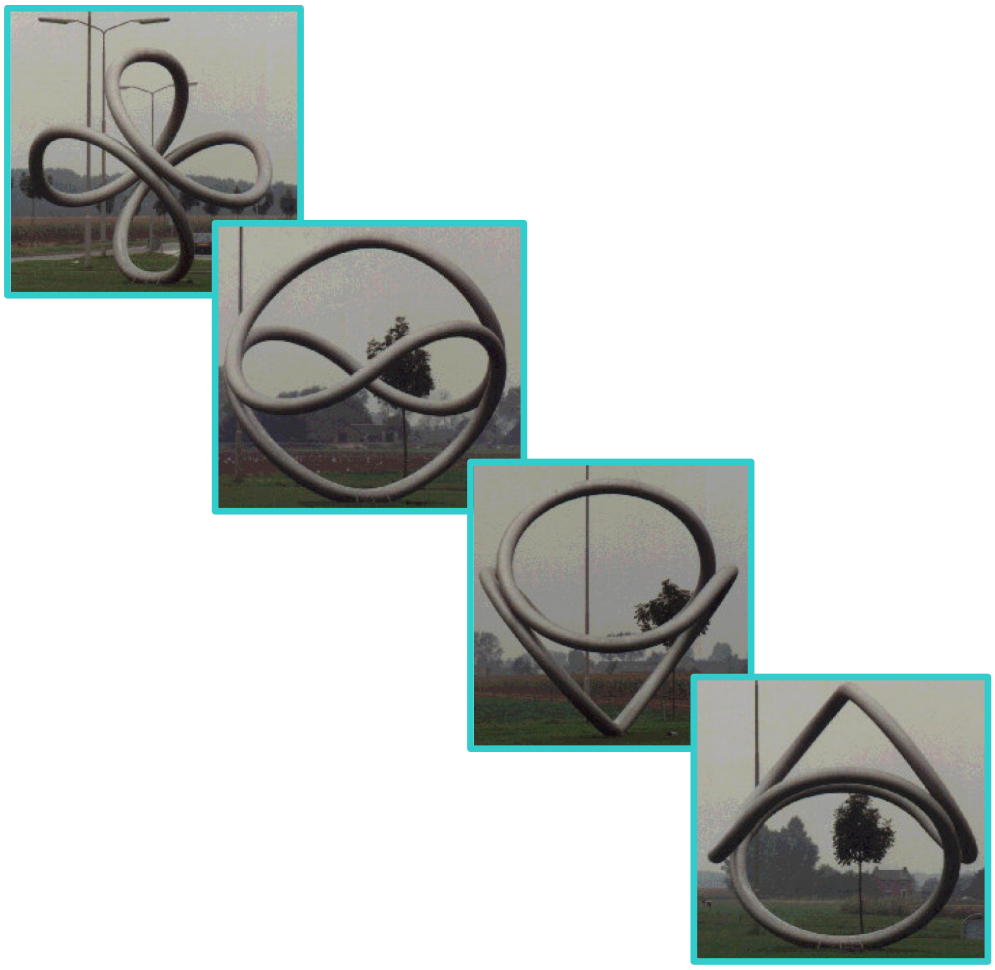
Framework for evaluating architecture modeling methods



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Summary

Businesses today face a wide range of issues that impede growth and profitability. Chief among them is the need for greater flexibility, driven by factors such as multi channel strategies, pressure to improve time to market, and the impact of mergers and de-mergers. At the same time, companies are striving for adaptive across-functional processes that can connect the silos created by ERP systems, while reducing unsupportable dependencies and costs. To overcome these challenges, business need to transform itself into a Service-Oriented Enterprise (SOE). An SOE creates business-driven value by defining and exposing its core business processes to, both the internal and external market, through the use of standardized open technology in the form of reusable services (Capgemini, 2006B). To transform an enterprise into an SOE it is necessary to identify and define those services that support in achieving the business goals. This is where Business architecture comes in.

To draw up a Business architecture, architects within Capgemini use the Integrated Architecture Framework (IAF). Modeling services call for a different mindset than modeling processes. The focus by modeling processes is to model (the sequence of) the end-to-end activities of one process and the sequence of multiple processes when processes are combined into a larger process. The focus by modeling services is to identify reusable services and to describe the output of a service. It does not focus on the way a service is realized.

This shift in mindset has its impact on modeling methods: the modeling method used to identify and define services has to be able to identify services and their relation (interaction). By using a modeling method which does not fully support this (because for instance it has a different objective), the quality of the model will reduce because not all necessary elements for identifying and describing services within Business architecture of the IAF will be covered.

In this research project I developed a framework for evaluating architecture modeling methods for their suitability for modeling services and applied it to three of the most frequently used methods within Capgemini by Business architects: DEMO (Dietz, 1999) and Business modeling Method for Information planning (BMI). The framework consists of criteria for modeling methods and a classification of these criteria. A complete overview of criteria including their classification is presented in *Appendix A: List of criteria*.

The criteria in the framework are based on literature study, a workshop with enterprise architects (Workshop, 2006), architecture training material form Capgemini and my own experience.

The framework consists of 5 groupings of criteria:

- Facilitating decision making. This process consists of the phases *Diagnose problem*, *Develop solution /Search* and *Selection*.
- Communication. For communication it is important to identify stakeholders and that communication is tuned to their specific interests and concerns. This part of the literature study also identified five dimensions of explicitness for representation of system development knowledge: *level of formality*, *level of quantifiability*, *level of executability*, *level of comprehensibility* and *level of completeness*.
- Artifacts of the Contextual Level of the IAF.
- Artifacts of the Business Conceptual Level of the IAF.
- Artifacts of the Business Logical level of the IAF.
- General criteria.

When the criteria are classified on the Seligman framework (Seligman et al., 1989) one may conclude that the *way of modeling* and *way of working* are the most important elements in the framework for modeling methods for SOE engagements. When the criteria classified as *way of working* are plotted on the Krogstie quality framework, it shows that the *Domain Appropriateness* quality aspect is the most important one followed by *Comprehensibility Appropriateness*.

For each modeling method two enterprise architects who applied the modeling method in SOE related engagements, were interviewed to score the method based on my framework. When looking at the scores of

each modeling method one might conclude that both methods can be applied for facilitating decision making and distinguishing the artifacts of the Business Conceptual Level of IAF. BMI and DEMO should not be used for distinguishing the artifacts of the Contextual and Business Logical level of IAF. DEMO is the best method for communication purposes to stakeholder while BMI should not be applied for communication purpose.

When the total score of the modeling methods are compared one sees that DEMO has the highest score (DEMO 55.5 versus BMI 24.5 points).

When looking at the detailed score of the modeling methods, one might conclude that, even though both methods can be applied for facilitating decision making, the weak point of them is determining the impact of scenarios on all relevant aspects (people, process, management and information) and that they do not provide enough input for simulation of the system being developed. In stead of BMI, DEMO can be extended to support these artifacts. Other differences between the modeling methods are that BMI has activities to divert the business mission objectives and to obtain business goals and DEMO doesn't and that DEMO supports an iterative way of working and BMI doesn't.

The results of the interviews indicated also that all modeling methods do not support all criteria of the framework. Out of 35 criteria BMI does not support 19 criteria and DEMO does not support 15 criteria. From these unsupported criteria DEMO can be extended more easily. When the modeling methods are extended BMI still does not support 12 criteria and DEMO 2 criteria. Based on this information I conclude that DEMO is the best of the evaluated modeling methods for modeling services during SOE related engagements since it scores significant higher than BMI on all groupings of criteria and it can be extended easily to support more criteria.

Also the modeling method Capability Mapping was scored. Since I could only find one architects who applied this modeling method during SOE related engagements and my own experience in this modeling method is also limited, I decided not include it in the conclusion of this thesis. The method scored promising though: a total of 90 points and it can be extended easily.

Preface

This paper is the result of a research project that was carried out for the final stage of the post academic master education “Architecture in the Digital World”. I started this master education at February 21, 2005. From that day on, I devoted a lot of my evenings and weekend to studying. After almost two years I can conclude that the study gave me everything I hoped for: it provided me with a valuable theoretical background and hands on training and it enabled me to give my career a boost.

For the topic of this research project I looked for a combination of literature study and something I could put into practice during my work as a Business and Information architect and also with added value to my employer and the architectural community in general. I think the outcome of this research project contributes to these goals: I evaluated three modeling methods for their suitability for modeling services in Service Oriented Enterprise related engagements and with the analyze framework I developed, architects can easily evaluate other modeling methods.

During the literature study I found several different definitions of a service. Because Capgemini uses the Integrated Architecture Framework I decided to use that definition of a service. I do realize that other definitions (like the one from OASIS) are slightly different, but I am convinced that with a few changes in my framework one can tune the framework to support their definition of a service.

One can not carry out a research project on its own. Therefore I would like to thank my supervisor prof. dr. H.A. Proper and my referent drs. H.M. Hendrickx for their reviews and information. I would also like to thank everyone who participated in the workshop and/or interviews: you provided me with a lot of useful information I could not do without.

At last, but not at least, I would like to thank my wife Christel who provided me with the support and motivation I needed. She gave me the confidence I needed at times and brought also the welcome distraction from the thesis. Furthermore, I would like to thank my parents, brother, other family, friends and fellow students for their support,

Jeroen Cloo

Duiven, January 2007

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1 Introduction

1.1 Problem area

Businesses today face a wide range of issues that impede growth and profitability. Chief among them is the need for greater flexibility, driven by factors such as multi channel strategies, pressure to improve time to market, and the impact of mergers and de-mergers. At the same time, companies are striving for adaptive across-functional processes that can connect the silos created by ERP systems, while reducing unsupportable dependencies and costs. To overcome these challenges, business need to transform itself into a Service-Oriented Enterprise (SOE). An SOE creates business-driven value by defining and exposing its core business processes to, both the internal and external market, through the use of standardized open technology in the form of reusable services (Capgemini, 2006B). In this research project I assume that a business has already identified the urge to transform into an SOE.

Within the Integrated Architecture Framework version 4 (IAF) a service is formulated as *something that describes an element of business behavior to achieve a specific business (sub) goal*. A service consists of things that need to be done (sequence of sub-activities) by a specific role (not necessarily 'people') to achieve a specific business (sub) goal. During the execution of the sub-activities, a service uses or consumes objects to achieve the (sub) goal. An object could, for instance, be information, machines or materials. Services work together to achieve all the business goals of the enterprise. A role is someone or something that is responsible for the execution of the activity.

By orchestrating services, business processes are set up. In order to be flexible, to easily change the orchestration of services, services need to be loosely coupled and the interfaces between services need to be standardized. The key difference between processes and services is that processes incorporate a sequence of activities and services don't. That's why SOE are able to adapt easily to changes in the environment: because their business processes are orchestrated out of loosely coupled and standardized reusable services, changing business processes can be achieved by only changing the orchestration of the services (or using new services) and not the services themselves. This means that people, computers or machines providing a service, do not have to work differently when the orchestration of services changes because of a change in the business process. Also new products can be developed by orchestrating new business processes out of existing services. This is the reason why an SOE is able to adapt faster and more easily to changes in the environment than a non SOE. This means a SOE has a competitive advantage over a non SOE.

To transform an enterprise into an SOE it is necessary to identify and define those services that support in achieving the business goals. This is where Business architecture comes in.

The objective of Business architecture is to identify the mission, vision and goals of an organization, to model the structure of an organization and her external relations and to describe value chains and the processes or services of an organization (Rijsenbrij et al., 2002). A Business architecture is a model of the current and/or future state of an organization. A model, in this research project, is an abstract representation of an object or system from a particular viewpoint (Wikipedia, 2006).

Architecture has several goals: to support the management in making decisions about the future and strategy of the organization, reduce complexity for (IT) managers, guarantee for quality, roadmap for realization and a way to communicate (Rijsenbrij et al., 2002). Because the transformation into an SOE is about the future and strategy of enterprises, the scope of this research project will be limited to that specific goal of architecture. By drawing up a Business architecture the necessary information (business goals, roles, activities and objects) is gathered to identify and define the services of an SOE.

To draw up a Business architecture, architects within Capgemini use the Integrated Architecture Framework. Because the IAF is independent of modeling methods, architects are free to use modeling methods they are familiar with (or are used by clients). Since there is no corporate modeling method prescribed, different modeling methods are used within Capgemini by Business architects.

The most frequently used methods within Capgemini are Capability Mapping, DEMO (Dietz, 1999) and Business modeling Method for Information planning (BMI).

A method, in this research project, is a codified series of steps taken to complete a certain task or to reach a certain objective (Wikipedia, 2006). For an architect a method is a 'toolbox' which he can use to fulfill the architecture engagement: to draw up the Business architecture.

Modeling services call for a different mindset than modeling processes: by processes the mechanism of the process is the key element (what does the process look like?), by services the key element is the deliverable of the service (what does the service deliver?) (Boer, de & Saaltink) and how services are orchestrated.

The focus by modeling processes is to model (the sequence of) the end-to-end activities of one process and the sequence of multiple processes when processes are combined into a larger process. During this type of modeling, the architect uses a white-box view.

The focus by modeling services is to identify reusable services and to describe the output of a service. It does not focus on the way a service is realized. During this type of modeling, the architect uses a black-box view.

This shift in mindset has its impact on modeling methods: the modeling method used to identify and define services has to be able to identify services and their relation (interaction). By using a modeling method which does not fully support this (because for instance it has a different objective), the quality of the model will reduce because not all necessary elements for identifying and describing services within Business and Information architecture of the IAF will be covered.

Since, in this research project, the goal of architecture is to facilitate in deciding about the future and strategy of an organization, applying an unsuitable method, might lead to a non optimal model. Based on a non optimal model, wrong decisions could be made. So using the most suitable modeling method will have benefit for both the architects (quality of their deliverables will improve) and clients (more value for money and optimal input for decision making).

A suitable method, in this research project, is a method which facilitates an architect in identifying and defining services and the relation between services so he is able to draw up an optimal Business architecture of the current and/or future state of an organization. The Business architecture can be used by a manager (e.g. CEO, CIO) to support in decision making about the organization of the enterprise.

For selecting the most suitable modeling method, criteria have to be defined before modeling methods can be validated for their suitability.

Based on interviews with four enterprise architects of Capgemini I conclude that architects tend to use the method they are most familiar with, regardless whether it is suitable for modeling services. The interviews and research project in the systems listed in *Appendix B: Search systems*, also proved that currently there are no criteria available to validate modeling methods for their suitability for modeling services and there is no evaluation available about the suitability of modeling methods used by Business architects for modeling services.

To be able to design high quality architectures for SOE modeling methods for Business architects need to be evaluated for their suitability in the context of SOE.

1.2 Problem statement

The aim of this research project it to contribute in selecting suitable modeling methods for Business architects and clients in modeling services during SOE engagements by evaluating different modeling methods currently applied by architects about their suitability of modeling services. Due to time limitations, the scope of this research project will be limited to modeling methods used by architects within my own organization: Capgemini.

1.3 Research question

In order to come to an increased understanding of the problem area, to indicate structure and find possible solutions I will define a number of questions. The main question for this research project is:

What is the suitability of modeling methods currently used within Capgemini by Business architects for modeling services during SOE engagements?

In order to answer this main question, the following sub questions are defined:

1. Which criteria for modeling methods are relevant for Business architects for modeling services during Service Oriented Enterprise engagements?

   Answering this question will provide me with a framework I can use to evaluate different modeling methods currently in use by Business architects within Capgemini.

   In order to develop this framework the following sub questions are defined:

   a. What are universal criteria for modeling methods?

      Answering this question will provide me with universal criteria for modeling methods.

   b. Which criteria are relevant criteria for modeling services?

      Answering this question will provide me with criteria for modeling services during SOE engagements.

2. What is the score on the analyze framework of the modeling methods DEMO, BMI and Capability Mapping?

   By answering this question I am able to able to answer the main question.

1.4 Research model and strategy

For this research project I used the following model:

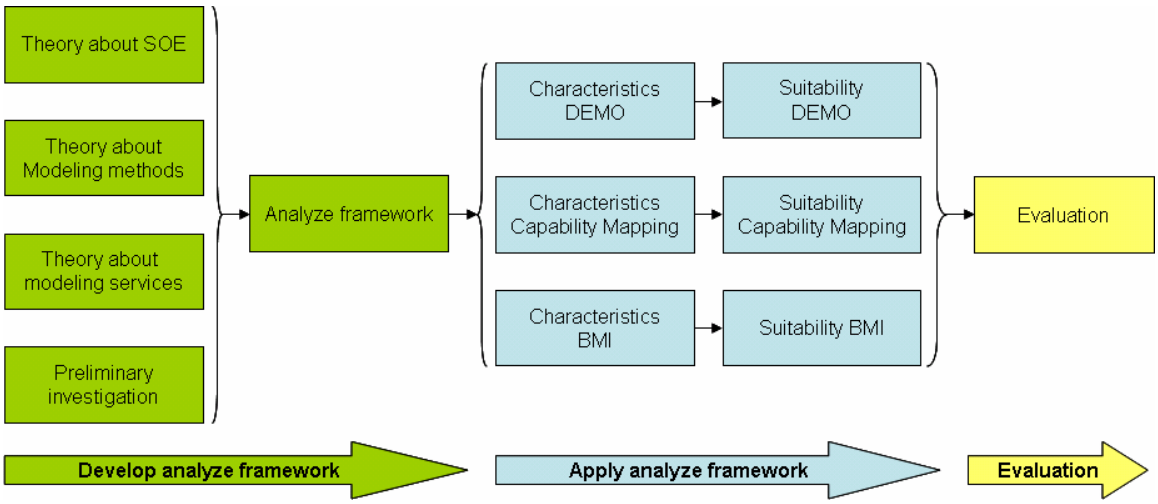

Figure 1: Research model

In order to evaluate the suitability of modeling methods currently used by Business architects within Capgemini, it was necessary to develop an analyze framework to determine the suitability of the modeling methods.

The analysis framework part of this research project resulted in a list of relevant criteria for modeling services. These criteria were then categorized into the different abstraction levels of IAF in scope since every abstraction level has a different objective.

For each criterion a definition, the objective and an explanation of the relevant of the criteria for modeling services are provided.

The criteria were drawn up by studying relevant theory about modeling methods and inviting one member of the community of practice ‘Methods’ within Capgemini for attending a workshop together with Business

architects. Specific criteria in the context of SOE were drawn up by studying relevant literature about SOE, Service Oriented Architecture (SOA) and modeling services and by inviting architects involved in SOE/SOA architecture engagements for a workshop (Workshop, 2006)

Once the analyze framework had been developed, the suitability of the modeling methods DEMO, Business modeling method for information planning (BMI) and Capability Mapping (CM) were analyzed by interviewing architects who have significant theoretical and practical knowledge of these modeling methods and applied them during SOE related engagements. By applying the framework, the framework itself was also validated.

1.5 Structure of the thesis

To develop a framework, theory about frameworks was studied. In Chapter 3 the foundation of my framework is presented: the framework for assessing modeling methods and principles for evaluating the quality of conceptual models are discussed.

In the following chapter the results of my literature study are discussed including the input from the enterprise architects involved in this research project. At first universal for modeling methods criteria are introduced by discussing the objective of a model in the context of this research project: decision making and communication. Then the architecture process of several architecture frameworks is discussed. At the end of that chapter the framework for evaluating modeling methods in the context of SOE is presented.

In the following chapter the framework is applied to the modeling methods Capability Mapping, DEMO and BMI. The final chapter covers the conclusion of this research project and recommendation for further research.

2 Theoretical background

In this chapter the theoretical background about frameworks is presented. I do not aim to cover all available frameworks but it introduces the concepts I will use for designing my framework.

At first a framework for determining the completeness of a method will be discussed followed by a framework for determining the quality of the 'language' used by a method. Finally five principles for structuring model quality frameworks are introduced.

2.1 Method completeness

When performing an (architectural) study, the architect is concerned with both product and process; the architect creates a solution that can be applied in the situation in which the problem was created. Architects also use a certain philosophy which makes sense of the choices one makes during this process (Habraken, 2005).

Seligman (Seligman et al., 1989) has organized these elements in a framework that can be used to classify different methodologies.

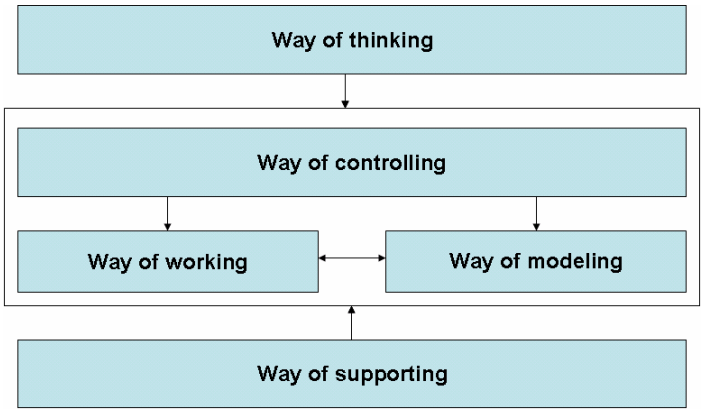

Figure 2: Seligman framework

The *way of modeling* is concerned with the product (the architectural model); how do we categorize and structure the problems and the solutions to these problems. Since there are different categories of problems, there are also different categories of modeling. This allows us to see the system from different perspectives.

The *way of working* is concerned with the types of activities that need to be performed in order to implement the solutions. It describes the strategy of the implementation. What are the tasks that need to be performed, when they are performed, what are the decision points in this process, etc. These tasks can include model construction, model evaluation, education, management reporting, etc. Also, the participants, or actors, are described here.

The *way of controlling* combines the two ways mentioned above to specify how the architecture study process should be managed.

Al these 'ways' have certain assumptions; about the system, the organization, reality in general, etc. These assumptions are described in the *way of thinking*. The *way of supporting* contains al the tools that are used during the architecture study.

2.2 Krogstie quality framework

During the preliminary investigations one framework for assessing the quality of models came up several times: the Krogstie quality framework (Krogstie et al, 1999). Because of the broad acceptance and the frequent usage of this framework in the academic literature I will also use this framework for qualifying the

method on the component 'way of modeling'. In Krogstie et al. (2005) the Framework is used to asses business process modeling languages. Six quality aspects for language quality are identified, with aspects related both to the meta-model and the notation.

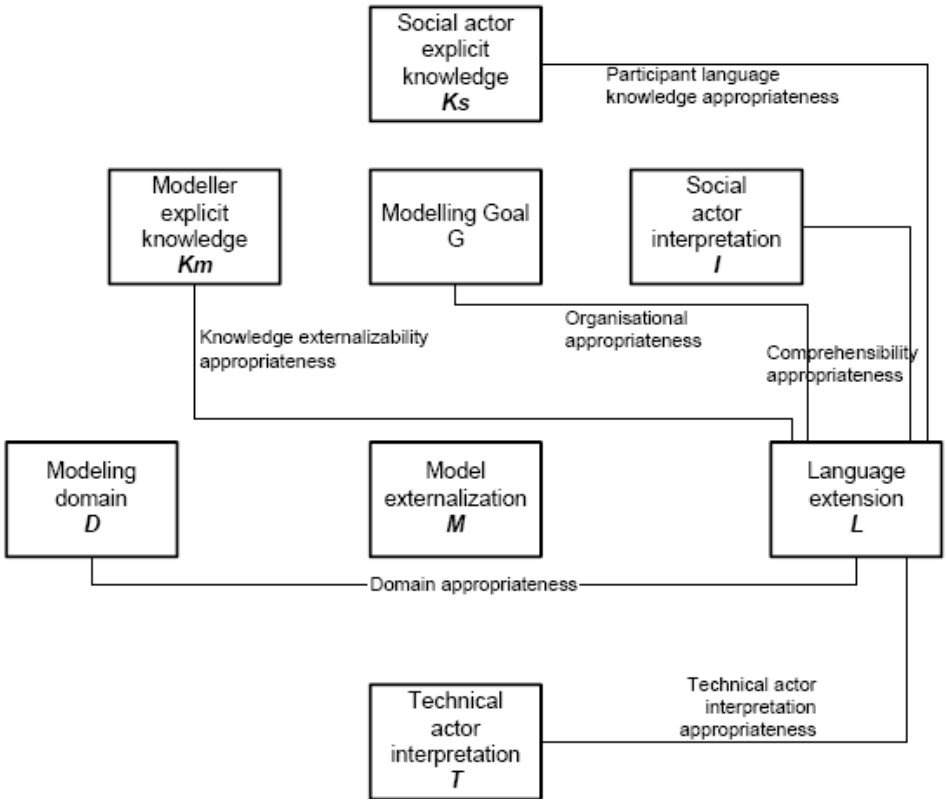

Figure 3: Language Quality Related to the Krogstie quality framework

The Krogstie Quality Framework uses a set-theoretic approach to the discussion of model quality at different semiotic levels, which has been defined as the correspondence between statements belonging to the following sets:

- **G,** the (normally organizationally defined) goals of the modeling task.
- **L**, the language extension, i.e., the set of all statements that are possible to make according to the graphemes, vocabulary, and syntax of the modeling languages used.
- **D**, the domain, i.e., the set of all statements which can be stated about the situation at hand.
- **M**, the externalized model.
- $\mathbf{K_S}$, the relevant explicit knowledge of the set of stakeholders being involved in modeling. A subset of the audience is those actively involved in developing models, and their knowledge is indicated by $\mathbf{K_M}$.
- **I**, the social actor interpretation, i.e., the set of all statements which the audience at a given time thinks that an externalized model consists of.
- **T**, the technical actor interpretation, i.e., the statements in the model as 'interpreted' by different modeling tools.

The framework uses the following quality aspects for evaluating modeling languages:

- **Domain Appropriateness.** Ideally, the conceptual basis must be powerful enough to express anything in the domain. On the other hand, you should not be able to express things that are not in the domain. The only requirement to the external representation is that it does not destroy the underlying basis.
- **Participant Language Knowledge Appropriateness.** This area relates the knowledge of the modeler to the language. The conceptual basis should correspond as much as possible to the way individuals perceive reality.
- **Knowledge Externalizability Appropriateness.** This area relates the language to the participant knowledge. The goal is that there are no statements in the explicit knowledge of the modeler that cannot be expressed in the language. Knowledge externalizability appropriateness is primarily a means to achieve physical quality.
- **Comprehensibility Appropriateness.** This area relates the language to the social actor interpretation.
- **Technical Actor Interpretation Appropriateness.** This area relates the language to the technical actor interpretation. For the technical actors, it is especially important that the language lends itself to automatic reasoning.
- **Organizational Appropriateness.** Relates the language to standards and other organizational needs within the organizational context of modeling. These are a mean to support organizational quality.

2.3 Principles for structuring model quality frameworks

Daniel L. Moody (Moody, D.L., 2004) conducted research in conceptual model quality and identified five most important features of a quality model for information system (IS) analysis and design:

- **Hierarchical structure.** Conceptual model quality should be decomposed into a hierarchy of quality characteristics, sub-characteristics and metrics.
- **Familiar labels.** Single words should be used for each quality characteristic and sub-characteristic, using commonly-understood terms.
- **Concise definitions.** Each quality characteristic and sub-characteristic should be defined using a single, concise sentence.
- **Measurement.** Metrics should be defined for measuring each sub-characteristic.
- **Evaluating process**. Detailed procedure should be defined for concluding quality evaluations.

Although the research project was about IS analysis and design, the principles are, in my opinion, generic and can be applied to the quality framework I will develop in this research project. To ensure the quality of my framework I will apply the quality features of Moody, but due to time limitations I will only apply the principles *hierarchical structure*, *familiar labels* and *concise definition*. The other principles could be a subject for further research.

2.4 Summary

In this chapter the results of the literature study about frameworks is discussed. At first I introduced the Seligman framework for evaluating the completeness of a modeling method (Seligman et al., 1989). This framework identifies five components for evaluating completeness*: way of modeling, way of working, way of controlling, way of thinking and way of supporting*.

Next I introduced the Krogstie quality framework (Krogstie et al., 2005) to assess one specific component of completeness: *way of modeling*. Krogstie uses six quality aspects for evaluating modeling languages: *Domain Appropriateness, Participant Language Knowledge Appropriateness, Knowledge Externalizability Appropriateness, Comprehensibility Appropriateness, Technical Actor Interpretation Appropriateness and Organizational appropriateness*. These quality aspects will be used to classify the criteria for the component *way of modeling*.

In the last paragraph of this chapter I introduced five principles for structuring model quality frameworks. Due to time limitations the principles only the principles *structure*, *familiar labels* and *concise definition* will be applied to my framework.

By applying these concepts discussed in this chapter, I ensure the consistency, usability and quality of my framework for evaluating different modeling methods currently in use by B&I architects within Capgemini.

3 Relevant criteria for B&I architecture

In this chapter the first research question '*which criteria for modeling methods are relevant for B&I architects for modeling services during SOE engagements?'* is addressed. This is done by researching universal criteria for modeling methods in the context of this research project. Since the architectural model of a Business architect should facilitate the management in decision making about the transformation into an SOE, at first theory about decision making and communication was studied.

Next, theory about the architectural process and architectural artifacts was studied to obtain further criteria for the components *way of modeling, way of working, way of controlling, way of thinking and way of supporting*.

Based on the literature study, criteria are defined and completed with criteria obtained form workshops with enterprise architects, architecture courses from Capgemini and my own experience.

At the end of each paragraph criteria related to the specific subject are summarized. In *appendix A*, a complete set of criteria is listed including their classification according to the Seligman framework (Seligman et al., 1989), ID, name and description. If the criterion is classified as 'way of modeling', the criteria will also be classified according to the Krogstie quality framework (Krogstie et al, 1999). Also an indication will be given to indicate the source of the criteria.

3.1 Criteria for facilitating decision making

Mintzberg, Raisinghani and Theoret (Mintzberg et al., 1976) performed a field study of 25 strategic decision making processes together with a review of empirical literature and drew up a generic model of this process. This model contains of three phases: *identification*, *development* and *selection*. During the *identification phase* a problem is recognized and diagnosed. The *development phase* consists of two activities *search* and *design*. *Search* is evoked to find ready-made solution while *design* is used to develop custom-made solutions or modify ready-made ones. The outcome of this phase is one or more solution alternatives for the problem addressed. The last phase is the *selection phase*. Selection is logically considered to be the last step in the decision process. However, because the development phase frequently involves factoring one decision into a series of sub decisions, one decision process could involve a great number of selection steps, many of these intricately bound up with the development phase. During this phase, solution alternatives are evaluated and decisions are made.

Keuning and Eppink (Keuning, D. et al., 1999) developed a similar model of the decision making process: at first the problem is identified, solution alternatives are developed, the impact of each solution alternative is indicated and finally a decision is made. Since the assumption for this research project is that an organization already made the decision to transform into an SOE, the problem has already been recognized. This leads to the following phases in decision making in the context of this research project:

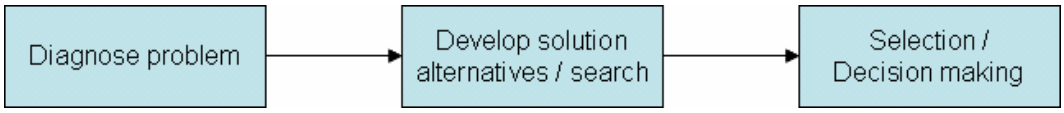

Figure 4: Phases in decision making in the context of this research project

3.1.1 Diagnose problem

To diagnose a problem, the current situation of an enterprise must be researched. This is generally done by developing an 'AS-IS' model to get a clear impression of the current situation. Based on the AS-IS model and the recognition (and definition of the problem), the origin of the problem can be diagnosed. During this phase architects try 'to understand the business'. Understanding the business is based on (Mintzberg et al., 1976):

- Functional analysis of the enterprise (including the coordination and decision making processes)
- Stakeholder analysis. A stakeholder is an individual, team or organization (or classes thereof) with interests in, or concerns relative to, a system (IEEE 1471, 2000).

- Social and contextual factors of the enterprise

Therefore it is a requirement that the modeling method focuses on all these factors and not only on a functional analysis [C2].

3.1.2 Develop solution / search

During this phase the architect is searching for solutions to develop alternatives. Based on own experience, reference models and discussion with fellow architects, the future situation (TO-BE) is being modeled.

For modeling the AS-IS and TO-BE situation [C1], it might be necessary to use different abstraction levels in the model [C3]: areas with no problem or areas with limited complexity can be modeled at a higher abstraction level than the area of the problem (Workshop, 2006).

During this phase, ready-made solution could be used to develop custom-made solutions or modify ready-made ones (Mintzberg et al., 1976). This implies that the method should support the usage of ready-made solutions like reference models or patterns [C4].

3.1.3 Selection

After one or more solution alternatives have been modeled, the management of an organization will have to decide for a solution alternative (or ask for other solution alternatives). The architectural model is used to facilitate this process.

During a workshop (Workshop, 2006) the following criteria were identified to facilitate selection / decision making:

- To method should support scenarios. Scenarios are widely used by corporations to help understand different ways that future events could unfold [C5].
- The impact of the solution alternative should be identifiable. The impact should be specified for people, process, management and information. This information serves as input for a business case [C6].
- Since every stakeholder had his own specific area of interest and concerns, the method should be able to present a stakeholder specific view based on the model [C7].

3.1.4 Summary of criteria for facilitating decision making

- C1: The method should be able to model the current and future situation an organization
- C2: The method should not only focus on functional analysis but also on stakeholder analysis and social and cultural factors
- C3: The method should support usage of different abstraction levels
- C4: The method should support usage of reference models and patterns
- C5: The method should support usage of scenarios
- C6: The impact of each scenario should address people, process, management and information as input for a business case
- C7: The method should support usage of views

3.2 Communication

3.2.1 Criteria for communication

Architecture has several goals (Rijsenbrij et al., 2002):

- Atlas for the management of enterprises: for positioning decision and making impact of change transparent and to align business and IT.

- Instrument for complexity control and reduction.
- Means of communication: directing the conceptualization of all stakeholders
- Framework for development: to control the content coherence of change programs.

These are all forms of communication. Lankhorst (Lankhorst et. al., 2005) even state that if some architecture description is not used as a means of communication in some shape or form, then this description should not have been created in the first place. Whatever the role of an architecture description is, it always involves some communication aspects. In essence, system development can be regarded as a knowledge transformation whereby conversations are used to share and create knowledge pertaining to, both of the system being developed, as well as the development process itself (Lankhorst et. al., 2005). System development, in this context, should be interpreted as any open and active system, consisting of both human and computerized actors, that is purposely designed.

For communication it is important to identify the stakeholders that can play a role in the communication that takes place during the system development process. Stakeholders will have some specific interests with regard to the system being developed. This interest implies a sub-interest with regards to the models that are communicated during the process. Therefore is it important that the modeling method is able to develop stakeholder specific descriptions where the specific stakeholder's interest is addressed. A stakeholder's specific description is also referred as a view (already covered by criterion [C7]).

During an architectural engagement, stakeholders have a need to communicate knowledge about the system being developed. In the field of knowledge management, a key distinction is made between explicit and tacit knowledge (Nonaka and Takeuchi, 1991). Explicit knowledge refers to knowledge that can be externalized in terms of some representation. Tacit knowledge cannot (easily) be externalized. This implies that the focus of communication within architecture studies is on explicit knowledge. Based on Frackson and Verhoef (Frankson and Verhoef, 1999) and Proper (Proper, 2001), Lankhorst (Lankhorst et. al., 2005) identified five dimensions of explicitness for representation of system development knowledge:

- **Level of formality.** The degree of formality indicates the type of representation language used. Such a language could be formal, in other words a language with an underlying well-defined semantics in some mathematical domain, or it could be informal, not mathematically underpinned; typically texts in natural language, graphical illustrations, animations, etc.
- **Level of quantifiability.** Different aspects of the designed artefact may be quantified. Quantification may be expressed in terms of volume, capacity, workload, effort, resource, usage, time, duration, frequency, etc.
- **Level of executability.** The represented knowledge may, where it concerns artefacts with operational behavior, be explicit enough so as to allow for execution. This execution may take the form of a simulation, a prototype, generated animations, or even fully operational behavior based on executable specifications.
- **Level of comprehensibility.** The knowledge representation may not be comprehensible to the intended audience. Tuning the required level of comprehensibility of the representation, in particular the representation language used, is crucial for effective communication. The representation language may offer special constructs to increase comprehension, such as stepwise refinements, grouping/clustering of topically related items/statements, etc.
- **Level of completeness.** The knowledge representation may be complete, incomplete, or overcomplete with regard to the knowledge topic it intends to cover.

Level of formality. During an architectural engagement different stakeholders are involved. In order to communicate and transfer knowledge, a formal language is necessary. This ensures that the stakeholders have the same conceptualization of the architecture model. A formal language also support re-use of information like reference models or patterns. On the other hand, a formal language could hinder the creativity during the *develop solution* phase: a language should be informal enough to add new or skip specific concepts/building blocks [C8].

Level of quantifiablity. The modeling method's language should support quantifiability: this information is crucial during the *develop solution* phase (e.g. what quality of service does a service deliver, what is the number of transactions, what is the necessary security level, what is the location of a service) and could also act as input for calculations for a business case (e.g. how many transactions per month, what is the resource usage) [C9].

Level of executability. The represented knowledge of artifacts may be input for a simulation of the system being developed. Simulation could be used for discovering errors in the representation of system being developed and may increase the level of comprehensibility of stakeholders (seeing is believing). The level of executability influences the quality of the simulation of the system being developed [C10].

Level of comprehensibility. Mintzberg found out that half the activities engaged in by CEO's lasted less than nine minutes, and only 10% exceeded one hour (Mintzberg, 1986). This implies that the representation of the system being developed should not be complex [C11]. The modeling method's language should be easy to understand for non-architects and therefore should contain limited variance in building blocks [C13]. Also, a study on architecture visualization (Baida, 2002) shows that managers prefer visualization to textual documents.

Level of completeness. The modeling method's language should be able to represent the artifacts discussed in the following paragraphs [C12].

3.2.2 Summary of criteria for communication

- C8: The level of formality should be *medium*: a certain kind of formalization is necessary but there should be room for skipping or adding concepts/building blocks
- C9: The level of quantifiability should be *high*: this information is necessary for designing and decision making
- C10: The level of executability is of minor importance. Although it could raise the level of comprehensibility, simulation is hardly ever used during the kind of architectural engagements in the context of this research project
- C11: Level of comprehensibility should be *high*: the modeling method's language should be intuitive and easy to understand for all stakeholders.
- C12: Level of completeness should be high: the modeling method's language should be able to represent the artifacts discussed in the following paragraphs
- C13: The modeling language should be intuitive to understand. It is necessary that all stakeholders 'speak' the same language and have the same interpretation of the model.

3.3 Criteria for the architectural process and artifacts in SOE engagements

3.3.1 Integrated Architecture Framework

Capgemini uses the Integrated Architecture Framework (IAF) version 4 (Capgemini, 2006A) as a framework for their architecture engagements. IAF is used to structure and define the architecture content. The framework provides a model for architecture development and usage, describes the format and content of elements of the architecture and specifies the way in which these elements relate to each other.

Within this framework, IAF artifacts describe the architecture elements. Artifacts belong to, and are derived within, specific areas in the architecture framework.

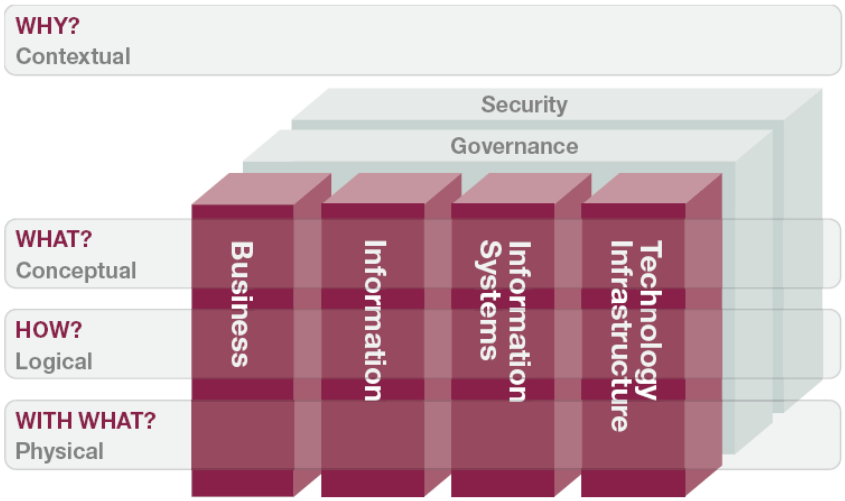

Figure 5: Integrated Architecture Framework version 4

Abstraction Levels

Abstraction within the IAF allows a consistent level of definition and understanding to be achieved in each area of the architecture, and is especially useful when dealing with large and complex architectures, as it allows for all relevant issues to be identified before further detailing is attempted.

The IAF defines four levels of abstraction:

- **The Contextual Level** is characterized by the "Why?" question. It is not about understanding what the new architecture will be, but identifying the boundaries for the new architecture and its context. Specifically this level focuses on the business aspirations and drivers and captures the Principles upon which the architecture will be based.
- **The Conceptual Level** is characterized by the "What?" question. The requirements and objectives are decomposed, ensuring that all aspects of the scope are explored, that relevant issues are identified and these issues are resolved without concern over how the architecture will be realized.
- **The Logical Level** is characterized by the "How?" question. The Logical Level is about finding the ideal solution in an implementation independent manner. From this, several "solution alternatives" can be developed that either provide the same outcome, or alternatively "test" different priorities and scenarios to understand the implication of different potential outcomes.
- **The Physical Level** is characterized by the "With what?" question. It is about determining the real world structure and organization, and is concerned with translating the Logical Levels 'ideal' structure and organization into an implementation-specific structure, bounded by standards, specifications and guidelines.

Since services are defined at the Conceptual Level and structured (and organized) at the Logical Level, based on outcomes (Principles) from the contextual level, the Physical Level is out of scope.

Aspect Areas

To break down the complexity of the Architecture, IAF recognizes six "Aspect Areas. " four of which focus exclusively on the core aspects of the overall architecture; Business, Information, Information Systems and Technology Infrastructure. The remaining two aspect areas specifically address the disciplines of Security and Governance.

- The **Business Aspect Area** adds knowledge about business objectives, activities, and organizational structure. Key artifacts in this aspect area include Business Goal, Business Service, Business Actor, Logical Business Component and Physical Business Component.

- The **Information Aspect Area** adds knowledge about the information the business uses, the information structure and relationships. Key artifacts in this area include Information Object, Business Information Service, Logical Information Component, etc.
- The **Information System** Aspect Area adds knowledge about types of information systems (packaged or bespoke) that can automate and support the processing of the information used by the business. Key artifacts include IS Service, Logical IS Component and Physical IS Component.
- The **Technology Infrastructure Aspect Area** adds knowledge about types and structure of infrastructure components ("boxes and wires") that support the information systems and actors. Key artifacts include TI Service, Logical TI Component and Physical TI component.
- The **Governance Aspect Area** adds knowledge about the manageability and quality of the architecture implementation. The artifacts for this area are all fundamentally defined within the core aspects areas.
- The **Security Aspect Area** adds knowledge about mitigating known risks to the architecture implementation. The artifacts for this aspect area are all fundamentally defined within the core aspects areas.

Since this research project is about modeling methods for identifying services only the Business Aspect Area is in scope of this research project. The link between the Business and Information Aspect Area are Information Objects with could be an Business Object a service consumes to achieve a Business Goal.

3.3.2 Architecture process

Roadmaps

IAF is not a 'cookbook' for architecture engagements: every type of architecture engagement has a specific roadmap. A roadmap guides the structure of different architecture engagements and is a process pattern describing how to run specific types of architecture engagements. A roadmap defines the scope (and focus) across the various aspect areas of IAF, including the artifacts needed. For the type of engagement of this research project (facilitating decision making about the transformation into an SOE) the following roadmap was designed during interviews with experienced enterprise architects.

Roadmap for SOE

For designing the business service architecture, Jones and Morris developed a methodology for services architectures (Jones et al., 2005). This methodology starts with creating the big picture of the architecture, which determines the scope of the services and identifies which services talk to another and to which external actors. The method starts at the top of the domain and uses the organizational functions to create services in stead of the high level business process because business processes are about to change and services need to be able to step in to that. The big picture is decomposed into finer grained services until the desired level of detail is achieved. After that, support services and shared services are identified and assimilated in the service structure (Jones et al., 2005). They state that a top down method is used to identify a Business architecture, not starting by identifying services from business processes, but from tasks. Flexibility of these business processes is one of the main benefits of an SOE, but is enough flexibility achieved when designing services from the current business processes? Other consulting firms like IBM or software vendors like SAP (SAP, 2005) use the same top down approach for identifying services. The main distinction with the methodology of Jones and Morris is that the services are derived from business processes in stead of business functions. Starting with the business processes tends to "drill-down" to early and leads to process "silos" of services (Jones et al. 2005). I do agree with this opinion.

An architect typically starts an architectural engagement at the contextual level to identify the boundaries for the new architecture and its context. At this stage architects are looking for principles. A principle is a statement of believe, approach or intent which directs the formulation of the architecture, and may refer to the current state or a desired future state. Principles are guidelines for the construction of the architecture, will underpin the investigation when the architect is looking at the architectural options, will be used to justify the decisions architects make about the components of the architecture and ensure that the architecture is consistent.

Identifying business services and discovering the relations between services are activities conducted at the conceptual level of IAF in the business aspect area. At the logical level at the same aspect area, the focus is finding the ideal solution in an implementation independent manner. At this level, solution alternatives (scenarios) are developed with will facilitate the management in decision making. This level will also provide enough information for a high level business case. At the physical level in the business aspect area, the focus is on determining the real world structure and organization. In my opinion is this abstraction level not necessary for facilitating decision making about turning into a SOE. Modeling at the physical level should be executed if a detailed business cases is desired or a transformation planning is being set up.

The other aspect areas (Information, Information Systems and Technology Infrastructure) are in the context of this research project out of scope unless the information of the business aspect area is unsatisfactory (e.g. the management want to include the impact on the other aspect areas in the scenarios or business case).

This leads to the following roadmap for SOE engagements[1]:

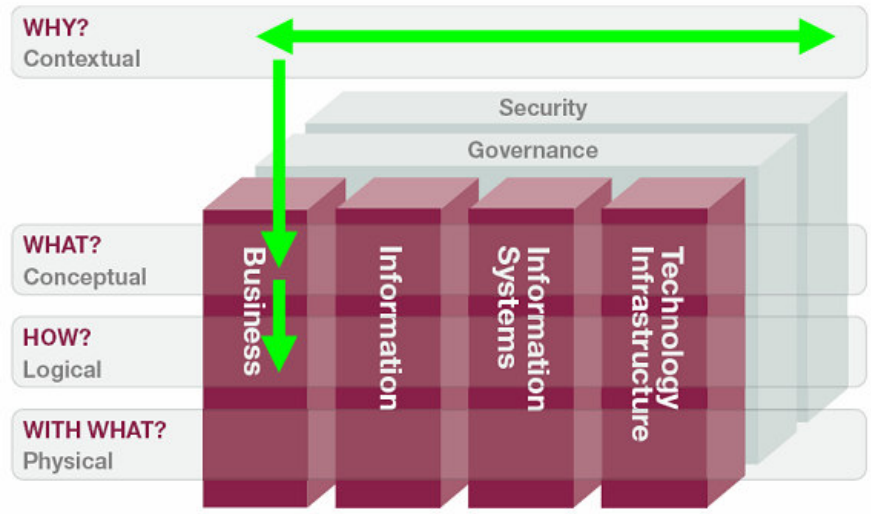

Figure 6: Roadmap for SOE

> The information in paragraph 3.3.3, 3.3.4, 3.3.5 and 3.3.6 is obtained from IAF training material (Capgemini Academy, 2006) and supplemented with own experience.

3.3.3 Artifacts of the Contextual Level

Principles are the major artifacts of the contextual layer. Principles are derived from the business mission, vision and strategy, the business context (e.g. market dependencies, cultural inertia), policies (e.g. government regulation) and technology context [C14]. Principles derived from the technological context are generally related to the IS and TI aspect area's which implies that the technological context is out op scope for this research project.

[1] The aspect areas Governance and Security are out of scope for this research project due to time limitations.

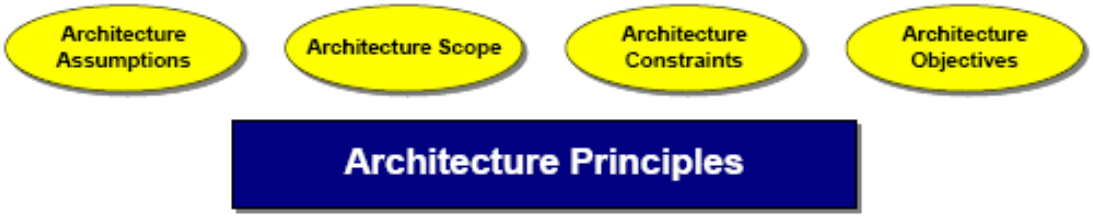

Figure 7: Artifacts of the Contextual Level

A principle is documented by a unique identification, description, motivation (the reasons for the principle being included), implication (the actions required or the effects resulting from the implementation of the principle), assurance (measurement and monitoring of the principle to ensure conformance) and a priority [C15].

During the contextual phase an architects gathers information from different stakeholders. Stakeholders have different interests or concerns which implies that principles are not 'neutral': they are linked to stakeholders and their concerns. By performing a stakeholder analysis insight in the different interests or concerns is obtained [C7.1]. This enables the architect to communicate in an optimal way to each stakeholder.

3.3.3.1 Criteria for the Contextual Level

- C14: The method should have an activity to obtain principles derived from the business mission, vision and strategy and the business context
- C15: The modeling language should enforce to document principles with an unique identification, description, motivation, implication, assurance and a priority
- C7.1[2]: The method should have an activity to perform a stakeholder analysis to get insight in their different interests or concerns to enable optimal communication to each stakeholder.

3.3.4 Artifacts of the Business Conceptual Level

At this phase in the architectural process the architect focuses what the business wants to achieve (the business goals) and what is necessary to achieve these goals (business activities, business roles and business objects).

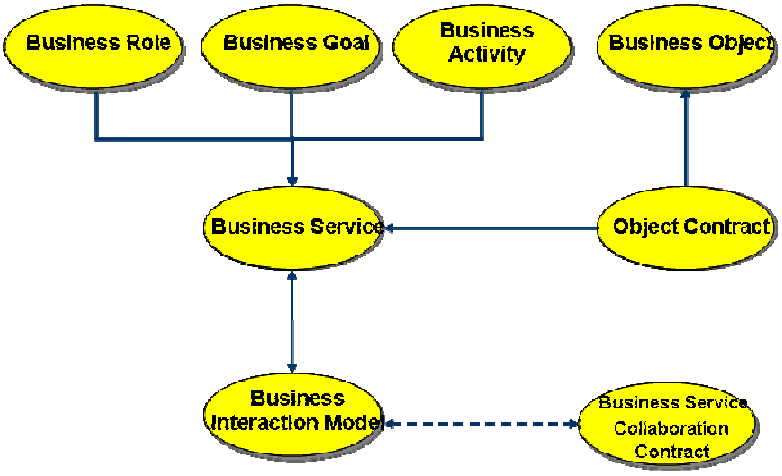

Figure 8: Artifacts of the Business Conceptual Level

[2] This criteria is related to criteria 7. This is the reason why this numbering was used.

Business goals are generally long term in nature and are focused on the business mission objectives [C16]. Business goals describe what the business wants to achieve to meet the business mission objectives [C17]. Business activities are things that need to be done to achieve the business goals (examples of business activities for a fishing firm are fishing, specify catch requirements, monitor catch quality) [C18]. A business role describes the 'elementary job positions' required to perform the activities in order to reach the business goals [C19]. A business role is responsible for the execution of business activities. Note that business roles are not similar to people because one person could have more business roles. During the execution of the business activities, a service uses or consumes business objects [C20] to achieve the business goal. The way this is done is described in an object contract [C21]. Business objects could, for instance, be an information system, physical objects like transportation devices or production machinery.

Within the Integrated Architecture Framework a service is formulated as *something that describes an element of business behavior to achieve a specific business (sub) goal*. A service consists of things that need to be done (sequence of sub-activities) by a specific role to achieve a specific business (sub) goal. Business services are related to each other in order to achieve all business (sub) goals [C22]. These relations are indicated in the business interaction model [C23]. This model gives an insight to identifying dependencies between business services. The interaction between services is described in collaboration contracts [C24]. These contracts describe for instance the general characteristics (like contract name, trigger of the interaction), quality of service (like service times, quality characteristics) and security aspects of the interaction.

3.3.4.1 Criteria for the Business Conceptual Level

- C16: The method should have an activity to divert the business mission objectives. This is an activity performed at the Contextual Level.
- C17: The method should have an activity to obtain business goals
- C18: The method should be able to model business activities
- C19: The method should be able to model business roles
- C20: The method should be able to model business objects
- C21: The method should be able to model the consumption of business objects by business services
- C22: The method should be able to model business services and link them to business activities, business goals and business roles
- C23: The relations between business services should be indicated and modeled in an business service interaction model
- C24: The interaction between services should be described in collaboration contracts. The method should be able to model this interaction.

3.3.5 Artifacts of the Business Logical Level

During this phase of the architectural engagement, the architect focuses on the structure or organization of the business services to represent the logical business components of the current of ideal future solution.

The architects can look at the element of business behavior (the business services) in many ways [C25]. These different viewpoints can be input for developing different scenario's (see [C5]):

Some examples of viewpoints are:

- The process aspect viewpoint defines logical process components, which are a grouping of business services, based on similarity in activities or process steps
- The governance aspect viewpoint defines logical governance components based on roles and responsibilities
- The organization aspect viewpoint defines logical organization components based on roles and activities

- Other viewpoints are possible (for instance based on security aspects, business value or usage of business objects).

Principles guide the architect in defining grouping criteria.

After business services are grouped into logical business components and when looking at the roles that are responsible for a business services, actors can de identified. Actors are a grouping of different roles for a logical component [C26].

At this level, also an interaction model and contract are defined which describes the interaction of the logical business components and the way they interact [C27, C28].

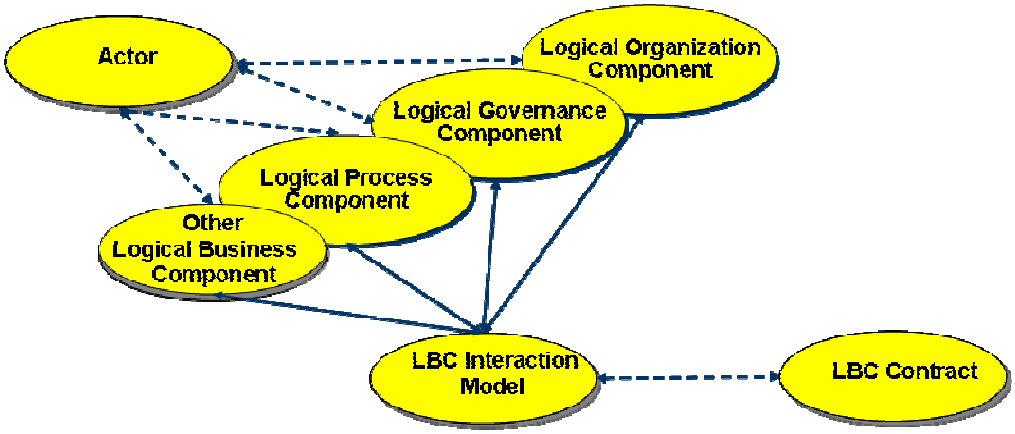

Figure 9: Artifacts of the Business Logical Level

3.3.5.1 Criteria for the Business Logical Level

- C25: The modeling method should be able to support the grouping of business services into logical business components based on different criteria (different viewpoints)
- C26: The modeling method should support the grouping of roles into an actor
- C27: The relations between logical business components should be indicated and modeled in an logical business component interaction model
- C28: The interaction between logical business components should be described in logical business components collaboration contracts. The method should be able to model this interaction.

3.3.6 General criteria

Besides the criteria listed in paragraphs 3.3.2 until 3.3.5, additional criteria apply to the modeling method. These criteria are based on personal experience in architecture engagements.

- C29: Architecture is all about traceability: every decision in the modeling process should be related to the enterprise strategy and / or a principle.
- C30: Architecture is an iterative process. The modeling method should support an iterative way of working.
- C31: The modeling method should support different views (see [C5]). This implies that different models for different stakeholders. The modeling method should enforce the consistency en cohesion between different models.
- C32: As discussed in the problem area of this thesis, the focus by modeling services is to identify reusable services and to describe the output of a service. It does not focus on the way a service is realized. During this type of modeling, the architect uses a black-box view. The modeling method should be able to address this concept.

- C33: The modeling method should prescribe ways to control the architectural engagement.
- C34: The modeling method should have a tool to support the modeling process.

3.4 Summary

In this chapter criteria for modeling methods are discussed. These criteria are based on literature study, a workshop with enterprise architects, architecture training material form Capgemini and my own experience.

At first literature from Mintzberg, Raisinghani and Thoret (Mintsberg et el., 1976) and Keuning and Eppink (Keuning, et al., 1999) was studied to obtain a deeper understanding of the decision making process. This process consists of the phases *Diagnose problem*, *Develop solution /Search* and *Selection*. For each phase criteria were formulated.

Next, literature about communication was studied since this is one of the major goals of architecture. For communication it is important to identify stakeholders and that communication is tuned to their specific interests and concerns. This part of the literature study also identified five dimensions of explicitness for representation of system development knowledge: *level of formality*, *level of quantifiability*, *level of executability*, *level of comprehensibility* and *level of completeness*. Based on literature study, criteria for modeling methods were formulated and completed with input from a workshop (Workshop).

Then, criteria for the architectural process and architectural artifacts in SOE engagements were formulated. These are based on IAF version 4. At first a roadmap for SOE engagements was drawn up to identify the necessary aspect area's and abstraction levels for these types of engagements. With this information the necessary artifacts and additional criteria for SOE related engagements were obtained.

Finally the set of criteria was completed with additional criteria based on personal experience.

Classifying the criteria on the Seligman framework (Seligman et al., 1989) leads to the following overview:

- Twenty five criteria are classified as *way of modeling*
- Seven criteria are classified as *way of working*
- One criterion is classified as *way of thinking*
- One criterion is classified as *way of controlling*
- One criterion is classified as *way of supporting*

One may conclude that the *way of modeling* and *way of working* are the most important elements in the framework for modeling methods for SOE engagements. Other types of criteria are, at least at this stage in the architectural process, of secondary importance.

When the criteria classified as *way of working* are plotted on the Krogstie quality framework, it shows that the *Domain Appropriateness* quality aspect is the most important one (18 criteria) followed by *Comprehensibility Appropriateness* (4 criteria), *Knowledge Externalizability Appropriateness* (1 criterion), *Technical Actor Appropriateness* (1 criterion) and *Organizational Appropriateness* (1 criterion).

A complete overview of criteria including their classification is presented in *Appendix A: List of criteria.*

4 Evaluation of modeling methods

In this chapter the analyze framework is applied to the modeling methods Capability Mapping, BMI and DEMO. This is performed for each modeling method by interviewing enterprise architects or filling in a questionnaire. All architects have extensive experience in that specific modeling method and have experience in SOE related engagements. The objectives of the interviews / questionnaire were twofold: at first the analyze framework was put in practice so it could be validated and evaluated on its completeness and secondly it provided me with the score of the modeling methods on the analyze framework. Al the interviewed architects stated that the analyze framework was complete: no criteria have been added.

For BMI and DEMO I interviews two architects each. For Capability Mapping I could only find one enterprise architect who had applied that modeling method in SOE related engagements. Capability Mapping has its foundations in strategic consulting. In my opinion, this is the reason why only a limited number of enterprise architects apply this method: since most enterprise architects don't have a background in strategic consulting they are not familiar with this modeling method. Since two respondents for a modeling method is minimal, I was forced to exclude Capability Mapping from this research project. The score or Capability Mapping and information about the respondent and the modeling method can be found in *Appendix E: Score of Capability Mapping*.

The questionnaire for the interviews can be found in *Appendix D: Questionnaire*. Each criterion could score 1 to 5 (1 = lowest score, 5 = highest score), *na* which meant that the modeling method does not support the criterion at all or *ex* which meant that the modeling method does not support the criterion, but the modeling method can easily be extended to support the criterion. For each modeling method a mathematical average score for each criterion was calculated (*na* is counted as -3 and *ex* as -1.This is the reason why an average score can be negative).

In each paragraph, a short introduction of the enterprise architects interviewed is given, followed by a brief overview of the modeling method. After the introduction and overview, the score of the modeling method on the analyze framework will be presented. Examples of each modeling method can be found in *Appendix H: Examples of models*.

4.1 BMI

For this modeling method I interviewed Bert Sneep and Ronald Orlemans.

Bert Sneep

Bert Sneep is an enterprise architect at Capgemini. He has about 16 years experience in architecture engagements and BMI. During the last 4 years he was involved in SOE related engagements at 2 large companies. He has applied BMI in 10 non SOE related engagements and 2 SOE related engagements. He also taught BMI during the post academic master education "Architecture in the Digital World".

Ronald Orlemans

Ronald Orlemans is an enterprise architect at Capgemini. He has about 18 years experience in architecture engagements and 15 years in BMI. He was involved in SOE related engagements at 3 large clients. He has applied BMI in several SOE related and non SOE related engagements. He was also a teacher at the post academic master education "Architecture in the Digital World".

4.1.1 Overview of BMI

BMI is a modeling method for implementation independent modeling of organizations. Implementation independent means that such an abstraction level is chosen that the model is indifferent to the organizational structure, processes and technology of a company.

BMI consists of business object modeling and business function modeling. A business object is a concrete 'thing', an event or a concept of the real world with added value to the goals of the business. Business object modeling has his foundations in the Set theory. A business object model is a group of definitions of the business objects in the model. The relations between the business objects are also modeled (relation types are;

specialization, generation, aggregation and classification). For a visual representation of the business object model, BMI uses the Venn-diagram technique.

A business function is a set of activities aimed to realize one specific business goal, indifferent of the way it is implemented. Business functions can be placed in a goal-means hierarchy. The top function is in that case similar to the mission of the company. Coordinate functions must be disjunctive. A higher function must be exactly the sum of the underlying functions. Business functions describe the essence of the business. They link those 'things' (characteristics of business objects) together that are inextricable related to each other according to the essence of the business.

BMI also uses a business interaction model to determine coherence between business functions and business objects. The business interaction model is a matrix of relations between business functions and business objects and also indicates whether an object is used or determined by a business function.

The approach of BMI is to translate the output of business processes or business activities into relevant business objects. This will exclude pure administrative actions. Next is analyzed which characteristics of business objects contribute directly to the desired result. All remaining characteristics must exist outside the boundaries if the company of there should be a business function which creates the characteristic. A best practice is to use a bottom up approach starting at the desired outcome. Finally the architect should give each business function a name that it fits with the outcome of the function.

4.1.2 Score of BMI

BMI scores a total amount of 24.5 points. A detailed score can be found in *Appendix F: Score of BMI*.

The following table shows the average score on each grouping of criteria of the analyze framework:

Grouping of criteria	Average score
Facilitating decision making	1.7
Communication	0.3
Artifacts of the Contextual Level	-1.7
Artifacts of the Business Conceptual Level	2.0
Artifacts of the Business Logical Level	-2.3
General criteria	-0.3

Based on this information, one might conclude that BMI can be applied for facilitating decision making, for distinguishing the artifacts of the Business Conceptual level of IAF and maybe for communication to the stakeholders. BMI should not be applied for distinguishing the artifacts of the Contextual and Business Logical level of IAF.

When looking at the detailed score of the groupings of criteria that have a positive average score, one might conclude that, even though BMI can be applied for facilitating decision making, the weak point of BMI is determining the impact of scenarios on all relevant aspects (people, process, management and information) and that BMI does not provide enough input for simulation of the system being developed. BMI is also not able to model logical business components at the Business Conceptual Level.

During the interviews, Bert Sneep and Ronald Orlemans also gave the following guidelines for applying BMI.

Use BMI:

- When an architects needs to understand the business
- For facilitating strategic decision making
- For information planning

- For conceptual philosophers (mostly staff functions)
- Political loaded environments
- At strategic level

Do not use BMI:

- For pragmatic philosophers
- To model administrative functions
- For projects with a limited scope

4.2 DEMO

For this modeling method I interviewed Hans Goedvolk and Martin Op't land.

Hans Goedvolk

Hans Goedvolk is an enterprise architect at Capgemini. He has about 20 years experience in architecture engagements and 15 years in DEMO. He has been involved in several SOE related engagements in the last 8 years. He has applied DEMO in several non SOE related engagements and SOE related engagements. He teaches DEMO at the Capgemini Academy.

Martin Op't Land

Martin Op't Land is an enterprise architect at Capgemini. He has about 17 years experience in architecture engagements and 6 years in DEMO. He has been involved in SOE related engagements since 2000. He applied DEMO in several SOE related and non SOE related engagements. He also teaches DEMO at the Capgemini Academy and was also a teacher at the post academic master education "Architecture in the digital world".

4.2.1 Overview of DEMO

The theory of DEMO is based on three different concepts. Together they form the basis of the different models of the method. The first concept is the system-concept: a (part of an) organization is, according to DEMO, a social system of actors, transactions and interstriction-relations. An actor represents one or more persons in a specific role in the organization. All actors have a relation with another actor, within or outside the system boundaries. This relation is either a transaction or an interstriction-relation. A transaction follows a certain communication pattern between two actors and result in an 'original fact'. Interstriction is consulting original facts which are realized in other transactions.

DEMO distinguishes an 'object world' and an 'inter-subject world'. The inter-subject world is a shared social world of several persons. The object world is the world outside the social world. People change the object world by performing actions. DEMO states that people commit themselves to actions by making agreements. Communication is the way to make those agreements, but also to describe the state of the object world. DEMO uses transactions as a standard pattern for communication between persons so the missing aspects of a conversation can easily be discerned.

Each transaction can be analyzed at four levels:

1. Essential level
2. Informational level
3. Documental level
4. Physical level

At the essential level, the original facts are created. A fact is always related to a change of the state of the object world, as an outcome of an action within a transaction. Consulting information about original facts does not change the state of the object world, and occurs at the informational level. Information can be

documented in different physical ways. The first three levels form the abstraction framework of DEMO, and enables to separate essential things and side issues.

DEMO uses four different aspect models.

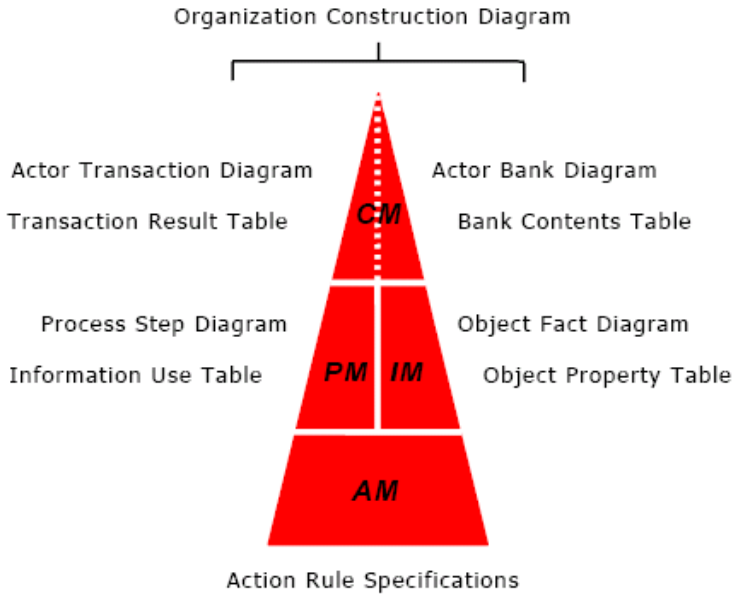

Figure 10: Aspect models of DEMO

Figure 10 shows the different aspect models of DEMO. The hierarchy in the pyramid indicates the level of detail of each model. The Construction Model (CM) describes the organization at the highest abstraction level. The model consists of actors, transactions and interstriction-relations. The original facts that are created and consulted are described in the Information Model (IM). In this model, also the information type is of the information is indicated (e.g. the information is a number of part of a certain class). The relation between the transactions is modeled in the Process Model (PM). Finally the rules of behavior that are followed by actors during transactions is modeled in the Action Model (AM).

4.2.2 Score of DEMO

BMI scores a total amount of 55.5 points. A detailed score can be found in *Appendix G: Score of DEMO*.

The following table shows the average score on each grouping of criteria of the analyze framework:

Grouping of criteria	Average score
Facilitating decision making	2.3
Communication	1.5
Artifacts of the Contextual Level	-1.0
Artifacts of the Business Conceptual Level	2.3
Artifacts of the Business Logical Level	0.0
General criteria	1,1

Based on this information, one might conclude that DEMO can be applied for facilitating decision making, communication and for distinguishing the artifacts of the Business Conceptual level of IAF and maybe for the artifacts of the Business Logical Level. DEMO should not be applied for distinguishing the artifacts of the Contextual Level of IAF.

When looking at the detailed score of the groupings of criteria that have a positive average score, one might conclude that, even though DEMO can be applied for facilitating decision making, the weak point of DEMO is determining the impact of scenarios on all relevant aspects (people, process, management and information) and that DEMO does not provide enough input for simulation of the system being developed. DEMO can be extended to support these artifacts.

During the interviews, Hans Goedvolk and Martin Op't Land gave the following guidelines for applying DEMO.

Use DEMO:

- When an architects needs to understand the business (a high level view of an organization)
- For construction and implementation engagements
- For determining production and implementation alternatives

You could use DEMO for evaluating strategic alternatives (new product / market combinations). DEMO will in this case provide the implications at a high level.

4.3 Summary

In this chapter the modeling methods BMI and DEMO were scored on the analyze framework for evaluating architecture modeling methods for modeling services. For each method, experienced enterprise architect were interviewed. The objective of the interviews was twofold: at first the analyze framework was put in practice so it could be validated and evaluated on its completeness and secondly it provided me with the score of the modeling methods on the analyze framework. Al the interviewed architects stated that the analyze framework was complete.

When looking at the scores of each modeling method one might conclude that both methods can be applied for facilitating decision making and distinguishing the artifacts of the Business Conceptual Level of IAF. BMI and DEMO should not be used for distinguishing the artifacts of the Contextual and Business Logical level of IAF. DEMO is the best method for communication purposes to stakeholder while BMI should not be applied for communication purpose.

When looking at the detailed score of the groupings of criteria with a positive average score, one might conclude that, even though both modeling methods can be applied for facilitating decision making, the weak point of them is determining the impact of scenarios on all relevant aspects (people, process, management and information) and that they do not provide enough input for simulation of the system being developed. In stead of BMI, DEMO can be extended to support these artifacts. Other differences between the modeling methods are that BMI has activities to divert the business mission objectives and to obtain business goals and DEMO doesn't and that DEMO supports an iterative way of working and BMI doesn't.

When the total score of the modeling methods are compared one sees that DEMO has the highest score (DEMO 55.5 versus BMI 24.5 points).

5 Conclusion and recommendations

5.1 Conclusion

In the first chapter I started with the main question of this research project and divided it into two sub questions. Now, I have a look back to these questions, to see whether I answered them completely. The first sub question was:

Which criteria for modeling methods are relevant for Business architects for modeling services during SOE engagements?

This question was divided into two sub questions:

a. What are universal criteria for modeling methods?

b. Which criteria are relevant criteria for modeling services?

These questions were answered by performing a literature study and organizing a workshop. This part of the research project led to two groupings of universal criteria (criteria for facilitating decision making and criteria for communication) and three grouping of criteria for modeling services (artifacts of the Contextual level, artifacts of the Business Conceptual level and artifacts of the Business Logical level).

These criteria combined led to a framework for evaluating architecture modeling methods for modeling services during SOE engagements. Also literature about frameworks was studied to make sure me framework was complete and of good quality. Finally the framework was validated and evaluated on its completeness during four interviews with experienced enterprise architects (see next sub question).

When the criteria are grouped based on the Seligman framework (Seligman et al., 1989), one can conclude that the *way of modeling* and *way of working* are the most important elements in the framework for modeling methods for SOE engagements.

When the criteria classified as *way of working* are plotted on the Krogstie quality framework (Krogstie et al, 1999), it shows that the *Domain Appropriateness* quality aspect is the most important one followed by *Comprehensibility Appropriateness*.

The second sub question of this research project was:

What is the score on the analyze framework of the modeling methods Capability Mapping, BMI and DEMO?

This sub question was answered by performing interviews with experienced enterprise architects. These architects had extensive experience in the modeling method and applied the modeling method during several SOE related engagements. During these interviews, the architects scored each criteria of the framework. By calculating a total score and an average for each grouping of criteria, the modeling methods could be evaluated and compared with each other for their suitability. With this information I was able to answer the main question of this research project:

What is the suitability of modeling methods currently used within Capgemini by Business architects for modeling services during SOE engagements?

The modeling method Capability mapping was excluded from this research project since I could only find one enterprise architect who had applied this method during SOE related engagements.

When looking at the scores of each modeling method one might conclude that both methods can be applied for facilitating decision making and distinguishing the artifacts of the Business Conceptual Level of IAF. BMI and DEMO should not be used for distinguishing the artifacts of the Contextual and Business Logical level of IAF. DEMO is the best method for communication purposes to stakeholder while BMI should not be applied for communication purpose.

When looking at the detailed score of the modeling methods, one might conclude that, even though both methods can be applied for facilitating decision making, the weak point of them is determining the impact of scenarios on all relevant aspects (people, process, management and information) and that they do not provide enough input for simulation of the system being developed. In stead of BMI, DEMO can be extended to

support these artifacts. Other differences between the modeling methods are that BMI has activities to divert the business mission objectives and to obtain business goals and DEMO doesn't and that DEMO supports an iterative way of working and BMI doesn't.

When the total score of the modeling methods are compared one sees that DEMO has the highest score (DEMO 55.5 versus BMI 24.5 points).

The results of the interviews indicated also that all modeling methods do not support all criteria of the framework. Out of 35 criteria BMI does not support 19 criteria and DEMO does not support 15 criteria. From these unsupported criteria DEMO can be extended more easily. When the modeling methods are extended BMI still does not support 12 criteria and DEMO 2 criteria. Based on this information I conclude that DEMO is the best of the evaluated modeling methods for modeling services during SOE related engagements since it scores significant higher than BMI on all groupings of criteria and it can be extended easily to support more criteria.

5.2 Recommendations for further research

During the first phase of this research project I put the following issues out of scope for this research project due of time limitations:

- Capability mapping was excluded from this research project but the score of this modeling method looks promising (see *Appendix E: Score of Capability Mapping*). Finding more architects to score this modeling method could be a part of another research project.
- The scope of this research project was limited to several modeling methods used by architects within my own organization: Capgemini. Other architectural modeling methods exist (like ARIS and ArchiMate). Applying the framework I developed in this research on these methods could be a subject for further research. This might lead to a better modeling method that DEMO of with a modeling method for those areas that are not covered by DEMO.
- Only the quality principles *hierarchical structure*, *familiar labels* and *concise definition* of Moody were applied on the framework. The other principles (*measurement* and *quality process*) could be a subject for further research to increase the quality of the framework.
- This research was limited to SOE related engagements. To set up a framework for non SOE related engagements could be a subject for further research. I think it would be very interesting to compare the SOE with the non SOE related engagement framework to determine the precise distinction between these types of engagements.
- For each modeling method two architects were interviewed. This was a limited number. On a couple of criteria these was a significant difference in the score of a criterion. To get a more 'leveled out' score of each modeling method, other architects could be interviewed.
- When an organization has decided to transform into a SOE the architectural model should be extended with the other aspect areas of IAF (*Information, Information System* and *Technical Infrastructure*) as well as the *Security* and *Governance* viewpoint. These areas and viewpoints probably have additional criteria for a modeling method. To determine these criteria and scoring additional modeling methods could be a subject for further research.

6 Refection

At the start of this project I wrote a research proposal. This proposal described the plan of approach of this research project and the aspects that were in scope. It was the first time for me to write an academic research proposal. Writing this proposal was very instructive for me: it helped me to limit the scope of the research project so I could finish it within the time constraints, it helped me in determining the research questions and the necessary literature and provided me with a solid planning. I learned a lot from this phase.

After approval of the research proposal I started with the literature study. I read literature about the quality aspects of modeling methods, communication and facilitating decision making and attended the Business & Information architecture course at the Capgemini University at Les Fontaines in France. This course gave me an insight of IAF version 4 and the way IAF is suitable for modeling services. I found a lot of literature out there and I had to push myself in limiting the literature I wanted to use in this research project.

For the first set of criteria I organized a workshop with enterprise architects. I thought I had prepared the workshop well. In spite of this preparation a lot of the time was spend on a (very good) discussion about the definition of a service. Some architects were not in favor of the IAF definition of a service and liked the OASIS or their own definition better. This discussion was very useful for me but I decided to stick with the IAF definition of a service since IAF was also the architecture framework I use in this research project. The other criteria were drawn up based on literature study and the necessary artifacts of the IAF for these types of engagements. Determining the criteria was the most difficult, but very instructive, part of this research project for me. I learned, amongst others, that even if Capgemini uses IAF as the default framework for architecture engagements, not all architects agree on the definitions used. This might also explain why there is not default modeling method for architects within Capgemini.

When I wrote the research proposal, at first I planned to study the modeling method too so I could evaluate them. This would provide me with a further understanding of the modeling methods. But due to time limitations I used a different approach to score the modeling methods: I interviewed enterprise architects who applied the modeling method during SOE related engagements. This proved to be very useful too. I met a couple of new collogues and during the interviews we had a few good discussions which gave me a further insight of the modeling method discussed. I also used the interviews to validate the criteria. It was a disappointment for me that I could not find an additional architect for Capability Mapping.

Looking back at this research project I can say that I am glad I did it. It provided me with a lot of information my collogues and I can use in our role as a Business & Information architects. On the other hand I wish I had more time available. This researched was aimed at one architecture framework and three modeling methods were studied and only a limited number of architects were interviewed. This limited number might give a biased result.

If I had to do this research project over again and there were no time constraints, I would have taken a different research approach: after studying literature about modeling and decision making I would have interviewed a significant number of CEO's, CFO's and CIO's and studied a significant number SOE related engagements to determine the criteria for a model. These criteria would be the basis for determining the characteristics of the ideal modeling method. This ideal modeling method would include all architectural aspect area's (business, information, information system and technical infrastructure) as well as all viewpoints (governance and security). Based on this information, the impact on all aspects of an organization can be determined for all types of stakeholders. This ideal modeling method would be used to develop a framework for evaluating modeling methods for their suitability. Then I would score several modeling methods based on literature study and a significant number of interviews with architects with experience in a specific modeling method. Finally I would evaluate these results with people involved in SOE related engagements (CEO's, CFO's, CIO's and architects as well as other stakeholders) where that specific modeling method was applied. This research provides a more scientifically based research project with a larger population of research objects.

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Appendix A: List of criteria

ID	Origin[3]	Classification (Seligman, Krogstie)	Name	Description
C1	L, W, E	Way of modeling, Domain appropriateness	AS-IS & TO-BE	The method should be able to model the current and the future situation of an organization.
C2	W	Way of modeling, Domain appropriateness	Focus	The method should not only focus on functional analysis but also on stakeholder analysis and social and cultural factors.
C3	W	Way of modeling, Domain appropriateness	Abstraction levels	The method should support different abstraction levels.
C4	L, W, E	Way of modeling, Domain appropriateness	Reference models	The method should be able to use reference models. Using existing solutions will ensure the usage of proven concepts and it will shorten the duration of the architecture engagement.
C5	W	Way of working	Scenarios	To method should support scenarios. Scenarios are widely used by corporations to help understand different ways that future events could unfold
C6	L, W	Way of modeling, Comprehensibility Appropriateness	Impact	The impact of each scenario should address people, process, management and information as input for a business case.
C7	L, W	Way of modeling, Comprehensibility Appropriateness	Views	Since every stakeholder had his own specific area of interest, the method should be able to present a stakeholder specific view based on the model.
C7.1	W	Way of working	Stakeholder analysis	The method should have an activity to perform a stakeholder analysis to get insight in their different interests or concerns to enable optimal communication to each stakeholder.
C8	L, E	Way of modeling, Domain Appropriateness	Formality	The level of formality should be *medium*: a certain kind of formalization is necessary but there should be room for skipping or adding concepts/building blocks.
C9	L, E	Way of modeling, Comprehensibility Appropriateness	Quantifiability	The level of quantifiability should be *high*: this information is necessary for designing and decision making.

[3] The origin of a criteria could be literature study (L), workshops (W) (Workshop, 2006) and own experience (E).

ID	Origin[3]	Classification (Seligman, Krogstie)	Name	Description
C10	L, E	Way of modeling, Knowledge Externalizability Appropriateness	Executability	The level of executability is of minor importance. Although it could raise the level of comprehensibility, simulation is hardly ever used during the kind of architectural engagements in the context of this research project.
C11	L, E	Way of modeling, Comprehensibility Appropriateness	Comprehensibility	Level of comprehensibility should be *high*: the modeling method's language should be easy to understand for all stakeholders.
C12	L, E	Way of modeling, Domain Appropriateness	Completeness	Level of completeness should be high: the modeling method's language should be able to represent the artifacts defined by the roadmap for SOE architecture engagements.
C13	W, E	Way of modeling, Technical Actor Interpretation Appropriateness	Intuitive	The modeling language should be intuitive to understand. It is necessary that all stakeholders 'speak' the same language and have the same interpretation of the model.
C14	L	Way of working	Principles	The method should have an activity to obtain principles derived from the business mission, vision and strategy and the business context.
C15	L	Way of modeling, Organizational appropriateness	Principle documentation	The modeling language should enforce to document principles with an unique identification, description, motivation, implication, assurance and a priority
C16	L, E	Way of working	Business mission objectives	The method should have an activity to divert the business mission objectives. This is an activity performed at the Contextual Level.
C17	L, E	Way of working	Business goals	The method should have an activity to obtain business goals.
C18	L, E	Way of modeling, Domain appropriateness	Business activities	The method should be able to model business activities.
C19	L, E	Way of modeling, Domain appropriateness	Business roles	The method should be able to model business roles.
C20	L, E	Way of modeling, Domain appropriateness	Business objects	The method should be able to model business objects.
C21	L, E	Way of modeling, Domain appropriateness	Usage of business objects	The method should be able to model the usage of business objects by business services.
C22	L, E	Way of modeling, Domain	Business services	The method should be able to model business services and link them to

ID	Origin[3]	Classification (Seligman, Krogstie)	Name	Description
		appropriateness		business activities, business goals and business roles
C23	L, E	Way of modeling, Domain appropriateness	Business services relations	The relations between business services should be indicated and modeled in a business service interaction model.
C24	L,E	Way of modeling, Domain appropriateness	Collaboration contracts	The interaction between services should be described in collaboration contracts. The method should be able to model this interaction.
C25	L, E	Way of modeling, Domain appropriateness	Logical business components	The modeling method should be able to support the grouping of business services into logical business components based on different criteria (different viewpoints).
C26	L, E	Way of modeling, Domain appropriateness	Actors	The modeling method should support the grouping of roles into an actor.
C27	L, E	Way of modeling, Domain appropriateness	LBC interaction model	The relations between logical business components (LBC) should be indicated and modeled in a logical business component interaction model.
C28	L, E	Way of modeling, Domain appropriateness	LBC collaboration contracts	The interaction between logical business components should be described in logical business components collaboration contracts. The method should be able to model this interaction.
C29	E	Way of working	Traceability	Decisions in the modeling process should be related to the enterprise strategy and / or a principle.
C30	E	Way of working	Iterative	The modeling method should support an iterative way of working.
C31	E	Way of modeling, Domain appropriateness	Consistency	The modeling method should enforce the consistency en cohesion between different models.
C32	L	Way of thinking	Black-box	The modeling method should focus on describing the output of a service (black-box) and not the way a service is realized (white box).
C33	E	Way of controlling	Controlling	The modeling method should prescribe ways to control the architectural engagement.
C34	E	Way of supporting	Tooling	The modeling method should have a tool to support the modeling process.

Appendix B: Search systems

For this research project I used the following search systems for all literature. All search systems except those marked with a '*' are recommended by the organizers of this education:

- ABI/Inform Global
- JSTOR
- K!New (Knowledgebase of Capgemini) (*)
- Science direct
- Springer Kluwer Online
- Web of science

I added K!New because I want to use relevant information available within Capgemini.

Appendix C: Sheets from workshop

Capgemini

Evaluation of architecture modeling methods for modeling services.
Criteria for modeling services.
Jeroen Cloo

Contents

Research ADW	**15 min.**
Objectives of today	5 min.
Workshops	70 min.

Research ADW – Problem area

- Business need to transform into an SOE

An SOE creates business-driven value by defining and exposing its core business processes to, both the internal and external market, through the use of standardized open technology in the form of reusable services (Capgemini, 2006).

- Services

A service is formulated as something that describes an element of business behavior to achieve a specific business (sub) goal (IAF4.0).

Research ADW – Problem area

- Modeling services versus modeling processes

By processes the mechanism of the process is the key element (what does the process look like?), by services the key element is the deliverable of the service (what does the service deliver?).

- Suitability of method will influence quality of model
- Suitable method

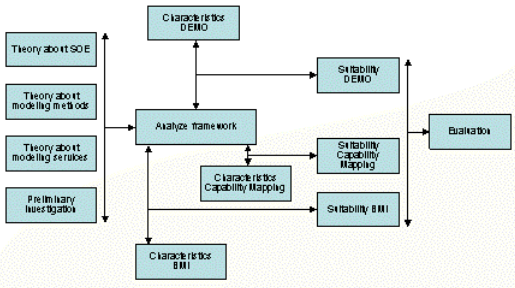
A suitable method, in this research, is a method which facilitates an architect in identifying and defining services and the relation between services so he is able to draw up an optimal Business & Information architecture of the current and/or future state of an organization. The Business & Information architecture can be used by a manager (e.g. CEO, CIO) to support in decision making about the future and strategy of the enterprise.

Research ADW – Research question

What is the suitability of modeling methods currently used within Capgemini by B&I architects for modeling services during SOE engagements?

- Which criteria for modeling methods are relevant for B&I architects for modeling services during SOE engagements?
  - What are universal criteria for modeling methods?
  - Which criteria are relevant criteria for modeling services?
  - Which additional criteria are relevant criteria for modeling services?
- What is the score on the analyze framework of the modeling methods DEMO, BMI and Capability Mapping?

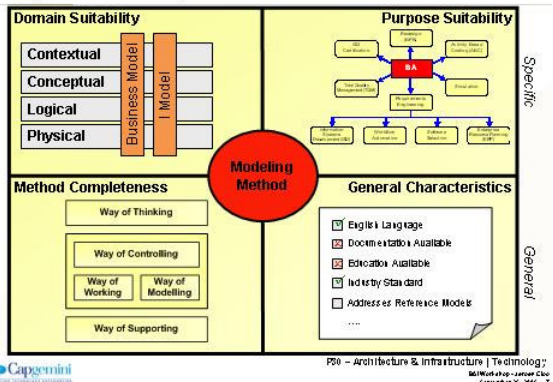
Research ADW – Approach



Contents

- Research ADW
- **Objectives of today**
- Workshops

Objectives of today



Objectives of today

A suitable method, in this research, is a method which facilitates an architect in identifying and defining services and the relation between services so he is able to draw up an optimal Business & Information architecture of the current and/or future state of an organization. The Business & Information architecture can be used by a manager (e.g. CEO, CIO) to support in decision making about the future and strategy of the enterprise.

- Define and prioritize criteria for 'Purpose Suitability'
  - Decision making
- Define and prioritize criteria for 'Domain Suitability'
  - Draw up optimal B&I architecture

Contents

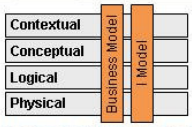
- Research ADW
- Objectives of today
- **Workshops**

Workshop 1 – Criteria for 'Purpose Suitability'

Purpose of the modeling method:
facilitate decision making about transformation into an SOE.

- *Criteria*
- *Objective of the criteria*
- *Relevance of the criteria*

Workshop 2 – Criteria for 'Domain Suitability'



IAF Coverage / Service Orientation
Principles, (business / IS) services, grouping into components, service contracts, ...

Process Modeling
Process steps, events, process logic, AO descriptions, Business Rules, KPI's, ...

Organizational Modeling
Function profiles, roles, actors, responsibilities, function profiles, RACI, ...

Information Modeling
Information products, business object modeling, information objects, create use relations, ...

Appendix D: Questionnaire

Universal criteria

C1: As-Is & To-Be

Does the method support to model the current and the future situation of an organization?

C2: Focus

Does the method focus on functional analysis, on stakeholder analysis and social & cultural factors.

C3: Abstraction levels

Does the modeling method support different abstraction levels for modeling?

C4: Reference models

Does the modeling method support the usage of reference models?

C5: Scenarios

Is the modeling method suitable for working out different / scenarios solution alternatives to facilitate decision making?

C6: Impact

The impact of the scenario / solution alternative should be identifiable. The impact should be specified for people, process, management and information. Is this supported by the modeling method?

C7: Views

Does the modeling method support different views for different stakeholders?

C7.1: Stakeholder analysis

Does the method prescribe an activity for a stakeholder analysis to get insight in their different interests or concerns to enable optimal communication to each stakeholder?

C8: Formality

What is the level of formality of the modeling language? Is there room for skipping or adding concepts / building blocks?

C9: Quantifiability

Does the modeling language support quantifiability between different components?

This information is crucial during the *develop solution* phase (e.g. what quality of service does a service deliver, what is the number of transactions, what is the necessary security level, what is the location of a service) and could also act as input for calculations for a business case (e.g. how many transactions per month, what is the resource usage).

C10: Executability

Does the modeling language models information that may be input for a simulation of the system being developed?

Simulation could be used for discovering errors in the representation of system being developed and may increase the level of comprehensibility of stakeholders (seeing is believing).

C11: Comprehensibility

Is the modeling method's language easy to understand for all stakeholders?

C13: Intuitive

Is the modeling method's language intuitive to understand for all stakeholders?

Criteria for IAFv4 artifacts

C12: Completeness[4]

Is the modeling method's language able to represent the artifacts defined by the roadmap for SOE architecture engagements?

C14: Principles

Does the modeling method have an activity to obtain principles derived from the business mission, vision and strategy and the business context?

C15: Principle documentation

Does the modeling language enforce to document principles with an unique identification, description, motivation, implication, assurance and a priority?

C16: Business mission objectives

Does the modeling language have an activity to divert the business mission objectives?

C17: Business goals

Does the modeling language have an activity to obtain business goals?

C18: Business activities

Is the modeling method able to model business activities?

C19: Business roles

Is the modeling method able to model business roles?

C20: Business objects

Is the modeling method able to model business objects?

C21: Usage of business objects

Is the modeling method able to model the usage of business objects by business services?

C22: Business services

Is the modeling method able to model business objects and link them to business activities, business goals and business roles?

C23: Business services relations

Is the modeling method able to model the relations between business services (e.g. a business service interaction model)?

C24: Business services interaction

Is the modeling method able to describe the interaction between services should in collaboration contracts?

C25: Logical business components

Does the modeling method supports the grouping of business services into logical business components based on different criteria (different viewpoints)?

C26: Actors

Does the modeling method supports the grouping of roles into an actor?

C27: LBC interaction diagram

[4] I will score question C12 based on questions C13 until C28.

Is the modeling method able to indicate relations between logical business components (LBC) and to model them in a logical business component interaction model?

C28: LBC collaboration contracts

Is the modeling method able to describe the interaction between logical business components (LBC) in logical business components collaboration contracts.

Additional universal criteria

C29: Traceability

Does the modeling method prescribe that decisions in the modeling process are related to the enterprise strategy and / or a principle?

C30: Iterative

Does the modeling method support an iterative way of working?

C31: Consistency

Does the modeling method enforce the consistency en cohesion between different models?

C32: Black-box

Does the modeling method focus on describing the output of a service (black-box) and not the way a service is realized (white box)?

C33: Controlling

Does the modeling method prescribe a way to control the architectural engagement?

C34: Tooling

Is the modeling process supported by a tool?

Appendix E: Score of Capability Mapping

For this modeling method Harry Hendrickx filled out the questionnaire.

Harry Hendickx is an enterprise architect at Capgemini. He has about 15 years experience in architecture engagements and 10 years in Capability Mapping. During the last years he was involved in SOE related engagements at 4 large companies. He has applied Capability in 12 non SOE related engagements and 2 SOE related engagements. He also taught Capability mapping during the post academic master education "Architecture in the Digital World".

Overview of Capability Mapping

Capability mapping is a modeling method for determining the strategic positioning of an organization. Capability Mapping is based on theory of Porter (Porter, 1996). Porter distinguishes four basic units of competitive advantage: product development, purchasing, operation and distributing of product or service. Performing these four activities better than rivals do is Operational Excellence. However, Operational Excellence is not sufficient since relative improvement in the productivity frontier does not occur for individual companies and with more competitive convergence, organizations become more indistinguishable from each other. The essence of strategic positioning is to choose activities that are different from rivals. Operational Excellence is about achieving excellence in individual activities, competitive advantage is about combining business services into new products or services.

Capability Mapping focuses on identifying strategic principles and core capabilities. Strategic principles are derived from business goals and business objectives and include long term value, short term revenues, Operational Excellence and competitive edge.

Capability Mapping is used to understand the implications of a strategy by seeing strategy in terms of capability systems. Capability Mapping uses activity-system maps for the visual representation of the model. Capabilities should be described by a name and quality characteristics like necessary people, technology, process, management and information.

Score of Capability Mapping

Capability mapping scores a total amount of 90 points.

The following table shows the average score on each grouping of criteria of the analyze framework:

Grouping of criteria	Average score
Facilitating decision making	1.8
Communication	1.0
Artifacts of the Contextual Level	0.3
Artifacts of the Business Conceptual Level	3.3
Artifacts of the Business Logical Level	3.0
General criteria	2.7

Based on this information, one might conclude that Capability Mapping can be applied for all groupings of criteria and distinguishing the artifacts of the contextual level is the weakest part of this modeling method.

When looking at the detailed score, one might conclude that the weak points of Capability Mapping are providing input for a simulation of the system being developed and that the method does not prescribe a way to control the architectural engagement. Capability Mapping can not be extended to support these criteria.

Harry Hendrickx also provided the following guideline for applying Capability Mapping: use Capability Mapping when the identification and implication of strategy into Business/IT alignment is not an issue. This is a weak point of Capability Mapping.

Detailed score of Capability Mapping

Criterion	Score H. Hendrickx	Motivation H. Hendrickx	Average score[5]
C1	5	For each Capability Mapping (CM) can be used	5
C2	Ex	Implicitly. For each capability and based on strategic principles this extension is very well possible. Per capability different competencies or type of people may be best positioned.	-1
C3	5	Contextual, Conceptual and Logical.	5
C4	5	Capabilities may be generic or could be re-used and adapted easily.	5
C5	Ex	The modeling is suitable for identification of different scenarios. It facilitates to have a comprehensive description of each scenario, meaning that all factors that are relevant for each scenario can well be identified.	-1
C6	5	Also the extension with Dependency Network Diagrams would be very feasible. This enables the systematic analysis of the impact on organization, resources and roles.	5
C7	1	Characteristic is that it presents one shared view based on agreed strategic principles. However, the view of different stakeholders can easily be visualized in a CM.	1
C7.1	Na	Not al all.	-3
C8	3	There is room for adding concepts.	3
C9	Ex	Can easily be added.	-1
C10	Na	I don't know.	-3
C11	5	Yes, it is all business language.	5
C12[6]			3
C13	5	It is all business language.	5
C14	5	The modeling method has a specific procedure to extract strategic principles.	5
C15	Ex	Can be easily extended with such a language to enforce.	-1
C16	3	The mission prescribes the scope of a business. Objectives are deducted from this, and are part of the strategy.	3
C17	5	Explicit procedure to arrive at goals.	5
C18	5	Activities, services or capabilities have all the same dimensions.	5
C19	5	If to the capability authority and tasks are added the role is defined.	5

[5] *Ex* is translated into -1, *Na* is translated into -3
[6] Calculated as an average of question C13 until C28

Criterion	Score H. Hendrickx	Motivation H. Hendrickx	Average score[5]
C20	3		3
C21	4	Yes it can visualize and put objects in context.	4
C22	Ex	Can be easily extended.	-1
C23	5	Very suitable to do this.	5
C24	Ex	The dependency network diagram is an extension that would precisely do this.	-1
C25	5	Capabilities can be easily clustered through the identification of trade offs, synergies or complementarities. Also clustering around strategic principles can be easily done.	5
C26	5	Since dependencies can easily be extracted this is easily done.	5
C27	5	See also 26.	5
C28	Ex	Provides the information, but does not have the specific procedure to do this.	-1
C29	5		5
C30	5	Workshops are used to share the insights of the business and develop.	5
C31	5	Principles are the binding factor to enforce cohesion.	5
C32	5	It enables the description of both.	5
C33	Na		-3
C34	Ex		-1
Total			90

Appendix F: Score of BMI

Criterion	Score B. Sneep	Motivation B. Sneep	Score R. Orlemans	Motivation R. Orlemans	Average score[7]
C1	5		5		5
C2	3	Functional analysis is fully supported (5). Others are *ex*.	3	Functional analysis is fully supported (5). Others are *ex*.	3
C3	5		3	Only 2 or 3 abstraction levels can be applied.	4
C4	5	Objects and functions are implementation independent: general applicable. So you can use reference models.	3	Reference models can be used. They are generally very abstract: difficult to use.	4
C5	Ex		Ex	Not a part of the method.	-1
C6	Na	Only information can be supported	Na	Because BMI is implementation independent and scenario's are not.	-3
C7	1	The only 'good' views are object diagrams.	Ex	Not a part of the method.	0
C7.1	Na		Na		-3
C8	4	Level of formality is high. You could skip some building blocks	2	Level of formality is not very high.	3
C9	Ex		Ex		-1
C10	Na		Na		-3
C11	1		3	But the language can easily be misinterpreted	2
C12[8]	1		1		1
C13	1		1		1
C14	Ex		Ex		-1
C15	Ex		Ex	Not enforced by the method	-1
C16	5	To determine the raison d'être of the organization, not to determine the strategy over 5 years.	5	This is the objective of business function modeling.	5

[7] *Ex* is translated into -1, *Na* is translated into -3

[8] Calculated as an average of question C13 until C28

Criterion	Score B. Sneep	Motivation B. Sneep	Score R. Orlemans	Motivation R. Orlemans	Average score[7]
C17	5	As long as the goals are implementation independent	5		5
C18	Na	Activities are not implementation independent: not supported by BMI	Na	Activities are not implementation independent: not supported by BMI.	-3
C19	Ex	It used to be in the Organization model of BMI. This model is not part of BMI anymore.	Ex		-1
C20	5		5		5
C21	5		5		5
C22	5		3	Only on a very abstract level	4
C23	4		3	Only a hierarchical relation can be modeled.	3.5
C24	Ex		Ex		-1
C25	Na		Na		-3
C26	Ex	It used to be in a previous version of BMI.	Ex		-1
C27	Na		Na		-3
C28	Na		Na		-3
C29	Ex		Na		-2
C30	Na		Na	Not relevant for this level of modeling.	-1
C31	Ex		Na	Depends on the modeler	-2
C32	5		5		5
C33	Na		Na		-1
C34	Na		Na		-1
Total					24.5

Appendix G: Score of DEMO

Criterion	Score H. Goedvolk	Motivation H. Goedvolk	Score M. Op't Land	Motivation M. Op't Land	Average score[9]
C1	5	Demo models are implementation independent	5	Demo is production and product independent	5
C2	Ex		Ex	In *Way of Working* you might want to prescribe which stakeholders should be involved	-1
C3	5		5		5
C4	5	See for example visie.nl	5	Sector specific models could be used as reference models	5
C5	1	Method stops at a certain abstraction level.	3	Only applicable for the production level. Not for product level or higher	2
C6	Ex	This could be derived from a DEMO model	Ex	This is taught at Hogeschool Utrecht (enterprise engineering).	-1
C7	2		Ex	Use common sense	1
C7.1	Ex		Ex		-1
C8	3	Very formal language, little room for adding concepts	3	Very formal language, little room for adding concepts	3
C9	Ex		Ex		-1
C10	Ex	Not a default feature of DEMO	Ex	A DEMO model could be used as a process model for simulation.	-1
C11	5		5		5
C12[10]					1.5
C13	5		5		5
C14	Ex	You need principles when the ontology model is constructed	Ex		-1
C15	Ex		Ex	Because C14 is also Ex	-1
C16	Na		Na		-3

[9] *Ex* is translated into -1, *Na* is translated into -3
[10] Calculated as an average of question C13 until C28

Criterion	Score H. Goedvolk	Motivation H. Goedvolk	Score M. Op't Land	Motivation M. Op't Land	Average score[9]
C17	Ex		Na		-2
C18	5		5		5
C19	5		5	Similar to DEMO Actor Role	5
C20	3		3	Objects are in objectnames, fact-sentences and derivation rules	3
C21	5		5	Part of the Action model	5
C22	5	A DEMO transaction is a Business Service	4	All bus goals	4.5
C23	5	Through actors	5	Through actors	5
C24	Ex		Ex	DEMO models interaction between actors, not services.	-1
C25	3	This are the actors with related processes	Ex	You need criteria for grouping	2
C26	3		Ex		2
C27	Ex		Ex	This is the added value of IAF: you can model the interaction in the IAF	-1
C28	Ex		Ex		-1
C29	NA		Ex		-2
C30	4		5		4.5
C31	5		5		5
C32	Ex	DEMO uses a white box approach, but you can also use DEMO with a black-box approach.	Ex		-1
C33	Na		Na		-3
C34	3	Essential Business Modeler	3	The tool Essential Business Modeler	3
Total					55.5

Appendix H: Examples of models

Capability Mapping

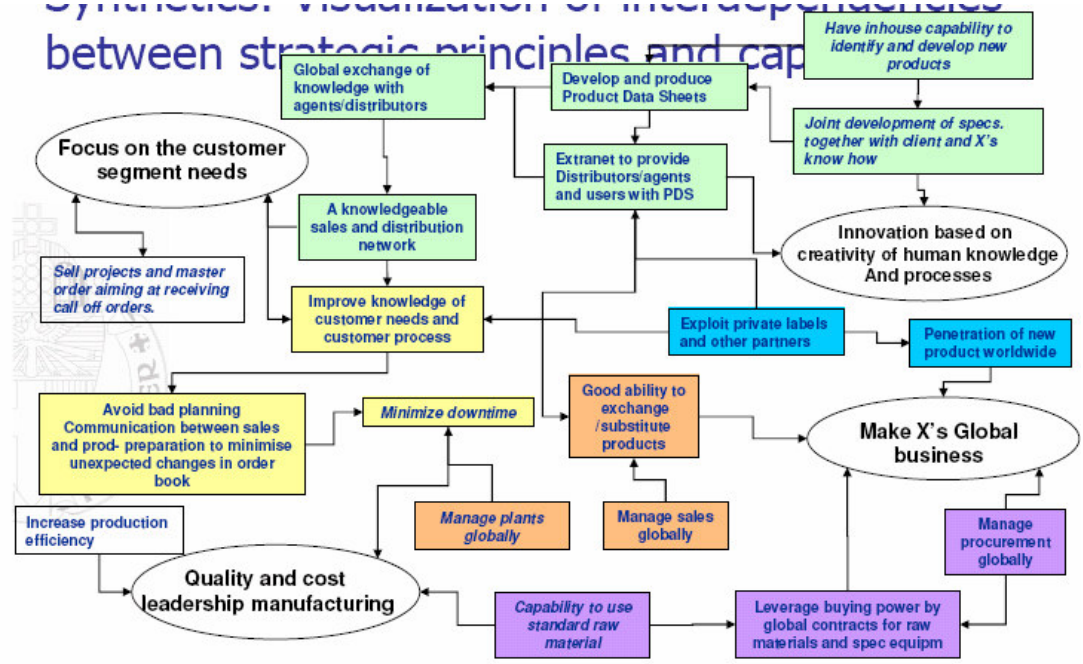


Figure 11; Example of a Capability Map

BMI

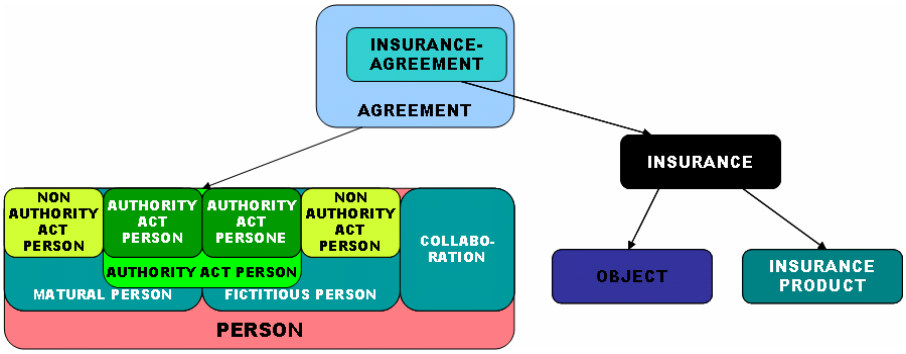


Figure 12: Example of a BMI Business object model

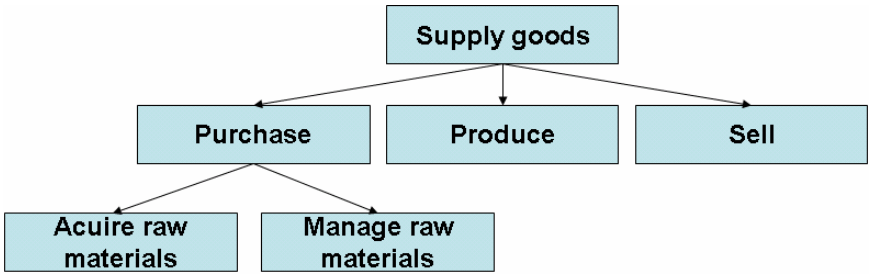


Figure 13: Example of a BMI Business function model

Interaction-matrix	Object 1	Object 2	Object 4
Function1	D		U
Function2	U	U	D
Function3	U		D/U

Figure 14: Example of a BMI Business interaction model

DEMO

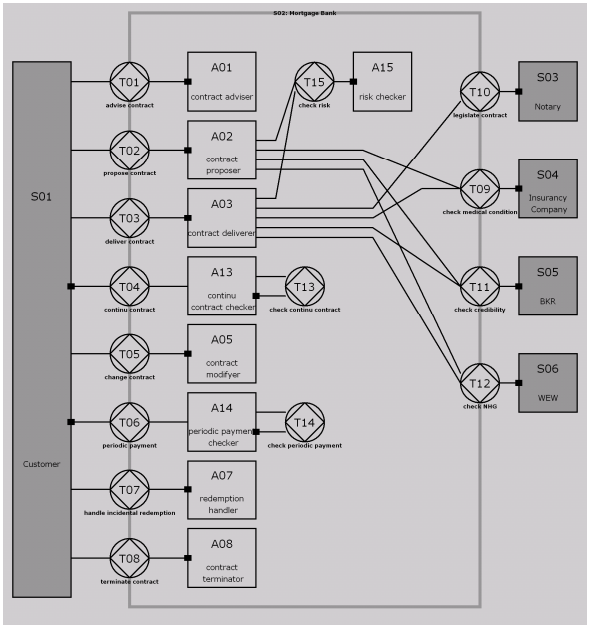


Figure 15: Example of a DEMO interstricion model

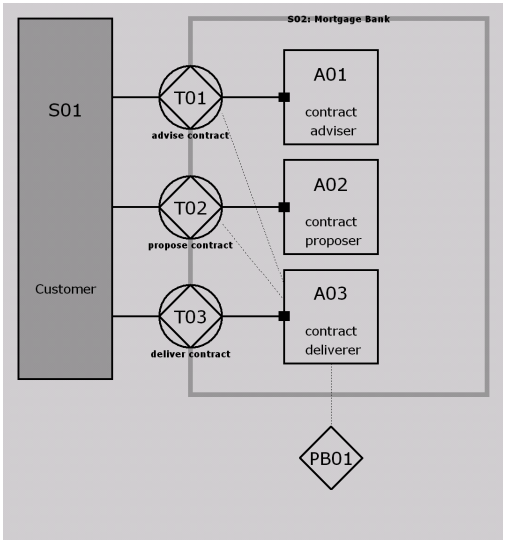


Figure 16: Example of a DEMO construction model