Trust

**Establishing Framework**

- Role & Involvement Concept
- Qualification Concept
- Control & Communication Concept
- Techniques & Tools Concept

**Maturity Levels**

- Level 1 to Level 2
- Level 2 to Level 3
- Level 3 to Level 4
- Level 4 to Level 5

**Figure 16: Customising matrix driven by EIMM Assessment**

During the customising according to the values of the Modelling Parameters specific instances in the concepts of Establishment Framework have to be indicated for every Set of Parameters and for every element of the Establishment Framework. (Figure 17).
Figure 17: Customising matrix driven by Modelling Parameters

While merging the separate elements of the Establishment Framework the steps of the procedure are determined. The specific Establishment Methodology therefore results from the adaptation of the generic Establishment Framework. (Figure 18).

Figure 18: Specific Establishment Methodology (after Customising)
4 Services to be included into the MPCE

This chapter indicates possible services supporting the establishment approach in industry and public organizations. Particular emphasis is given to supporting the collaborative establishment process and the maturity assessment methods by applying the EIMM, as described in chapter 3.3

Ways of introducing EM, approaches, methodologies and services described are based on past experiences and the specifications of the MPCE. Once the MPCE is released (version 1.0 scheduled for June 2005) and we start gaining experiences with it and model-configured, user-composed application platforms, we anticipate that the content of this chapter can be improved and the services and platform levels be described in more concrete ways.

In the first step, we have identified services that support the EIMM part of the Establishment Framework as well generally for the different user groups:

1) Newcomer,
2) Experienced Beginner and Advanced Modeller and
3) Knowledge Capturer.

The services for the other parts (e.g. deducing modelling approach or morphologic box) will be defined in the next period of A1.4.

4.1 Services to support the EIMM

Applying the EIMM depends on enterprises and users engaging in collaborative processes to model the relevant aspect and views of the areas-of-concern, described in chapter 3. Also services to implement, apply and support the EIMM framework must include services to define maturity levels and aggregate, propagate and display maturity indicators for the involved user categories and distributed across all the areas of concern (c.f. Table 3). The services in Table 3 are not included in the DA.1.5.1

We foresee that the maturity indicators must be derived by inviting users to perform self-assessment of their own, their colleagues competences, and of their enterprise maturity in the areas-of-concern. Users must also be involved in the aggregation and adjustment of overall indicator values.

Applying the EIMM will require an own set of services for user-friendly introduction and usage by different user categories. The composition of these services is related to the levels of maturity defined in the EIMM. The purpose and ambition of the modelling and use of models will clearly decide the amount of work in modelling the right aspects and views of the defined areas-of-concern.

When considering these services we have to remember that different user categories will work with different service structures and platform levels.

<table>
<thead>
<tr>
<th>Service No.</th>
<th>Service</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIMM01</td>
<td>Modelling the EIMM framework</td>
<td>The Framework itself should be a model which can be adjusted according to the different specific applications (like introducing reference models)</td>
</tr>
<tr>
<td>EIMM02</td>
<td>Services to model and manage relevant areas-of-concern</td>
<td>Links to enterprise applications according to the tasks and standard processes. Should allow invoking external applications or Web Services.</td>
</tr>
<tr>
<td>EIMM03</td>
<td>Services for Maturity Assessment</td>
<td>Many of these services will have to support methods for self-assessment of maturity levels by individuals, teams and entire organizations (like checklists integrated into the framework model).</td>
</tr>
<tr>
<td>EIMM04</td>
<td>Services to manage and use maturity indicators</td>
<td>Maturity Indicators must be develop by personal assessment, by comparisons with other assessments and by balancing the assessment across the enterprise or business network.</td>
</tr>
</tbody>
</table>

Table 2. Table 3: Categories of services to implement, apply and support the EIMM framework and methods.

The EIMM bears some resemblance to enterprise benchmarking methodologies, and extending the EIMM to integrate benchmarking methods and services may be a future research challenge.
4.2 Services for user groups

4.2.1 Services to introduce EM with Newcomers

The most used way of introducing EM to newcomers is to start with what is called a Proof-of-Concept phase or step. This is normally offered at a fixed price and with no obligations for the customer, the newcomer, than to make competent people, information and data available for a modelling team involving some users and an IT person and a management team involving representatives from all parties. Keeping these two teams small and empowered is important for a successful outcome.

There are certain services that are always very important to provide. Among these we would include services for creating user views, services for model-generating workplaces, for information management, logistics development, and shared value views, and for model and view annotation and management.

Service to model the chosen Use-cases

These are traditional EM services and modelling capabilities to represent aspects and views of units or spaces of any enterprise. For more detail of the services available, see WD A1.1.2 (the updated Athena state-of-the-art report).

Services to perform Analyses

These are services covering some 17 known methods of qualitative and quantitative analysis, from “what-if” to single parameter, to impact, risk and process dry-runs.

Services to perform Model Comparison

Most users will want to compare their own models or sub-models to identify differences in both descriptive, functional, content and contextual aspects and views.

Table 4 summarizes the described services.

<table>
<thead>
<tr>
<th>Service No.</th>
<th>Service</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NewC01</td>
<td>Services for PoC modelling</td>
<td>Performing the use-case modelling for the PoC; see sub-section above.</td>
</tr>
<tr>
<td>NewC02</td>
<td>Services to model use-cases</td>
<td>This will often involve creating an defining UML diagrams and derived views as part of the model.</td>
</tr>
<tr>
<td>NewC03</td>
<td>Services to perform analyses</td>
<td>For checking model consistency: “what-if” analyses, and then there are some 16 other analyses methods.</td>
</tr>
<tr>
<td>NewC04</td>
<td>Services to compare models</td>
<td>Model comparison is very useful to find differences, spot changes, derive new knowledge and more.</td>
</tr>
</tbody>
</table>

Table 3. Table 4: Categories of services to perform successful Proof-of-Concept for Newcomers

4.2.2 Services to introduce EM with Experienced Beginner and Advanced Modeller

This section briefly mentions some of the most established reference models and any services to be supported from the MPCE or by enhanced platforms in order to implement the reference models within enterprises. There are two main categories of reference models:

• Models defining Approaches, that is knowledge about how to get started and build the adapted model, an example is an EA Planning Model.

• Models defining Methodologies, that is knowledge platforms for what domains of knowledge will be required to model the solution, and example is the DODAF EA Methodology Model.

Introduction and Establishing approaches and methodologies are themselves reference knowledge models representing reflective views for planning and operating solution delivery models. Hence their implementation may be supported by pre-packaged structures of services to be made available from the approach and methodology platform layer, the first layer above the MPCE.
Table 5 gives an overview about the services. Some of the services are already mentioned in Table 4. The reason for naming them again is that they support the user group Experienced, Beginner and Advanced Modeller in a different way.

<table>
<thead>
<tr>
<th>Service No.</th>
<th>Service</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBAM01</td>
<td>Services for generating views</td>
<td>Generating stakeholder views that need to be represented and automatically presented over the web.</td>
</tr>
<tr>
<td>EBAM02</td>
<td>Services to model use-cases</td>
<td>Capturing and representing all knowledge aspects and parameters</td>
</tr>
<tr>
<td>EBAM03</td>
<td>Services to perform analyses</td>
<td>Developing and expressing new knowledge views, also derived from model comparisons.</td>
</tr>
<tr>
<td>EBAM04</td>
<td>Services to compare models</td>
<td>Storing, configuring and reusing knowledge across the network</td>
</tr>
<tr>
<td>EBAM05</td>
<td>Services for data import/export</td>
<td>Importing and exporting data from legacy system and databases</td>
</tr>
<tr>
<td>EBAM06</td>
<td>Service for document production</td>
<td>Generating documentation according to standard templates, e.g. the AS 300 standard for the US military.</td>
</tr>
</tbody>
</table>

Table 4. Table 5: Categories of services to support Experienced Beginner and Advanced Modeller introduce and establish successful Reference Models

The service categories in the table above are all common to the Reference Model Use. In the next two years we will see a lot of work to develop and establish reference models. This section should be continuously updated. Another interesting effect is that the more reference models are developed and pushed in the markets the easier will the introduction and establishment of EM be.

4.2.3 Services to introduce EM with Knowledge Capturer

This is truly realizing the possibilities of creating dynamic and active views, that can only be shared and changed in proactive visual scenes. This involves putting pragmatic logic and not words at the foundation of ways of working and creating knowledge: Our perception of human knowledge representation is changing, and tacit knowledge can be increasingly externalised and shared.

At the moment, we have not defined specific services for this User Group. This is one of the major challenges for the next period of A1.
5 Use Cases

The establishment methodology as explained in the previous chapters is not completely new for the community. But it combines existing approaches for enterprise modelling with adapted achievements coming from the software development domain. So it exists only weak experiences by applying the new methodology in real enterprise modelling projects. In the following chapter already existing projects in establishment enterprise modelling will be introduced and it will be explained how the new methodology would improve the project itself and the possible results. In order to show that the methodology can be used independently from modelling languages and for a wide range of modelling objectives three different projects will be described. First in the projects are described how are they performed without the establishment methodology. Based on the experiences of the use case provider an estimation of potential benefits of the new methodology will be explained.

The following sub chapters contain three different Use Cases that show the different approaches of the partners to establish enterprise modelling at customers. In the last subchapter a conclusion of the possible benefits and the impact of the establishment methodology will be estimated according to the methodology elements:

- EIMM Assessment,
- Deducing Modelling Approach,
- Modelling Parameters as well
- Morphologic Box which including concepts

and the objectives of the establishment methodology:

- Reduce Duration of modelling,
- Reduce Cost for modelling,
- Improve Employee Involvement,
- Improve Sustainability and
- Improve usage for daily business.

5.1 USE CASE A: Automotive Sector: Supplier

5.1.1 Introduction

The Enterprise works as an independent subsidiary of a world wide acting automotive supplier. Because of their know how and their innovative behaviour the company is well known as a competent and skilful development partner for new technologies. The company delivers components to most of the famous car manufacturers in the world. The company produces single parts as well as complete components for the car interior and plays the corporate role as competence centre. The capacity is 100,000 units per day with more than 800 employees.

Because of the market development the company had to face an increase of the income by average 20% per year in the last decade. The consequences were also an increasing of complexity of enterprise structure and processes especially in order to manage the complexity by serving for different OEM at the same time. Here the capabilities for collaboration with the OEM should be improved.

5.1.2 Objective

In order to achieve more transparency of changes in the company it was decided to introduce an enterprise model. The model should be used in the daily work by the employees. An other application field should be the support of the preparation for the first certification according to the ISO/TS 16949. In order to have a living and beneficial quality management system the objective was to have a high acceptance of the approach by the employees. For this the IPK concept for participative enterprise modelling developed at IPK Berlin were chosen.

5.1.3 Establishment and Modelling Approach

For modelling the enterprise in the holistic way a core team with participants from all main processes and enterprise systems was established. In a first workshop the enterprise management decided together with the core team about the modelling objectives according to the strategic enterprise missions. After having a short introduction into IEM and MO²GO this team developed the model design concept (e.g. level of formalisation, how to externalise documents and organisation) based on the modelling and enterprise objectives. The design of the first top level model was also moderated and
coached by IPK. The moderation here was a very important part in order to achieve consensus between the different partners. Based on the top level model small teams were established which were responsible for designing the sub models. Every third week IPK organised workshops for refining, consolidation the model and updating the work plan. The company was trained in the methodology and the tool step by step. The models were accessible by all employees of the company via process assistant and model viewer. In parallel, the model was enriched to store all relevant data for including the quality management system as well the relevant aspects for the environmental management system.

On the other hand during the modelling activities a lot of problems and gaps were identified. Here by applying a weak point analysis approach these aspects were analysed, prioritised and in some cases immediately solved.

5.1.4 Results

After the project the

- Holistic enterprise model was implemented as the one common documentation of processes, organisation, product structure, documents and IT systems after 6 month project,
- Company was certified as the first subsidiary of the corporation according to ISO TS 16949 and ISO 14.000
- Company spend less resources for consultants
- And 1,5 years after the project the enterprise is still working with the model because it supports a lot of people (not only planning people) by their strategic and daily work
- The company is now able to support different OEM with alternative approaches for product development and supply chain concepts.

![Figure 19: Enterprise Model and Process Assistant](image)

5.1.5 Problems and Possible Parts of the Establishment Methodology which could be used

During the project IPK faced to different problems:

- Capability of the involved people for conceptualising the enterprise design was not clear
- Documentation was available but it was not clear how it is used in the daily real work and how formal the enterprise was working with
- It was sometimes not clear, how detailed the model had to be designed in order to get the right transparency. This was especially true for the more fuzzy processes in the enterprise and also in
relation to the organisation and IT systems. One example here is the product development process in which the logic aspects, rules and concepts were not clear for all participants.

- Weak systematic support for decision about the most important elements for establishment the model – related to the goals and capabilities of the enterprise. Sometimes there was a feeling that the team were focussing too much on modelling elements instead of solving obvious problems based on the first analysis.

For improvement the following elements of the establishment methodology can be used:

- EIMM Assessment – would lead to a better analysis of the enterprise situation and enterprise improvement areas in order to follow the objective to increase the capabilities for collaboration with different OEM. The assessment would lead to involve from the beginning the core team members more individual in terms of coaching.

- Deducing Modelling Approach – would lead to a better estimation of required resources and modelling achievements. On the other hand this will also support more rational decision about the right modelling concept. Based on the experiences of the project it can be estimated: By having this deducing approach we were able to save more than 2 person month for designing the product development process.

- Morphologic Box which includes alternative methods for modelling approaches and project steps – will lead to more opportunities for achieving the results. Very important is the fact that these alternative methods are often more adapted to the enterprise employees capabilities and skills. This could be a major element to encourage more people to apply enterprise modelling in the company.

5.2 USE CASE B: Coaching in the Automotive Sector

5.2.1 Introduction

The company is a world wide acting automotive enterprise and is well known for producing premium cars. The market development expects the company to adapt as fast as possible to new situations. These new situations refer to continuously changing customer expectations as well as new sales markets.

To deal with these new conditions the logistic management processes moves into centre stage.

5.2.2 Objectives

In order to adapt to new market situations as fast as possible the decision has been taken to align the planning as well as the logistic processes of the different divisions. The goals was here to realize an equal utilisation of the divisions, equal planning periods as well a coordinated communication with the suppliers. So, one of the major challenges was to analyse and improve the As-is-situation of the planning and logistic processes. In order to meet the requirements the DFKI was chosen to coach the employees of the company how to do this transformation process with ARIS.
5.2.3 Approach

To reach the defined goals, the coaching approach contained three main steps (cf. Figure 20):

![BPM-approach](image)

In the beginning the AS-IS-Processes had to be analysed. After the Business Process Analysis the As-Is-processes had to be modelled and in a third step optimised by using cause and effect diagrams.

1. **Business Process Analysis**

   First of all based on the defined objectives the identification of the main processes has to be identified. Afterwards the illustration of the procedures as well as the definition of relevant indicators for measuring the process capabilities had to be decided. The last part was the a standardised and paper based investigation of the processes in order to deduce the As-Is-situation. To gather the information we used standardised questionnaire as well as interviews with the employees. Besides that, we used already existing process descriptions.

2. **Business Process Modelling**

   The collected information have been modelled with the ARIS Toolset™. For modelling the process, three different levels were specified. For the core processes on top level value chain diagrams have been used. Each value chain function was described more in detail through assignments. The representation of the detailed procedures had been realised through Event-driven Process Chains (EPC) (cf. Figure 21).
On the EPC level, the performance indicators have been allocated to the different functions to enable the evaluation of the process performance. For the performance measurement, indicators like processing time or static wait time were chosen. The evaluation has been done by the ARIS Simulation component (cf. Figure 22). The simulation enabled the identification of the level of utilisation of e.g. the humans resources in the implemented application systems. Based on this data the designation of bottlenecks was possible.

Based on the results of the simulation and the defined goals the To-Be-processes have been deduced. The realisation of the improvement process has been done within a project. To assure the success of the project, a team was introduced to take the responsibility of the course of action. The team consisted of employees as well as DFKI-consultants.

In order to be able to identify the relations between indicators on the lowest level and the strategic objectives the cause and effects have been shown in a cause-and-effect-diagram (cf. Figure 23). This
integrated approach gave the company the possibility to see directly the results of process changes to the strategic objectives.

5.2.4 Improvements by applying the establishment approach

- The morphologic box will help to identify the relevant specification of the different structuring elements of the establishment framework faster depending on the initial enterprise situation and defined modelling parameters.
- The use of the proposed modelling parameters could speed up the process of figuring out the correct detailing of the parameter.
- Deducing the right level of maturity with the help of the EIMM would enable the consultants to concentrate on the most critical areas that have to be regarded in the first place.

5.3 USE CASE C: Metis Planning model

Metis is a modelling tool delivered by Troux Technologies (formerly called Computas) that is used by a large number of large organizations: US Government customers such as US Mint, Environmental Protection Agency, US Census, NOAA, Department of Defence, as well as privately held companies such as Boeing, EDS, NCR, State Farm etc.

This section describes how a planning model is used in conjunction with Metis EA projects.

5.3.1 Background

The main application of Metis is for Enterprise Architecture projects, and Metis has an IT Management (ITM) metamodel and template that defines hundreds of object and relationship types that are useful in such settings.

Metis is a “methodology independent” tool. This is both a strength and a weakness: It gives each individual customer the full freedom to choose a methodology to follow in the Enterprise Architecture project, but at the same time provides little guidance even by using the SGAMSIDOER approach developed by the METIS Company in 1993.
Some Metis customers have thought of this as a great strength, since they have their own EA methodology already. For these customers, all what was needed from the vendor was the necessary training resources on the Metis tool itself, and they themselves would control the process of establishment the EA project and running it.

For other customers, this has not been satisfactory. They have not had a mature EA framework already, or this framework has not dealt with issues such as project establishment, follow up and EA operational issues. Because of this, Troux has established the “EA Planning model” to help customers getting started, plan their work and get the EA projects running.

5.3.2 EA Planning Model

The Metis EA Planning Model consists of:

- A methodology for how to approach EA projects: What to gather from the stakeholders in the early phases, etc.
- A model structure in which to store all planning results and artefacts. This model also describes and document the methodology.
- A metamodel with some new constructs useful for planning and project follow up of EA initiatives.

5.3.2.1 The model

When opening the EA planning model, the Figure 25 is shown. This is the front page of the model, and links to four main aspects of the planning model (from left to right):

- A description of the methodology itself.
- Various utilities to use during the planning.
- A construction area in which gathered artefacts are stored and the progress of the planning is documented.
- Standardized reports that are useful in the planning phase of the project.
Welcome to the Enterprise Architecture Planning Model

This model is designed to help you through the steps necessary to create a complete and useful architecture for your enterprise and should be used in conjunction with help from a Computas consultant.

5.3.2.2 The process

Figure 26 shows the overall aspects of the methodology. Various inputs are collected from Enterprise Architecture stakeholders during workshops and interviews: Project goals, tasks, staffing, business questions, available data, risks etc. Each of these areas are documented in the model (construction area).
Figure 26 - EA planning methodology.

The output from the planning process is some EA findings, and EA model and a glossary as well as some recommendations for how to proceed with establishment of a durable EA that is maintained within the enterprise.

5.3.2.3 Choosing scope of the EA project

The main driver behind the EA project is a set of business questions that the stakeholders want answered. This can for example be: “Which organizational units are depending on Oracle databases, and what business functions would be affected if all Oracle databases were stopped?”. A collection of such questions if documented in Figure 27.

From the business questions, we can derive the needed information, and compare this with available data sources. By looking at the IT meta model, we figure out how to represent this data inside an EA model, and also if additional meta modelling is needed.

The business questions may also require special kinds of reporting, so having the data available is not enough in all cases. Such business questions are mapped to various IT governance service that can support them. The business questions are prioritised, and based on this and available data etc it is decided:

- Which data shall be imported into the Enterprise Architecture model
- Who owns the data
- Who maintains it
- How can the business questions be answered, and what type of reports are available
5.3.3 Improvements by applying the establishment approach

With this new methodology for how to establish an Enterprise Modelling initiative in enterprises, Troux can focus on its main business: To create the world’s best Enterprise Architecture tool instead of focusing on creating and documenting a planning methodology to help customers get started with their EA work. The following aspects of the establishment methodology will improve enterprise IT architecting by METIS:

- The morphologic box will contain best practice processes depending on the initial enterprise situation without inventing them / discovering them from scratch.
- EIMM Assessment – which is compliant to the CMM Assessment for software development would lead to faster identification of problematic process interoperability problems related to the already existing analysis (e.g. consequences of stopping ORACLE).
5.4 Use Case Conclusion

In the following Table 6 the possible impact of the Establishment Approach Elements are indicated related to the use cases. Obviously the EIMM assessment and the morphologic box seems to be most important. Whilst the complete morphologic box today not exists, the indication is a little weak. Nevertheless this indication shows the relevance of such kind of method box. On the other hand the existing EIMM assessment approach seems to be already very useful to be applied in an industrial environment. Because of the generality, the assessment could be enriched by several already existing sector specific assessments like for COBIT.

<table>
<thead>
<tr>
<th>Establishment Approach Element</th>
<th>Use Case A Automotive</th>
<th>Use Case B Coaching in the Automotive Sector OEM</th>
<th>Use Case C: Metis Planning model</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIMM Assessment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deducing the Modelling Approach and the Methodology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modelling Parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morphologic Box which including concepts</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:  - no enrichment;  - small enrichment  - strong enrichment

Table 5. Table 6 Elements of the Establishment Methodology to enrich already existing approaches

The EIMM assessment is on the one hand site new for enterprise modelling, so it needs more and more practical approval in the industry and for revising as well for maintenance. On the other hand such kind of assessments became in the past years more important, so companies are already experienced by executing similar activities. We expect here less barriers especially by taking into account to reduce effort by having coordinated assessments. By looking to the generic benefits of the establishment approach in Table 7 we estimated the relevance of the establishment approach according to the major requirements which are demanded for modelling to supporting collaborative enterprises:

- Reduce Modelling Time
- Reduce Costs for modelling
- Improve Employee Involvement
- Improve Sustainability
- Improve usage for daily business.

Based on the use cases the support for sustainable enterprise development is most beneficial. In the past this was a major critic against enterprise modelling from the practical point of view. But the approach is only small contributing for the topic of daily business support. Here in A1 we expect more impact of the model generated work places (MGWP) itself.
<table>
<thead>
<tr>
<th>Establishment Methodology Element</th>
<th>Benefits and Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reduce Modelling Time</td>
</tr>
<tr>
<td>EIMM Assessment</td>
<td>●</td>
</tr>
<tr>
<td>Deducing the Modelling Approach and the Methodology</td>
<td>●</td>
</tr>
<tr>
<td>Modelling Parameters</td>
<td>○</td>
</tr>
<tr>
<td>Morphologic Box which including concepts</td>
<td>○</td>
</tr>
</tbody>
</table>

Legend: ● – no relevance, ○ - small relevance, ● - strong relevance

Table 6. Table 7 Potential Benefit
6 Conclusion

The Framework for the Establishment and Management Methodology and their concepts that are elaborated in WP A1.4 and described in this deliverable (such as EIMM and Maturity Assessment, Deducing Modelling Approach with Modelling Parameters, Establishment Methodology and Mapping Method) has as goal the improved utilisation of enterprise modelling to enable the enterprises to have efficient collaboration with each other.

The application of this concepts allow the enterprises to:

- Create the enterprise models for improving the interoperability capabilities in short time with using a modelling approach that is adapted to the specific enterprise requirements;
- Keep the developed models alive and to use them to support the daily business of employees;
- Follow incremental and thus more controllable approaches for applying enterprise modelling in order to improve the business.

The usefulness and expedience of the concepts is validated in the use cases that based on the real industrial projects.

The use cases are showing that the establishment methodology is complementary to the existing tool and language specific approaches. However a first view may indicate to have an additional concept which leads to an increased complexity. But in fact this approach will reduce complexity because it:

- Limits the level of detail for each model according to purpose and enterprise capability and skills
- Provides easy applicable metrics for deducing the right approach
- Provides a solution for maturity assessment which is already successful used for software engineering and other application domains and will
- Guides through the jungle of approaches for enterprise modelling.

Admittedly the concepts of Framework for the Establishment and Management Methodology have to be extended in the context of specifying of their details. For example some issues are:

- Instantiation of the morphologic box with best practices and reference elements,
- Analysis of dependencies of the elements in the morphologic box and to elaborate the rules for solving the conflicts,
- Definition of customising rules in the mapping method according to the elements of the morphologic box.

An other important issue is to define the templates and rules for applying the approach for the Establishment and Management Methodology according to specific enterprise challenges. It means, that the EIMM parameters as well as the deducing methodology have to be extended according to the specific conditions of this challenges. The entire approach can be used for deriving general and specific services for the EIC.
7 References


Schekkerman, Jaap „How to survive in the jungle of enterprise architecture frameworks : creating or choosing an enterprise architecture framework“ ; Victoria, B.C. : Trafford, 2004.

8 Abbreviation and Glossary

CITC: “Collaboration and Interoperability Technology Council”

CMM: “Capability Maturity Model”

COBIT: “Control Objectives for Information and related Technology” have designed the product primarily as an educational resource for controls professionals. The IT Governance Institute and the sponsors make no claim that use of this product will assure a successful outcome.

CMMI: “Capability Maturity Model® Integration”

EIC: “Enterprise Interoperability Center” –founded by the ATHENA project

EIMM: (Enterprise Interoperability Maturity Model) is a Model that focuses on assessing the current status of the enterprise process areas and defines an improvement path that will raise the maturity of the enterprise for collaboration.

EIMM Improvement Plan: The set of practices that the organisation should implement to raise its maturity for collaboration.

EIMM Maturity Assessment: Using the EIMM. The result of the first step is supposed to be the maturity level of the company for participating in a collaboration. The maturity level must focus on the management issues as well as technological issues. Besides that the gaps that have to be filled up must be deducted.

eTOM: “enhanced Telecom Operation Map” is a business process framework to guide the development and management of key processes within a telecommunications service provider. It provides this guidance by offering a catalogue of industry standard names and descriptions, with scope at multiple hierarchical levels.

ICT: “Information and Communication Technologies”

ISM: “Information Security Management”

ISO 9000: The ISO 9000 family is primarily concerned with “quality management”. ISO 9000 has become an international reference for quality management requirements in business-to-business dealings.

ISO TS 16949: forms the requirements or the application of ISO 9001 for automotive production and relevant service part organizations.

ITIL: IT Infrastructure Library consists of 6 sets: Service Support; Service Delivery; Planning to Implement Service Management; ICT Infrastructure Management; Applications Management; The Business Perspective. Within these a variable number of very specific disciplines are described and adopted across the world as the standard for best practice in the provision of IT Service.

MDA: “Model Driven Architecture”

Model Generated Workplace (MGWP): Flexible front-end for supporting the daily business of different kind of roles in the enterprise.

P2P: “Peer to Peer”

Parameter of the Model-based collaboration: The different parameters of the model-based collaboration maturity framework describe the different parts that have to be considered in order to get an appropriate result (Scooping Business Modelling, Level of formalization, Model Completeness, Model Granularity, Competence, skills and attitudes).

Procedure for Model-based collaboration: 5 Steps procedure to derive a target specific methodology for an specific model-based collaboration.
SCOR: “Supply Chain Operation Reference Model” is a process reference model that has been developed and endorsed by the Supply-Chain Council as the cross-industry standard diagnostic tool for supply-chain management. SCOR enables users to address, improve, and communicate supply-chain management practices within and between all interested parties.

SOA: “Service Oriented Architecture”

SOX 404: “Sarbanes-Oxley Act” - Section 404, Internal Control Review and Auditor Attestation that requires public companies to thoroughly investigate and take responsibility for all of their internal operational and financial controls.

UEML: “Unified Enterprise Modelling Language”

VCOR: “Value Chain Operations Reference model” aggregates business applications and business processes to a higher level of abstraction. In this way, value chain integration enables coordination across departmental, organizational, and enterprise boundaries from an overall business-level perspective. VCOR is enhancing SCOR according by additional enterprise aspects (e.g. research)

VPN: “Virtual Private Network”

WS: “Web Services”