Universiteit Leiden

ICT in Business

Increasing the Benefits of Enterprise Architecture

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Date: 28/08/2013

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MASTER'S THESIS

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Management Summary

Approach

Applying an Enterprise Architecture Framework leads to benefits. The research question of this thesis is: *"How are the benefits of Enterprise Architecture increased by applying an Enterprise Architecture Framework?".* This research question is split into two sub research questions. *R1: "What are the relations between the Enterprise Architecture Content Framework and benefits?", R2: "What are the relations between the Enterprise Architecture Governance Framework and benefits?".* To answer R1 and R2 I structured the research in four steps. These steps were performed at the Dutch operating company of a multinational in the food and beverages sector.

Step 1: Obtain the current state of the Architecture Content and the Architecture Governance Framework

Interviews with the Architects of the case organization were held to describe the current state of the Architecture Content and the Architecture Governance Framework. It was concluded that there were no target Architectures. On the catalog level target standards were defined for the infrastructure layer. The Architects did have a vision of the future IT landscape in their mind, which was used to guide Architecture decisions. Architecture governance processes were not documented.

Step 2: Determine Architecture Maturity, based on the current state of the Architecture Content and the Architecture Governance Framework

An Architecture Maturity Model was selected, the results of step 1 were mapped on this model. It was concluded that the Architecture Maturity level was "Level 2 - Assigned" on the AMM model. The target Architecture Maturity level was "Level 3 - Established". The Maturity targets for the Architecture Content and Governance Frameworks were identified.

Step 3: Determine the improved state of the Architecture Content and the Architecture Governance Framework.

A subset from TOGAF was selected to match the Maturity target, based on the descriptions of the next level in the AMM model. Interviewees were confronted with this subset, the responses led to the creation of a documented improved Architecture Content and Architecture Governance Framework.

Step 4: Research the benefits of the improved Architecture Content and the Architecture Governance Framework.

The improved Architecture Frameworks will lead to a more effective Architecture. This increase in effectiveness will lead to increased Architecture benefits. To determine the relations between the elements of the Architecture Frameworks and benefits, interviewees were asked to describe what the rationale would be to implement an element.

Conclusions and Research Limitations

The answer to the research question is:

A. The benefits of Enterprise Architecture increase as we improve the effectiveness of Enterprise Architecture.

B. The effectiveness of Enterprise Architecture can be improved by increasing our Enterprise Architecture Maturity Level.

C. To increase the Enterprise Architecture Maturity level, we need to select a set of relevant Framework elements and construct a Content and Governance Framework. Those Frameworks need to be aligned with the current and destination Architecture Maturity level.

D. By relating the Framework elements to the generic Architecture benefits, we can justify the investment of resources. This is the rationale to implement the improved Architecture Frameworks.

E. When the improved Architecture Frameworks are implemented, the benefits of Architecture can be measured through KPI's. The insight in the performance of Architecture stimulates the investment of resources in Enterprise Architecture. Thereby the Maturity of Enterprise Architecture can be repeatedly increased, which can lead to more benefits.

The research has been limited to one case organization. This organization had a specific Architecture Maturity level. Future research can be focused on determining the Frameworks required to bridge gaps between the other Architecture Maturity levels. An evolutionary approach to growing an Architecture capability can then be developed. Research on a larger scale will be required to verify that such an evolutionary approach to Architecture Capability Development is usable in multiple, ideally all, organizations.

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1. Research Method

1.1 Introduction to Enterprise Architecture

A common definition of Enterprise Architecture is:

"A coherent whole of principles, methods and models that are used in the design and realization of an Enterprise's organizational structure, business processes, information systems and infrastructure" (Lankhorst et al., 2005)

Enterprise Architecture consists of content (principles, models), which can be structured by using a Content Framework. The methods and processes that develop, apply and maintain the Enterprise Architecture are part of a Governance Framework.

Applying an Enterprise Architecture Framework leads to benefits. These benefits can be tangible or intangible: Cost Efficiency and Business Effectiveness. Business Effectiveness results when a company increases it's market share, beats competitors, improves quality or improves customer relationships. (Buchanan et al., 2002) Other benefits of Enterprise Architecture are: enabling integration, agility and change (Hoogervorst).

1.2 Research Questions

The research question is:

"How are the benefits of Enterprise Architecture increased by applying an Enterprise Architecture Framework?"

This research question is split into these sub research questions:

R1: "What are the relations between the Enterprise Architecture Content Framework and benefits?"
R2: "What are the relations between the Enterprise Architecture Governance Framework and benefits?"

1.3 Research Approach

To answer R1 and R2, I structured the research in four steps.

1. Obtain the current state of the Architecture Content and the Architecture Governance Framework.
2. Determine Architecture Maturity, based on the current state of the Architecture Content and the Architecture Governance Framework.
3. Determine the improved state of the Architecture Content and the Architecture Governance Framework.
4. Research the benefits of the improved Architecture Content and the Architecture Governance Framework.

These steps were performed at the Dutch operating company of a multinational in the food and beverages sector. This company is referred to as "the case company" in the remainder of the document.

I will explain the method used in each step of the research.

Step 1: Obtain the current state of the Architecture Content and the Architecture Governance Framework

The current state of the Architecture Content and Governance Framework was obtained through interviews with the Architects of the organization. They were asked to show or verbally describe the Architecture processes, the Architecture principles and the results of Architectural work, such as visualizations. I asked about roles and responsibilities. The interviews were recorded, transcribed and coded. The analysis of the coded interviews led to a summary of the conclusions of the interview. I then merged the conclusions and confronted all interviewees with the differences in a group workshop, to determine the current state of Architecture.

Step 2: Determine Architecture Maturity, based on the current state of the Architecture Content and the Architecture Governance Framework.

The result from step 1 was the input to determine the Architecture Maturity level. The state of processes, products, Architecture roles, definitions and the view of management on Architecture was collected in this first round of interviews. In step 2 I selected an Architecture Maturity model. I mapped

the interview data on this model to determine the current level of Architecture Maturity. I organized another workshop with the interviewees to conclude the discussion about the Architecture Maturity level.

Step 3: Determine the improved state of the Architecture Content and the Architecture Governance Framework.

In order to improve the benefits of Architecture, we need to improve the effectiveness of Architecture by increasing its Maturity. To achieve this an improved state of the Architecture Content and the Architecture Governance Framework had to be determined. Ideas were obtained from the TOGAF documentation. TOGAF can only be implemented in a big bang manner in an ideal world, were an organization has management buy-in, time and money to implement an extensive Enterprise Architecture method. Interviewees were confronted with a subset of elements obtained from the TOGAF documentation. The idea of using interview data was based on the fact that the answers of the interviewees are related to the Architecture Maturity level of the organization. It is likely that the responses would be positive towards initiatives that fit with the Maturity level and negative towards initiatives that fit with a higher Maturity level. The interviews were recorded, transcribed and coded. The analysis of the coded interviews led to an improved state of the Architecture Content and the Architecture Governance Framework.

Step 4: Research the benefits of the improved Architecture Content and the Architecture Governance Framework.

I asked the interviewees about their arguments for approving or disapproving an Architecture Content or Governance initiative. The coded interviews were used to visualize the relations between the improved state of the Architecture Content and the Architecture Governance Framework and the general Architecture benefits as described by theory. Additional discussions were held with management about measuring the benefits of Architecture. This led to a set of Key Performance Indicators.

1.4 Document Structure

Chapter two, three, four and five cover the research steps described in paragraph 1.3.
In each of these chapters the first paragraph covers the theory that is relevant for the research step. The second paragraph is about the case. In every case paragraph I describe the approach, the obtained data and the analysis and conclusions derived from this data. In chapter six conclusions, research limitations and suggestions for future research are given. In the appendixes I included samples that clarify the research approach.

2. Current state of the Architecture Content and the Architecture Governance Framework.

2.1 Relevant Theory

Any Enterprise Architecture Framework has two key elements. The first is a description of the method by which the Architecting activity should be done, the second is a definition of the deliverables this activity should produce. The majority of the Enterprise Architecture Frameworks is focused on the deliverables. (Goethals, 2003)

We therefore acknowledge a separation of the Architecture Framework into the Architecture Content Framework and the Architecture Governance Framework.

2.1.1 Architecture Content Framework

Architecture Content Frameworks contain the deliverables of Architecture: principles and Architectural representations of the Business, Application and Infrastructure landscapes. Differences between Architecture Frameworks arise in their approach and level of detail (Lise Urbaczewski, 2006). The Zachman Framework describes that an Information System Architecture is relative to the perspective from which it is viewed. Therefore the Zachman Framework contains a set of Information System Architectures, for the different stakeholders. (Zachman, A framework for information systems architecture , 1987) Compared to the Zachman Framework, other Frameworks limit themselves to a small number of viewpoints. (Goethals, 2003)

In paragraph 4.1.1 the theory on Architecture Content Frameworks is continued. TOGAF will be selected and explained. It will serve as a reference framework for the tailored Content Framework (paragraph 4.2.1) for the case organization.

2.1.2 Architecture Governance Framework

An Architecture Governance Framework is the method used to perform Architecture. TOGAF has the Architecture Development Method (ADM) (Tang et al., 2004). An Architecture method is a systematic way to achieve an Enterprise Architecture. In the book “Wegwijzer voor methoden bij Enterprise-Architectuur” eleven Enterprise Architecture Methods are compared (van den Berg, 2009). It is described that the general approach for Enterprise Architecture Methods spans analyzing the business

strategy, defining the principles, defining current and target Architectures, defining migration plans, performing implementation governance and performing Architectural maintenance. The authors conclude that some Enterprise Architecture Methods cover those aspects better than others.

In paragraph 4.1.2 the theory on Architecture Governance Frameworks is continued. TOGAF will be selected and explained. It will serve as a reference framework for the tailored Content Framework (paragraph 4.2.2) for the case organization.

2.2 Case

As described in paragraph 1.3 I conducted interviews with the Architects of the organization to obtain the current state of the Architecture Content and Governance Framework. The results of the individual interviews were merged and discussed in a group workshop with the interviewees.

2.2.1 Architecture Content Framework

To obtain the state of the Architecture Content Framework, I asked about the Architecture products. I was told in advance that there was no structure defined. An Architecture Framework did not exist. I decided to focus on the actual content, the Architecture principles and available Architecture products.

In each of the interviews I asked about the Architecture Principles. The first question was if they had any documented Architecture principles.

A selection of responses:

"Principles about Infrastructure standards are documented."

"We have a standards catalogue for Technical Architecture, dated at around 2006/2007"

"I suggest guidelines to the Technical Architect as I use them in guiding projects"

"Often principles are personal, stored in the minds of persons"

"I have standard building blocks, is that what you mean by principles?"

"We use standards that are defined by the Architect"

From those responses I concluded that there were no documented principles. Upon reviewing the documents mentioned during the interviews, I noticed that those documents all contained standards. Standards are the result of principles being applied. Therefore I asked what principles they use to determine standards. By means of brainstorming, suggesting and asking I obtained different principles from every interviewee.

Every interview led to a set of principles, which was verified in a concluding meeting with every interviewee. An example of such a set of principles can be found in appendix A.2. I merged the results and organized a group workshop to decide on the final Architecture Principles. This led to a set of seven core principles:

1. Maximize the benefit to the local operating company of the case company.
2. Standardize IT Solutions.
3. Maximize IT Solution availability and continuity.
4. Maximize data availability, confidentiality, integrity, authenticity.
5. Uniform master data definitions.
6. Maximize availability and continuity of Technical Infrastructure.
7. Maximize maintainability and flexibility of Technical Infrastructure.

For each of the principles the group identified the rationale and the implications. In Appendix A.1 the principles, rationale and implications are included. The group acknowledged thirty derived principles. These principles are a concretization of the seven Architecture principles. These derived principles can be found in appendix A.3.

In the interviews I asked whether Architecture descriptions and catalogues with building blocks are documented. I have been shown the products that were documented and described. I will list these products.

Catalogs:

- Catalog that maps functional capabilities to applications. Work in progress, not complete.
- Catalog that contains technical infrastructure standards. Building blocks. Work in progress, includes current and target standards.

Architectures:

- Visualization: Current situation of the application landscape. Not kept up to date.
- Visualization: Current relation of the application landscape to the business processes. Not up to date.
- Paragraph in the project plan called “Project Architecture”. This served to describe the relation between a project and the current application landscape. There was no formal check on this paragraph.
- Technical Designs for each project. This was a high level design created by technical consultants, who worked closely with the technical Architect. Focus was on the infrastructure layer. These documents were up to date and created for every project.

I concluded that there were no target Architectures. Definitions of a target application landscape, technical landscape or business landscape did not exist. On the catalog level there were target standards defined on the infrastructure layer. This leads to the situation were a project Architecture can only be related to the current application landscape. The contribution of a project to a target Architecture is impossible when a target Architecture is not defined. However, the Architects do have a vision of the future landscape, which is used to guide Architecture decisions. It should be noted that such a vision is not documented, it is personal and stored in the mind.

2.2.2 Architecture Governance Framework

To obtain the state of the Architecture Governance Framework, I asked the interviewees about the Architecture process. I wanted to know what happens in Architecture practice. There was no documented Architecture process. The process was stored in the minds of people.

In order to obtain information about the process I asked every interviewee what happens in each stage of projects. I also asked how Architecture is involved in the three year planning cycle, on a strategic level. For each interviewee I summarized the results. Those results were confirmed by the interviewee. Such an example can be found in appendix A.4.

Figure one describes the merged Enterprise Architecture Process Model. This is the current state of the Enterprise Architecture Governance Framework. It is not based on a theoretic framework, during the interviews whiteboard drawings were used to visualize the state of architecture.

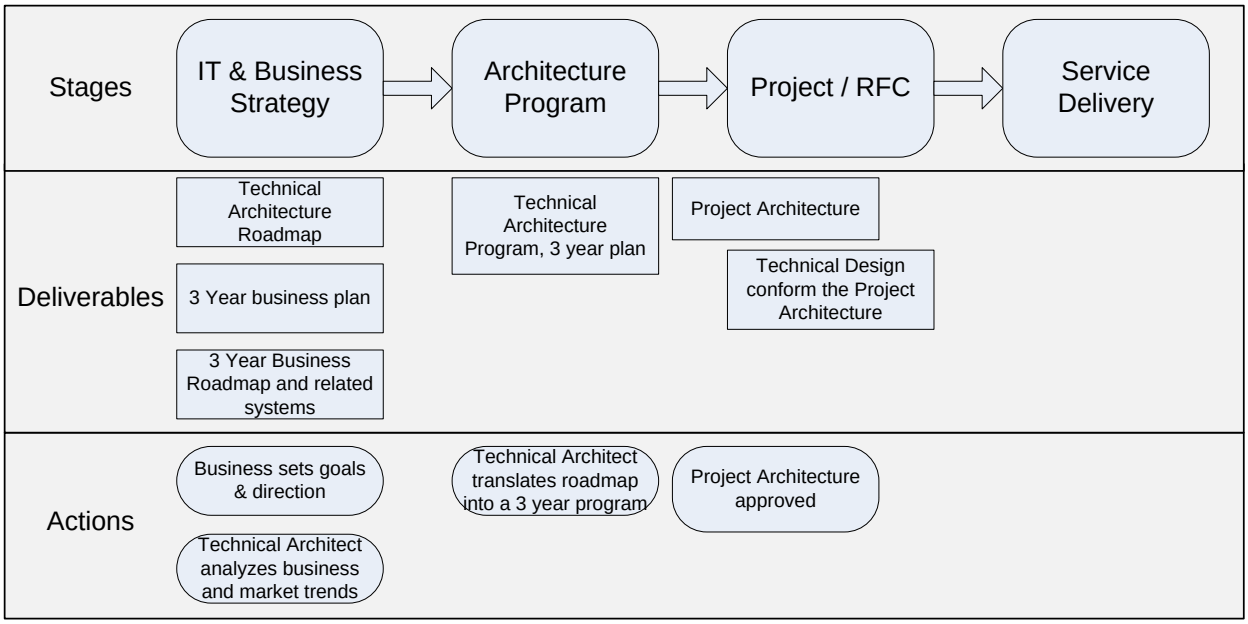

Figure 1 Current state of the Enterprise Architecture Process Model

The stages describe the flow from strategy to Architecture program, projects and operations. The deliverables and actions are actually performed in the current situation. I will highlight a couple of the actions and deliverables.

Business sets goals & direction
Business strategy is determined by the business. They create a 3 year roadmap with related systems. Involvement of the Architects is informal.

Technical Architect creates a 3 year program
The roadmap that is the result of the business strategy process is used by the technical Architect to create a 3 year program. He incorporates business and market trends into this program. Such a program is not created for application Architecture.

Missing: Creating AS IS and TO BE Architectures

The available AS IS Architectures were incomplete and outdated. They are not created by means of a process, only on an ad-hoc basis as one time effort. TO BE Architectures did not exist.

Project Architecture

At the start of each project the project manager was asked to describe how the project relates to the Architecture. This was done in cooperation with the Architects. Architect had to approve this project Architecture.

Technical design conform the Project Architecture

The technical Architecture consultants of the Architecture team create a high level technical design for every project. The implementation of those designs was guided by those consultants.

3. Architecture Maturity Assessment

3.1 Relevant Theory

Architecture Content and Governance Frameworks are extensive. Therefore implementing them is challenging, where to start? Architecture Maturity Models provide stepping stones for implementing Architecture Governance and Content Frameworks.

The purpose of Enterprise Architecture Maturity Models is the same as for any other Capability Maturity Model. The goals are to increase the performance and effectiveness upon achieving a higher Maturity. (Meyer et al., 2011)

The Architecture Maturity Models that I have considered are: IT-CMF, EAMM, ACMM, EAMMF, AMM (Zee et al., 2000), Maturity Model (BiZZdesign, 2007). I based the selection of an Architecture Maturity model on five criteria: Availability (Is documentation of the Framework available), Scope of the model (Strategy, Architecture, Operations), Formulation (Formulation of Maturity levels, SMART definitions) Assessment methods and Maturity Improvement directions (Incorporated best practices to bridge Maturity gaps). These criteria are based on the criteria used in the paper "An Analysis of Enterprise Architecture Maturity Frameworks" (Meyer et al., 2011).

Findings:

- Some Maturity models have a broader scope then Architecture. Included was IT-CMF, excluded for this reason are CMMI, CoBIT/ValIT and SAMM.
- Architecture Maturity Models with descriptions on a macro level are clear, but lack improvement directions. It is limited to a description of the characteristics of each Maturity level.
- Some Architecture Maturity Models are developed for specific (US governmental) organizations.

In my opinion an Architecture Maturity model should describe the characteristics of the stepping stones, without forcing a specific path. The change path is organization specific. A Maturity model should provide guidance for improvement without limiting the improvement.

Model	Availability	Scope	Formulation	Assessment	Improvement directions
AMM (Van der Zee)	Research Report "Architectuur als Management instrument"	Architecture	Limited and high level	Matrix table	Guidelines for Architectural change
IT-CMF	High level, €10.000 for full access	IT organization, 36 IT capabilities	Per IT capability	Questionnaire per IT capability	Per IT capability
EAMM	Freely available	Architecture	Extensive, definitions are detailed	NASCIO Toolkit, survey	None
ACMM	Freely available. Referred to in TOGAF documentation	Strategy, Architecture, Operations	High level, developed for United States Department of Commerce	Scorecard. Maturity level per area	None
EAMMF	Freely available	Architecture	Detailed, developed for US government	Implemented practices	Practices and deliverables to implement
Maturity Model (Bizzdesign)	Handbook Enterprise Architecture (BiZZdesign, 2007)	Architecture	Appears to be based on EAMM, inconsistent definitions	Matrix table	None

I organized a workshop session to discuss the state of Architecture Maturity. The reference I used for this discussion was the Bizzdesign Maturity Model from the Handbook Enterprise Architecture (BiZZdesign, 2007). This led to discussion about the detailed formulations of the maturity levels. The participants did not appreciate this Maturity Model, because the detailed descriptions gave the impression that architecture had to be implemented in a very specific way. (Workshop, January 2013) After analyzing the transcript of the workshop I selected the AMM model from van der Zee. (Zee et al., 2000) I mapped the results from the workshop on the AMM and presented the result in a second workshop on Architecture Maturity.

Figure 2 displays the maturity model. It contains five levels. At level zero the organization associates architecture with a fear for bureaucracy. At level one, awareness, the organization has a global idea of the benefit of architecture. At level two, assigned, a role is defined and an architect has been appointed. At level two the effectiveness of Architecture depends on the efforts of a person. At level three, established, there is a process driven Architecture effort in several areas. Processes drive Architecture. At level four, policy, Architecture is accepted and is a part of policy. At level five, acknowledged, architecture is a part of organizational culture. At this level the management focus is on continuous improvement of the results that investments in architecture generate.

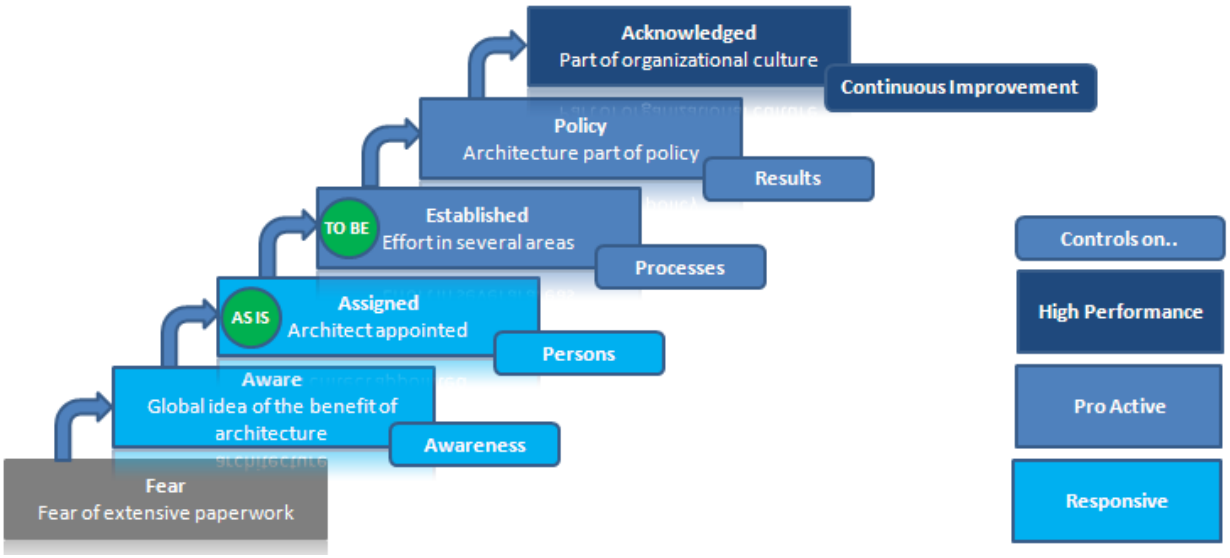

Figure 2 Architecture Maturity Model (AMM), van der Zee, translated to English

This Maturity model describes the characteristics of the different Maturity levels without forcing a specific implementation path. The table describes for every maturity level the role of management, the state of definitions, the role of the architect, the state of processes and the state of products.

Level	Management	Definitions	Role Architect	Process	Products
1 – Aware	Is probing	Cautious first attempts	Not appointed	Not described	General idea
2 – Assigned	Controls on persons	Workable, formalizing	Appointed	General described per discipline	Acknowledged
3 – Established	Controls on processes	Known and acknowledged	Responsible for the process	Alignment between disciplines	Described unambiguously and aligned with each other
4 – Policy	Controls on results	Known and acknowledged	Responsible for the results	Integrated description	Consistent to vision
5 – Acknowledged	Controls on continuous improvement	Known and acknowledged	Initiates continuous improvements	Optimized	Are highly effective

I was surprised that Architecture Frameworks do not describe their relation to Architecture Maturity models. TOGAF refers to the ACMM model, but there is no relation between the implementation steps of TOGAF and the Maturity levels of the ACMM model. It appears that an organization is expected to implement a full Framework, regardless of their Maturity level. I would expect that such a big bang implementation of an Architectural Framework would lead to high costs, while the benefits are unclear. Apart from this negative business case I expect that the cultural change would be large and therefore difficult to successfully realize.

3.2 Case

As described in paragraph 1.3 the information about the current state of the content and governance Framework was used to determine the Architecture Maturity level. In this step I selected an Architecture Maturity model through literature research, as can be read in paragraph 3.1.

Based upon analysis of the interviews about the current state of the Architecture Content and Governance Framework, I concluded the Maturity by mapping quotes to the descriptions in the table. This matrix is from the documentation of the Architecture Maturity Model (Zee et al., 2000).

As an example I will explain why the role of the Architect is appointed, level 2. The conclusion "appointed" is based on the following quotes from interviews:

"The manager of the Project Management Office has delegated decisions about Architecture to the Architects".

"The Business IT Manager is the contact person for the business."

"A difference with a couple of years ago is that there always needs to be someone involved from team Architecture before a project can be started."

"At the start of a project I create a high level technical design, a concretization from the project Architecture. I then ask the technical Architect whether he agrees to this design. When I don't forget it I also ask the application Architect whether he knows of this project".

"The application Architect determines whether the business needs a system."

"In the intake phase of a project the role of the Architect is to review new functionality that is added to the organization. For technical infrastructure the technical Architect has this role".

In these quotes it is clear that the Architect is not responsible for a process. He is a contact person for the Business IT Manager, through this line requests for projects arrive. He is also a sparring partner for the technical consultants that translate a project Architecture into concrete high-level designs.

Level	Management	Definitions	Role Architect	Process	Products
1 – Aware	Is probing	Cautious first attempts	Not appointed	**Not described**	General idea
2 – Assigned	**Controls on persons**	**Workable, formalizing**	**Appointed**	General described per discipline	**Acknowledged**
3 – Established	Controls on processes	Known and acknowledged	Responsible for the process	Alignment between disciplines	Described unambiguously and aligned with each other
4 – Policy	Controls on results	Known and acknowledged	Responsible for the results	Integrated description	Consistent to vision
5 – Acknowledged	Controls on continuous improvement	Known and acknowledged	Initiates continuous improvements	Optimized	Are highly effective

This table was introduced in paragraph 3.1. It describes the characteristics of each of the levels of the Architecture Maturity Model. The colored fields are the current level of Architecture Maturity. This has been determined by analyzing the interviews. In paragraph 3.2.1 and 3.2.2 I will explain the results that led to these conclusions.

The Maturity level was verified by a group workshop. An interview with the domestic IT manager was held to obtain management buy-in on the conclusions. In paragraph 3.2.1 and paragraph 3.2.2 the Maturity level of every area is explained.

3.2.1 Architecture Content Framework

Definitions – Workable, formalizing

On some areas the organization clearly reached this Maturity level. For every project a Technical Architecture documented is created. A formal template is used, the document is known and acknowledged. Other Architecture definitions do not have this level of Maturity.

For example, AS IS Architectures of the technical and application layer are outdated and incomplete. Definitions of the TO BE Architecture are non-existent. Decisions about Architecture are made on a per-project basis. Because there is no reference TO BE Architecture, this decision is based on the experience and knowledge of the Architect. It is difficult to determine whether a project contributes to the long-term Architecture.

Products – Acknowledged

Technical Architecture has some deliverables, mainly on the project level, that are being updated regularly and are used consistently. Application Architecture is developing a catalog that lists functional and information capabilities. Those are mapped on standard applications.

3.2.2 Architecture Governance Framework

Management – Controls on persons

The Architects are persons, processes have not been defined. Management controls Architecture by steering those persons.

Role Architect - Appointed

Architects are appointed for Technical Architecture (1fte), Application Architecture (0,5fte), Business Intelligence (embedded in function program manager) and e-Business Architecture (embedded in function Senior e-Business Consultant). There are also project Architecture consultants appointed (3fte).

One interviewee mentioned that “There is not enough time available for Architecture”. Another interviewee mentioned that a concession on quality is made by only appointing 0,5fte to the application Architect function.

The Architect does not have mandates, there is no reason as he's not held accountable for anything. Thus a project manager, being accountable for executing a project within time and budget, can choose to dispose the judgment of the Architect. I think that the role of the Architects is not clear due to a lack of processes that are associated to the role.

Process – Not described

The project management process is well-developed and executed. Enterprise Architecture doesn't have documented processes, therefore it is uncertain whether Enterprise Architecture is doing the right thing. Enterprise Architecture gives direction to projects in an informal manner, judgment is based on experience / gut feeling and limited Architectural descriptions. Catalogs are maintained by Enterprise Architecture, in an informal manner.

A high level TO BE Architecture for the Technical Architecture is updated on an ad-hoc basis. There is no TO BE Architecture of the future application landscape. Business Architecture is out of scope. Business Process Management maintains process descriptions. Those processes are published on the intranet. The processes are accessed by the application Architect when knowledge about a process is required. There are no descriptions of target processes.

3.2.3 Target Architecture Maturity

A characteristic of Maturity models is that an organization can only improve a capability by one step at the time. It's not possible to skip steps. The TO BE ambition for the case company is Level 3: Established. This means that the targets for each of the areas are:

Architecture Content Framework

1. Definitions – Known and Acknowledged.

2. Products - Described unambiguously and aligned with each other.

Architecture Governance Framework

1. Management – Controls on processes.

2. Role Architect – Responsible for the process.

3. Process - Alignment between disciplines.

By modifying the Architecture Content Framework and the Architecture Governance Framework to match the characteristics of the target Maturity level, we can increase Architecture Maturity.

4. Improved state of the Architecture Content and the Architecture Governance Framework

4.1 Relevant Theory

In the previous chapter we determined the TO BE Maturity level that the case company aims for. The Architecture Maturity Model (Zee et al., 2000) was used. Goals for the Architecture Content Framework are: Known and acknowledged definitions and properly defined Architecture products. Goals for the Architecture Governance Framework are: Management controls on processes, the Architect is responsible for the process, and the processes between disciplines are aligned.

In order to realize each of these goals, improvements for the Architecture Content Framework and Architecture Governance Framework need to be implemented. To determine these improvements, I will review the literature for best practices and combine this information with case data.

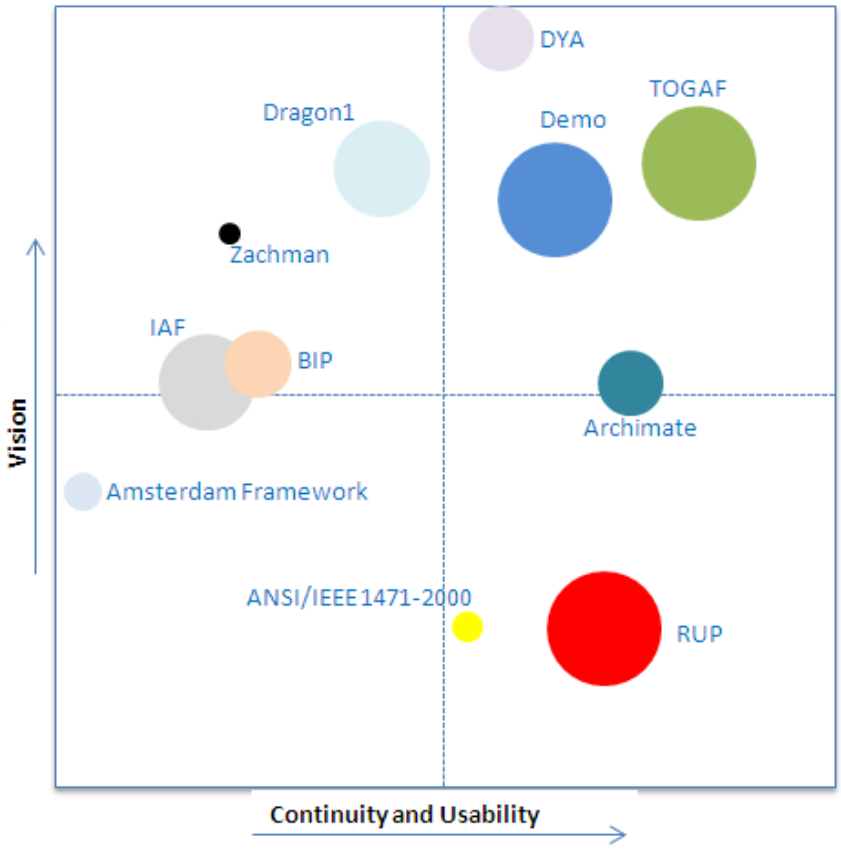

Figure 3 Comparison of EA Frameworks (van den Berg, B. B., Wegwijzer voor methoden bij Enterprise Architectuur)

This matrix gives an overview of the different Architecture Frameworks. The Frameworks are mapped on their depth of vision and on usability and continuity. According to this matrix DYA, Demo, TOGAF and Archimate as the most complete methods for Enterprise Architecture.

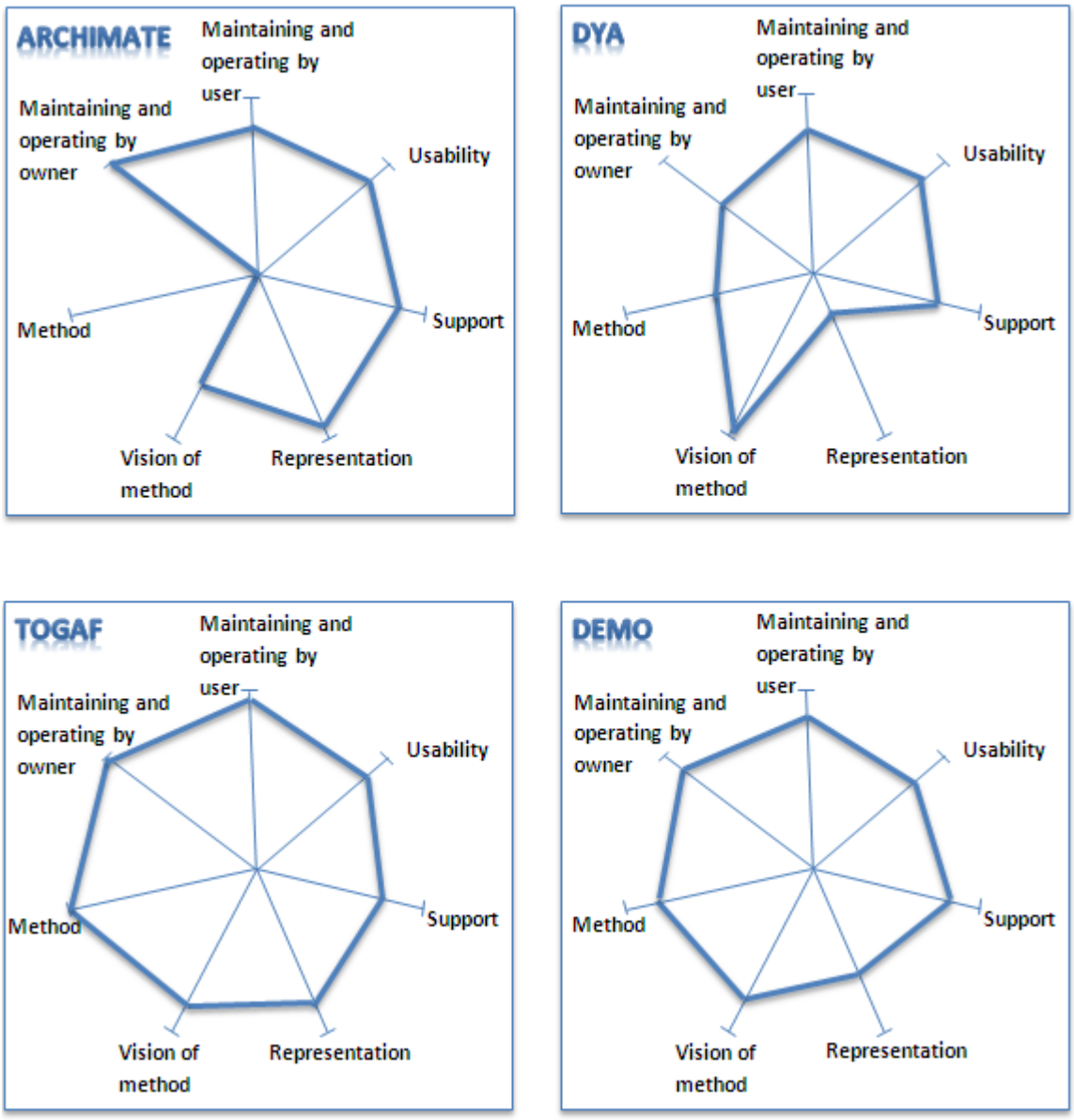

Figure 4 Characteristics of Archimate, DYA, TOGAF, DEMO (van den Berg, B. B., Wegwijzer voor methoden bij Enterprise Architectuur)

I selected TOGAF as a reference framework for the case organization. The case organization is a domestic operating company of a multinational in the food and beverages sector. DYA is mostly used within the Netherlands, while Archimate and DEMO are not as complete as TOGAF. The TOGAF documentation is an extensive reference work. Organizations can pick elements of TOGAF and implement it in their own Architecture Content and Governance Framework. I will zoom in on the TOGAF Framework in the next paragraphs.

4.1.1 Architecture Content Framework

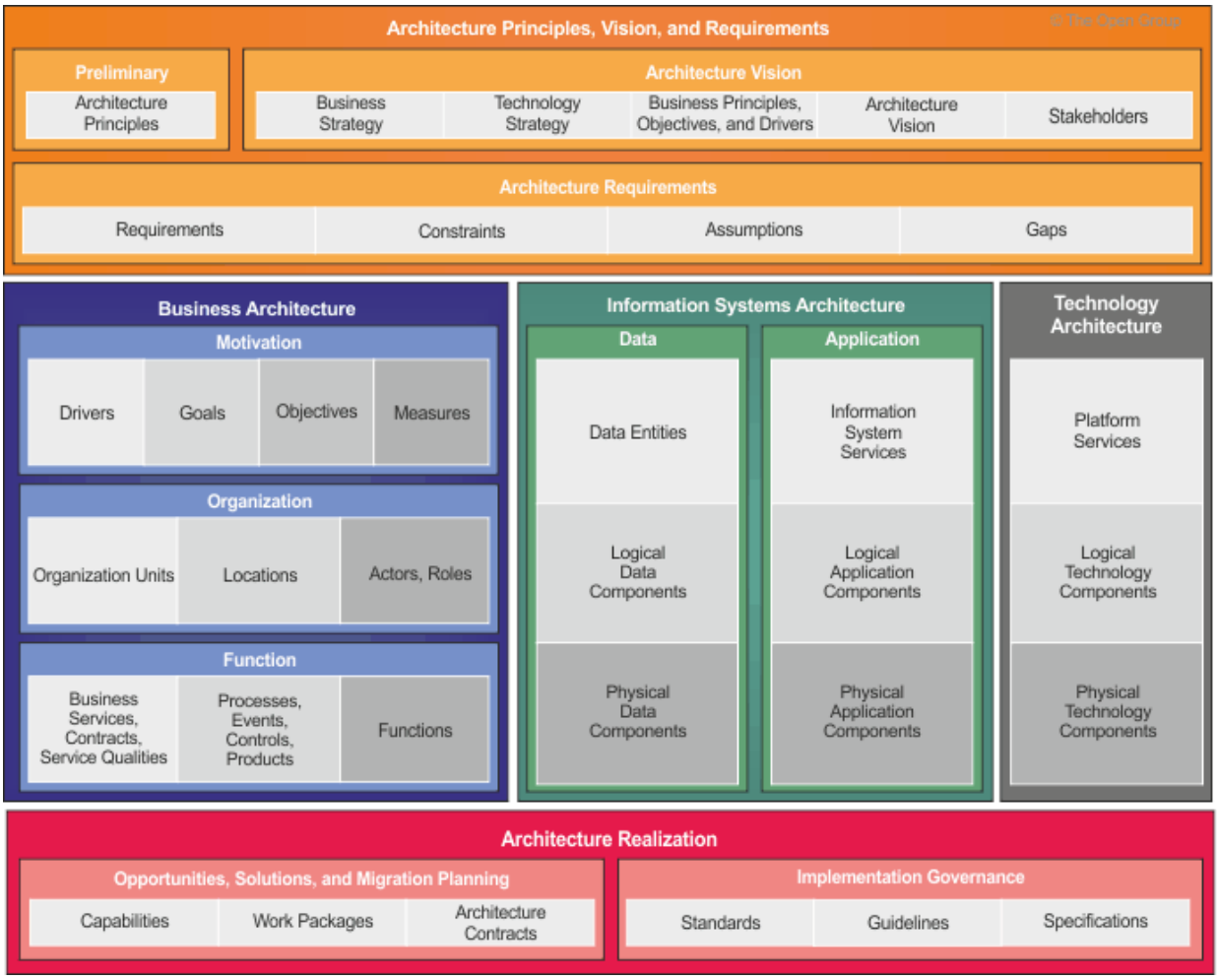

Figure 5 TOGAF Architecture Content Framework (TOGAF 9 online documentation, Chapter 33)

The Architecture Content Framework is used to store the Architecture products. Artifacts are sub products. Each Architecture product consists of one or multiple of artifacts. Building blocks are also acknowledged, these are reusable components that can be used to compose Architectures.

I will explain the elements of the TOGAF Content Framework as described in chapter 34 of the TOGAF 9 online documentation. They are presented as a list in the table. The column "Case Framework" will be used in paragraph 4.2.

Content Framework Elements	TOGAF	Case Framework
Architecture Principles		
Architecture Vision		
Architecture Requirements		
Category: Business Architecture		
Motivation (e.g. Drivers, Goals, Objectives, Measures)		
Organization (e.g. Organization Units, Locations, Roles)		
Function (e.g. Business Services, Processes, Functions)		
Category: Information Systems Architecture		
Data (e.g. Data Entities, Data Components)		
Application (e.g. Application Components, Services)		
Category: Technology Architecture		
Platform Services		
Technology Components		

Architecture Principles

Architecture principles give direction to Architecture decision making. The definition in the TOGAF documentation for Architecture principles is: *"Architecture principles are general rules and guidelines, intending to be enduring and seldom amended, that inform and support the way in which an organization sets about fulfilling its mission".* The sub-product (artifact) is the "Principles Catalog".

Architecture Vision

In the TOGAF content framework the Architecture Vision category describes the vision of Architecture. This is based on the business and technology strategy. Business principles, objectives, drivers and

stakeholders are complementary to the Architecture Vision.

The sub-products (artifacts) are:

- Stakeholder Map Matrix
- Value Chain Diagram
- Solution Concept Diagram

Architecture Requirements

Architecture Requirements describe the scope and goals of an Architectural effort. Constraints limit the possibilities, budget requirements are a clear constraint. The sub-product (artifacts) is the "Requirements Catalog".

Business Architecture

The Business Architecture represents business goals, the organizational structure and the business processes. It is summarized in the TOGAF content framework as motivation, organization and function.

The sub-products (artifacts) are:

- Organization / Actor Catalog
- Role Catalog
- Business Service / Function Catalog
- Business Interaction Matrix
- Actor / Role Matrix
- Business Footprint Diagram
- Business Service / Information Diagram
- Functional Decomposition Diagram
- Product Lifecycle Diagram

Information Systems Architecture

The Information Systems Architecture represents data and application components. The relationship to the Business Architecture is also described. An example is an artifact that describes the relation between applications and organizational roles.

The sub-products (artifacts) are:

Data

- Data Entity / Data Component Catalog
- Data Entity / Business Function Matrix
- Application / Data Matrix
- Conceptual Data Diagram
- Logical Data Diagram

Application

- Application Portfolio Catalog
- Interface Catalog
- Application / Organization Matrix
- Role / Application Matrix
- Application / Function Matrix
- Application Interaction Matrix
- Application Communication Diagram
- Application and User Location Diagram
- Application Use-Case Diagram

Technology Architecture

The Technology Architecture represents platform services and technology components. The relationship to the Application Architecture is also described.

The sub-products (artifacts) are:

- Technology Standards Catalog
- Technology Portfolio Catalog
- Application / Technology Matrix
- Environments and Locations Diagram
- Platform Decomposition Diagram

4.1.2 Architecture Governance Framework

The Architecture Development Method (ADM) is the core of TOGAF's Architecture Governance Framework. This method is an iterative process model that enables organizations to develop, to maintain and to apply Architectural content. Organizations are free to add, change or remove steps of the ADM.

Central in the ADM are requirements, in the ADM requirements management interacts with every step. A critical note on the ADM is that it is "heavyweight", a lot of paperwork can be produced if it is implemented page by page. I will explain the elements of the ADM.

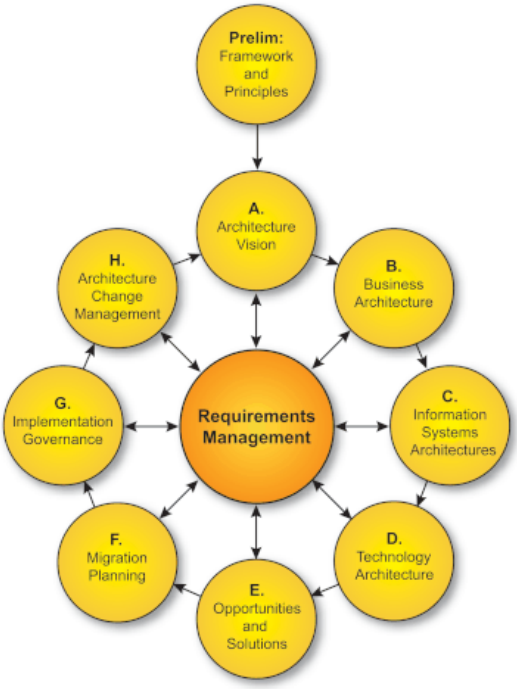

Figure 6 TOGAF Architecture Development Method (TOGAF 9 online documentation, Chapter 5)

I will explain the process elements of the ADM, the basis of the TOGAF Governance Framework. They are presented as a list in the table. The column “Case Framework” will be used in paragraph 4.2.

Governance Framework Elements	TOGAF	Case Framework
Defining Architecture Principles		
Defining Content Framework		
Evaluating Architecture Maturity		
Defining scope of Architecture Development		
Defining business drivers of Architecture Development		
Category: Developing Architectures		
Developing a baseline Architecture		
Developing a target Architecture		
Performing a gap analysis		
Category: Developing Roadmaps		
Identifying business opportunities		
Identifying (financial) constraints		
Creating a high level migration roadmap		
Validating risks		
Estimating benefits		
Category: Architecture Implementation		
Defining project Architectures		
Performing compliance assessments		

Prelim

This phase is outside the iteration. It is about defining the Architecture Principles, Content Framework, evaluating the Architecture Maturity and defining the relationships between the different management Frameworks which an organization employs.

A. Architecture Vision

In this phase the scope of the Architectural effort of the iteration is being determined. The purpose, often business drivers, for the iteration are being determined.

B, C, D. Business, Information and Technology Architecture

In these phases the Architecture is assembled in three layers. Each of these phases consists of three steps: Develop the baseline Architecture, develop the target Architecture, and performing a gap analysis. The gap between the baseline and the target Architecture description is the input for the next steps.

E. Opportunities and Solutions

This phase is about determining the opportunities and solutions for a best-fit Architecture roadmap. The goal is to implement the target Architecture in a way that incremental business value is added. Therefore it is desired to sail on the waves of business changes, it is in these changes that the benefit of Architecture can be made clear, which leads to organizational readiness. Additionally constraints need to be identified, for example financial resources. The result of this phase is a high-level migration roadmap.

F. Migration Planning

In this phase a detailed best-fit Architecture migration roadmap is developed. This is done in cooperation with other management Frameworks in the organization that impact the Architecture. Business planning, portfolio management and operations management all impact the migration roadmap.

For each step on the migration roadmap, risk validation and a benefit estimate can be performed, to support prioritization.

G. Implementation Governance

In this phase conformance of implementation projects with the Target Architecture is ensured, by performing the appropriate Architecture Governance functions. Examples are compliance assessments, assessing project scope definitions and defining a high level project Architecture.

H. Architecture Change Management

A need can arise for a change of the target Architecture and the roadmap. Examples are changes in business strategy, resource availability and operations management. This phase is about managing the impact of these changes on the Architecture migration projects.

4.1.3 EA Maturity and TOGAF

The authors of the book “Digitale Architectuur” describe that the risk exists that TOGAF becomes a paper exercise where the conversation with the business is easily forgotten (Kruiswijk et al., 2012). This is related to the high amount of documenting that is suggested by TOGAF. An Architect can spend a lot of time delivering all kinds of prescribed documents.

Organizations that are new to Enterprise Architecture do not want a lot of paperwork. Capability Maturity models describe how an organization can incrementally grow a capability. Architecture is a capability that should be grown incrementally. TOGAF does not contain a Maturity model. In paragraph 51.5 of the TOGAF 9 documentation it is described that future versions of TOGAF may include a Maturity model to measure the adoption of TOGAF itself.

TOGAF gives organizations the freedom to implement a set of best practices from the large documentation, but does not give suggestions related to the current Architecture Maturity of an organization. This is a weak spot, and is a challenge for every organization that wants to implement an Architecture governance and content Framework.

4.2 Case

In paragraph 3.2.3 the target Architecture Maturity was identified. As described in paragraph 4.1.3, Architecture Frameworks such as TOGAF do not explain what parts of the Framework should be implemented to achieve a certain level of Maturity. As explained in paragraph 1.3, the presented content and governance Framework are based on TOGAF. The Frameworks are based on elements from the TOGAF documentation. The selection of elements is based on interview data. Interviewees were asked how Enterprise Architecture should be organized. They were also confronted with idea's. For each idea the "why" question was asked. The response was used as an indicator to identify whether the idea matches the Architectural Maturity level. Interviews were recorded, transcribed and coded to identify the elements that received positive responses.

Before presenting the Architecture Content and Governance Framework for the target Maturity level in paragraph 4.2.1 and 4.2.2, I will present direction setting quotes derived from the interview data:

- "There is no reference Architecture, the contribution of a project to a future IT landscape cannot be measured".
- "Business strategy and global IT strategy have been unstable in the past, making it impossible for Enterprise Architecture to align".
- "Enterprise Architecture should use the momentum of business changes to prove its value. Examples are Supply Chain 3.0 and Global Business Services".
- "Enterprise Architecture needs to be involved early in the inception of projects".
- "Required stakeholders in the Architecture development and implementation governance are Service Delivery, Architecture Team, Business IT Managers and the customer".
- "Enterprise Architecture implementation governance should be done via tollgate checks".
- "The project manager is accountable for the implementation of a project within the boundaries set by the Architecture".
- "The Architect is accountable for the Architecture and the implementation governance. The Architect should have a mandate to pause a project when its contribution to the Architecture is in danger".
- "There is not enough time and budget available for Enterprise Architecture".

These quotes contain direction setting information. It appears that reference Architectures are important. This requires a process in the Governance Framework and storage in the Content Framework. The mention that there is not enough time and budget means that Enterprise Architecture will need to prove its value without large investments of resources. Therefore Architectures should be created only at the moment that they are required. A reference Architecture can be created when a strategic change occurs. After the implementation, this Architecture can be used as an AS IS Architecture. Architecture should use the momentum of business changes. Their appears to be a need for clear roles and mandates. It is interesting that it was mentioned that there is a lack of time and budget for Enterprise Architecture. Enterprise Architecture needs to prove its value without creating a lot of overhead. Architecture compliance is an essential part of the governance of the Architect. The responsibility for compliance to the Architecture is shared with the project managers.

4.2.1 Architecture Content Framework

In paragraph 4.1.1 I explained the Architecture Content Framework of TOGAF. This Framework contains a lot of different blocks and stores a lot of different Architectural (sub-)products. For the case company I created a Content Framework tailored to the Maturity level with a smaller amount of Architectural (sub-)products. This tailored Content Framework allows the organization to achieve level 3 on the Architecture Maturity Model (AMM). As described in the table in paragraph 3.2 this means that the following characteristics need to be achieved:

1. Definitions – Known and Acknowledged.

2. Products – Described unambiguously and aligned with each other.

The table gives a summarized overview of the differences between the TOGAF Content Framework and the tailored Content Framework. The colors green, orange and red respectively mean that an element is included, partly included, or not included..

Content Framework Elements	TOGAF	Case Framework
Architecture Principles		
Architecture Vision		
Architecture Requirements		

Category: Business Architecture		
Motivation (e.g. Drivers, Goals, Objectives, Measures)		
Organization (e.g. Organization Units, Locations, Roles)		
Function (e.g. Business Services, Processes, Functions)		
Category: Information Systems Architecture (Application Architecture)		
Data (e.g. Data Entities, Data Components)		
Application (e.g. Application Components, Services)		
Category: Technology Architecture		
Platform Services		
Technology Components		

The tailored Architecture Content Framework is presented in Figure 7.

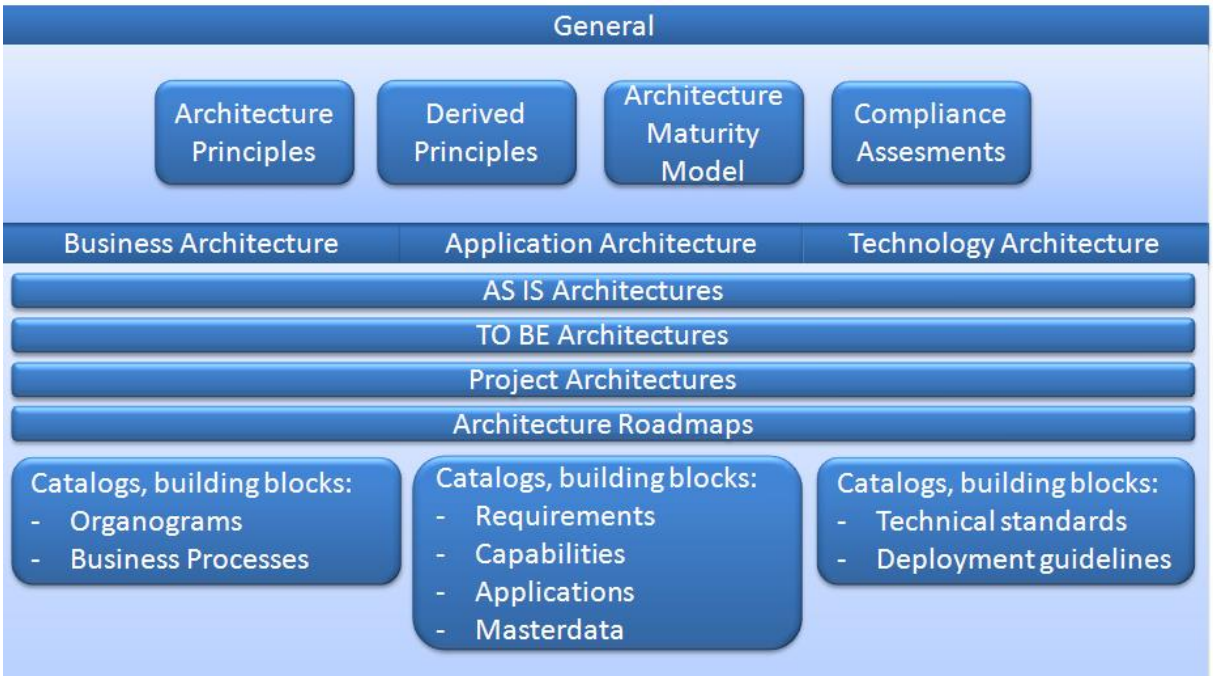

Figure 7 Architecture Content Framework for the case company

I will describe the differences on the level of sub-products, this will explain how some elements are partly included in the tailored Content Framework.

General

Architecture principles are stored in this category. In TOGAF the sub-product (artifact) is called the "Principles Catalog". The derived principles are concrete translations of the high-level Architecture principles. The need for derived principles is related to the low maturity of the organization. The Architecture Maturity Model is stored to keep track of Architecture Maturity. Compliance Assessments contain the results of the governance process "Architecture Implementation Governance" (presented in paragraph 4.2.2).

Business Architecture

The Business Architecture consists of a catalog with the building blocks Organograms and Business Processes. These building blocks can be used in the products AS IS Architectures, TO BE Architectures, Project Architectures and Architecture Roadmaps. In paragraph 4.1.1 it was explained that TOGAF acknowledges nine sub-products. Of those nine the Organization / Actor catalog relates to the building block organograms, the Business Service / Function Catalog relates to the processes. An advantage of the Business Architecture Catalog is that business processes and organograms were documented and available in the case organization.

Application Architecture

The Application Architecture is called Information Systems Architecture in TOGAF. In the case organization the function Application Architect existed, which included applications and data. Therefore the tailored Content Framework speaks of Application Architecture instead of Information Systems Architecture. The Application Architecture Catalog contains four building blocks: Requirements, Capabilities, Applications and Masterdata. These building blocks can be used in the products AS IS Architectures, TO BE Architectures, Project Architectures and Architecture Roadmaps. In paragraph 4.1.1 it was explained that TOGAF acknowledges fourteen sub-products. Requirements and Capabilities were accepted terms in the case organization. An application portfolio catalog existed, but the term applications was used. The case organization preferred not to introduce new terms if it could be avoided. Like other areas, this area of an Architecture Framework is simplified to match the maturity level of the organization.

Technology Architecture

The Technology Architecture consists of a catalog with the building blocks Technical Standards and Deployment Guidelines. These building blocks can be used in the products AS IS Architectures, TO BE Architectures, Project Architectures and Architecture Roadmaps. In paragraph 4.1.1 it was explained that TOGAF acknowledges five sub-products. Of those five the Technology Standards Catalog relates to the Technical Standards. The Deployment Guidelines are not included in the TOGAF documentation, it was a wish of the case organization to include those documents in the Content Framework. There seemed to be a relation between a preference for concrete products and Architecture Maturity.

Not included: Architecture Vision

In the case organization business strategy does not belong in the IT department. Business principles, objectives and drivers are not documented. They do exist and are well-known by business stakeholders, but it would not be appreciated when they are documented by Architects in the IT department. A maturity issue, cultural resistance. In developing Architectures business strategy and related objectives are communicated.

Not included: Architecture Requirements

Architecture requirements are discussed for each Architectural effort. The requirements themselves are not stored in the Content Framework, because they will be different on every Architecture effort. The constraints, such as budget requirements, can change as well. When Architecture improves its value the constraints will be reduced while the scope of Architecture will increase.

In the interviews I have confronted the interviewees with elements of the TOGAF Framework. In Appendix C the questions that were used in interviews to determine the tailored Architecture Content Framework can be found. Examples of deviations that arose are:

- The Information Systems layer was renamed to Application layer. The reason was that the interviewees explained that alignment of applications and business processes has the highest priority. The sub layer Data of TOGAF was not included. It is related to the application and technology layer.
- Formal documents such as Architecture contracts have been removed because of the Architecture Maturity level. These are only useful when Architecture has proper processes and

produces results. The compliance assessment has been included, as this report is the result of involvement of the Architect within projects.

- I have simplified the descriptions within the layers Business, Application and Technology. The TOGAF content Framework is overwhelming for an organization with a low Architecture Maturity. On the three layers the Content Framework acknowledges AS IS Architectures, TO BE Architectures, Project Architectures and Catalogs. The catalogs contain the building blocks used to assemble the other products, TOGAF calls them components, artifacts or entities.
- I simplified the category Architecture Principles, Vision and Requirements to three elements instead of the ten used in TOGAF. We store principles, derived principles, compliance assessments and keep track of the Architecture Maturity by using the Architecture Maturity Model. Business and technology strategy are inputs for Architecture, but do not need to be included in the content Framework. Architecture requirements stay in the minds of the Architects for the time being, they change too often to be documented.

4.2.2 Architecture Governance Framework

In paragraph 4.1.2 I explained the Architecture Governance Framework of TOGAF, especially the Architecture Development Method (ADM). This method is extensively documented. For the case company I created a Governance Framework tailored to the Maturity level, with a smaller amount of (sub-)processes. This tailored Governance Framework allows the organization to achieve level 3 on the Architecture Maturity Model (AMM). As described in the table in paragraph 3.2 this means that the following characteristics need to be achieved:

1. Management – Controls on processes.

2. Role Architect – Responsible for the processes.

3. Process – Alignment between disciplines.

The table gives a summarized overview of the differences between the TOGAF Governance Framework and the tailored Governance Framework. The colors green, orange and red respectively mean that an element is included, partly included, or not included.

Governance Framework Elements	TOGAF	Case Framework
Defining Architecture Principles		
Defining Content Framework		
Evaluating Architecture Maturity		
Defining scope of Architecture Development		
Defining business drivers of Architecture Development		
Category: Developing Architectures		
Developing a baseline Architecture		
Developing a target Architecture		
Performing a gap analysis		
Category: Developing Roadmaps		
Identifying business opportunities		
Identifying (financial) constraints		
Creating a high level migration roadmap		
Validating risks		
Estimating benefits		
Category: Architecture Implementation		
Defining project Architectures		
Performing compliance assessments		

The tailored Architecture Content Framework is presented in Figure 8.

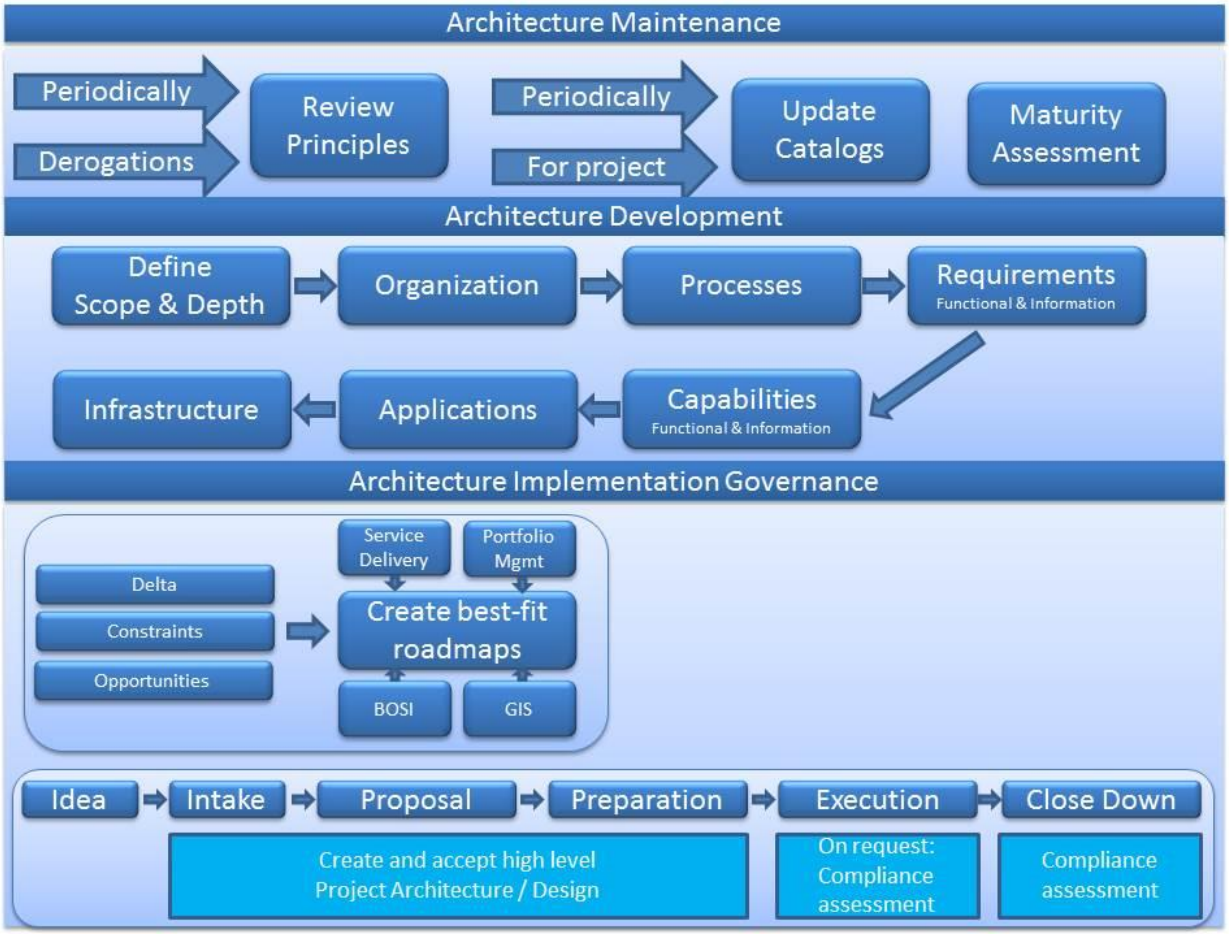

Figure 8 Architecture Governance Framework for the case company

I will describe the differences more detailed. This will explain how some elements are partly included in the tailored Governance Framework.

Architecture Maintenance

Architecture Maintenance contains two processes: Review Principles and Update Catalogs. It relates to the stages Preliminary and Architecture Vision (A) of TOGAF's ADM.

The Architecture principles and the derivatives of those principles are to be reviewed periodically, or when a lot of derogations to those principles occur, which would be an indicator that the principles are outdated. Reviewing the principles is an activity to be performed by the Architecture team. To define the initial principles I hosted a workshop session with this team.

The update of the catalogs concerns a review of the building blocks on the business, application and technology layers. The Architecture Content Framework describes what categories of building blocks are acknowledged. The principle Reuse before Buy, Buy before Build triggers the update catalogs activity. When a project requires something that is not in the current catalog, the catalog needs to be updated. Periodical reviews of catalogs are useful to determine if building blocks such as processes and applications are still up to date and conforming the Architecture principles. For example, an operating system could soon be out of support. This would lead to a catalog change where the technology standards are changed.

TOGAF defines the scope of Architecture Development in this stage, in the tailored Governance Framework a scope is determined per Architectural effort, not in the maintenance phase. Business drivers are not defined, but they are the trigger for Architecture Development.

Architecture Development

Architecture Development concerns the development of AS IS and TO BE Architectures. The scope of the Architecture Development process contains the Business, Application and Technology layers. It relates to the stages Business Architecture (B), Information Systems Architecture (C) and Technology Architecture (D) of TOGAF's ADM.

I will explain each of the process steps.

- Define Scope & Depth

  The trigger to create an Architecture is an opportunity provided by business change. It is in change programs that there is a clear benefit of Architecture, as it is important that the IT landscape fits the new business landscape. This also provides an opportunity for additional targets, such as cost savings through the consolidation of applications. The scope describes how extensive the Architecture will be. Depth is the level of detail of the Architecture. Efforts with a large scope and a large depth will take a lot of time. Other efforts are: large scope with a low depth and small scope with a high depth. The scope & depth and the business change are related.

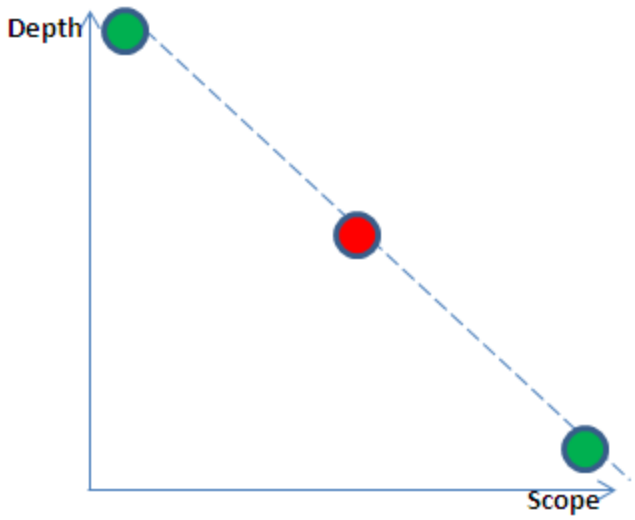

Figure 9 A balance between scope and depth is required for Architecture efforts

- Organization

  In this step organograms are created to define the structure of the organization in the Architecture. Depending on the type of Architecture, this can be the current organogram or a target organogram. A business change can lead to a change in organizational structure.

- Processes

  In this step business processes are defined and related to the organization structure. A business change can lead to a change in business processes.

- Requirements

  In this step Functional and information requirements for the applications are defined. The business processes are supported by applications that need to meet certain requirements.

- Capabilities

  In this step Functional and Information Capabilities are mapped to the requirements that were defined in the previous step. Capabilities are defined in a catalog and are related to standard applications. They are the bridge between detailed requirements and applications. The purpose of bridging detailed requirements with high-level capabilities is that it is possible to reuse

applications. Concessions in the requirements might be required, this can however lead to cost savings and a reduction of the complexity of the application landscape.

- Applications

  In this step the Applications that relate to the selected Capabilities are defined. This information is stored in the Capabilities catalog. When an application is replaced the new application will need to deliver the Information and Functional Capabilities. By reviewing the Architectures it can then be determined which business processes and organizational units will be impacted by the replacement of an application.

- Infrastructure

  In this step the infrastructure is related to the applications that were defined in the previous step. Standard technology components from the catalog are used whenever possible.

Architecture Implementation Governance

Architecture Implementation Governance contains three (sub-)processes: Create best-fit roadmaps, create project Architectures and perform Compliance Assessments. It relates to the stages Opportunities and Solutions (E), Migration Planning (F) and Implementation Governance (G) of TOGAF's ADM. The goal of the three processes is to guide the implementation of a TO BE Architecture. I will explain each of the three processes.

<u>Create best-fit roadmaps</u>

In the process Architecture Development an AS IS and a TO BE Architecture have been defined. In this step best-fit roadmaps will be created to bridge the difference between the AS IS and the TO BE Architecture. Best-fit roadmaps contain projects that contribute to the implementation of a TO BE Architecture.

The goal of creating a best-fit roadmap is to create a roadmap that:

- Fits the delta between AS IS and TO BE Architecture descriptions.
- Is linked to an opportunity, such as a business change program, cost savings or a reduction of landscape complexity.
- Is within resource constraints.

- Is created in cooperation with Portfolio Management, Operations Management, Business Planning (BOSI) and Global Information Services (GIS). (See the explanation about the context of Architecture at the end of this paragraph)

Create Project Architectures

In this sub-process a Project Architecture is created. This Project Architecture describes the contribution of a project to a TO BE Architecture. It defines the boundaries of a project, a project manager is free to choose an implementation within these boundaries.

Perform Compliance Assessments

In this sub-process it is assessed whether a project contributes to the defined Architecture. If a project complies to the Project Architecture, this should be the case. This compliance assessment is performed at the project stage “close down”. At this moment the project is delivered to Operations Management (Service Delivery). If during the execution phase the project manager thinks that he might cross the boundaries of the Project Architecture, a Compliance Assessment can be requested.

Context of Architecture

Enterprise Architecture is related to the Portfolio / Project Management, Business Planning and Operations Management. The next figure shows these relationships, within the case organization.

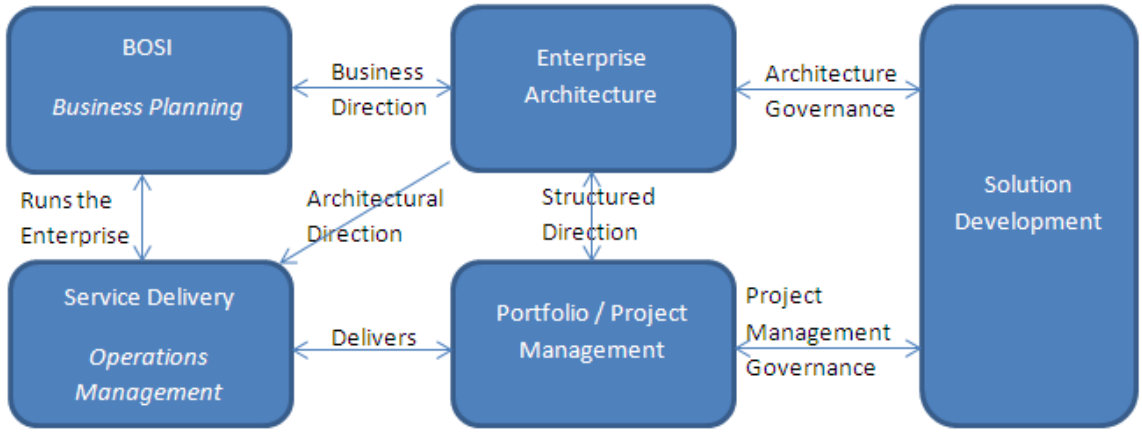

Figure 10 Relation of Enterprise Architecture to other Frameworks (TOGAF 9 online documentation paragraph 6.2.6)

Enterprise Architecture is related to:

- Business Planning
    - Enterprise Architecture aligns the (future) application and technology Architecture with long term business strategy.
    - BOSI is applied at the case company for business planning.
- Portfolio / Program / Project management.
    - Enterprise Architecture provides input to the portfolio management process, to ensure realization of the (future) application and technology Architecture.
    - Enterprise Architecture is involved with project management to ensure that every project has a known contribution to the (future) application and technology Architecture.
    - There will be a new project management method within the case company.
- Solution Development
    - Enterprise Architecture governance of Solution Development is necessary to verify that the solution complies to the Architecture.
    - Project Management governance is concerned with realization of the envisioned solution within time and budget constraints.
    - Enterprise Architecture is concerned with the long-term contribution of a project to the business strategy, Project Management is concerned with the scope of the specific project.
- Service Delivery
    - Enterprise Architecture gives direction to Service Delivery (Operations Management).
    - The future application and technology Architecture are communicated, so that Service Delivery can obtain the required knowledge and tools to operate the future IT environment.

The responsibility of the Architect is that projects contribute to the realization of Architectures. In order to fulfill his role, the Architect requires certain mandates. For example, the Architect must have the mandate to refuse a project when he performs a compliance assessment. He can require the project manager to change his scope, approach, or decide not to allow the project. Additionally, the Architect requires the mandate to provide a derogation, which means that a project is allowed to deviate from the project Architecture.

5. Benefits of the improved Architecture Content and Architecture Governance Framework

5.1 Relevant Theory

The goals of Enterprise Architecture are to improve cost efficiency and improve business effectivity (Buchanan, 2002) and to enable integration, agility and change of IT and Business (Hoogervorst).

The dissertation of Ralph Foorthuis on Enterprise Architecture Compliance lists nine benefits of Enterprise Architecture. (Foorthuis, 2012):

1) EA enables management to achieve key business goals.
2) EA enables management of organizational complexity.
3) EA facilitates the integration, standardization and deduplication of processes and systems.
4) EA enables the Enterprise to deal with its environment effectively.
5) EA enables effective communication between members of the organization.
6) Working with EA reduces project costs and project duration.
7) Working with EA reduces project risk and improves project success.
8) Working with EA enables projects to manage complexity.
9) Working with EA speeds up the initialization of a project.

A theoretical model of EA Benefit realization has been researched, incorporating benefits and succes factors of Enterprise Architecture. The model describes that EA product quality, EA function setup quality, EA service delivery and EA cultural aspects contribute to the “Intention to use”, which translates into use that leads to net benefits. It is mentioned in this article that “reference Architectures are discussed in literature to further increase efficiency and effectiveness of an EA practice”.
(Lange et al. M.)

Measuring the benefits of Enterprise Architecture can be done through Key Performance Indicators. There are different schools of thought about Key Performance Indicators to measure the benefits of Enterprise Architecture. At one side of the spectrum, it is said that the best KPI’s are the business results, such as net profit, revenue, amount of customers or customer satisfaction. An issue with this might be that those results are influenced by many other factors then Enterprise Architecture. At the other side of the spectrum, there are process indicators. Those KPI’s measure the amount of

Architecture blueprints such as the amount of compliance assesments and the percentage of approved projects. An issue with this might be that we measure the process , but not the results of the process.

The third idea is in the middle, an attempt to measure the result of the processes of the Enterprise Architecture Framework. Here we measure KPI's such as the number of applications, the percentages of reuse, build and buy applications and the Total Cost of Ownership of the IT landscape. An issue might be that other factors then Enterprise Architecture influence those results.

The Architecture Maturity Model describes different levels of Architecture Maturity. It is indicated that management controls Enterprise Architecture on awareness, people, processes, results or continuous improvement, depending on the Maturity level. My idea is to align the KPI's to the level of Maturity we want to achieve. If we want to know if the process level (AMM level 3) is reached, we could use process indicators to verify the functioning of the Enterprise Architecture Frameworks. If we want to know the output of the process, the results (AMM level 4), we can use the KPI's of the TCO and number of applications. Once we are focussed on continuous improvement (AMM level 5), the KPI's can be expanded to outcomes that are only partly influenced by Enterprise Architecture, such as the total revenue. In my opinion the Architecture Maturity Model can assist in determing the correct KPI's. By measuring several levels of Maturity, it is possible to spot a change in Architecture Maturity.

5.2 Case

In the case I interviewed the Business IT Managers, those are responsible for the communication between IT and business domains. In their mitigating role, they know the complaints about the IT organization. I asked them about the benefits of implementing an Enterprise Architecture Framework. As described in paragraph 1.3 these interviews were transcribed and coded. This analysis led to a visualization of relations between the Architecture Content and Governance Framework and Architecture benefits.

5.2.1 Architecture Content Framework

I will list the benefits mentioned by the interviewees for the elements of the Architecture Frameworks.

Architecture principles and derived principles

Principles and derived principles guide the development of Architectures and catalogs.

Benefits mentioned are:

- Transparent and consistent decision making.
- Maximize the benefit to the case company.

Architecture catalogs

Architecture catalogs contain building blocks that are used for the composition of Architectures.

Benefits mentioned are:

- Keep track of standards for infrastructure and applications.
- Reuse of components.

AS IS Architectures

AS IS Architectures describe the current state of the Process, Application and Infrastructure landscapes, within a defined scope.

Benefits mentioned are:

- Overview of the landscape to fit in new applications.
- An assigned owner for every application, data entity, process entity, etc.

TO BE Architectures

TO BE Architectures describe the envisioned state of the Process, Application and Infrastructure landscapes, within a defined scope.

Benefits mentioned are:

- TO BE Architecture can be used by Service Delivery to prepare for future operations.
- TO BE Architecture can be used by Business Information Manager to communicate to business.
- TO BE Architecture can be communicated to the international office of the case company.
- Benefits of scale as more domains are covered by TO BE Architecture: Sharing infrastructure, applications and processes.

Project Architectures

Project Architectures describe the relation and contribution of a project to the AS IS and TO BE Architectures.

Benefits mentioned are:

- Project Architectures fit in the AS IS Architecture.
- Project Architectures contribute to the TO BE Architecture.

Architecture roadmaps

Architecture roadmaps describe the migration path from an AS IS landscape state to a TO BE landscape state.

Benefits mentioned are:

- Visible impact of 3 year business planning on infrastructure and application landscape.

5.2.2 Architecture Governance Framework

Architecture development (AS IS and TO BE)

This process is aligned with the existing business planning method, to develop AS IS and TO BE Architecture with a pre-determined scope & depth.

Benefits mentioned are:

- Project Architecture can be created on the basis of AS IS and TO BE descriptions.
- Enables implementation of IT strategy.

Best-fit roadmap Development

A best-fit roadmap describes the path to achieve a TO BE Architecture in a specific business domain, taking into account constraints, opportunities and other management Frameworks.

Benefits mentioned are:

- Alignment with the global IT plans of the case company.
- Alignment with the business planning of the case company.
- Reduce risk by reducing the need for unmanaged applications, such as excel sheets.
- Improve the awareness that IT adds value.

Implementation governance

Implementation governance is used to make sure that projects comply to their project Architecture. The project Architecture is contributing to the implementation of a TO BE Architecture description. The project might be a step in a best-fit roadmap.

Benefits mentioned are:

- Improved scoping of projects, mapping on the TO BE Architecture.
- Architect is accountable for the realization of an Architecture.
- Architect verifies compliance to the project Architecture.

Maintenance of catalogs and principles

Catalogs contain the building blocks that form the Architecture descriptions. Standards and guidelines. The principles are leading in Architecture decision making.

Benefits mentioned are:

- Safeguard the maintainability of the IT landscape by standardization.
- Decisions are made about the adoption of new technologies.

5.2.3 Relation to theoretic benefits

I related the mentioned benefits to the generic benefits of Enterprise Architecture as obtained from the literature review.

To explain how these relations were created, we will investigate a relation.

Figure 11 Example relation

The Architecture initiative is: Architecture Development, the creation of AS IS and TO BE Architectures. Arguments for this initiative are based on the interview transcripts and codings.

This line is based on the quotes tagged with #Architecture_TOBE_benefit and #Architecture_ASIS_benefit:

"We need a destination IT landscape Architecture to be able to communicate our IT strategy."

"Business and IT strategy are not aligned. This leads to implementation issues."

"When a new project starts, we should compare it with a long-term plan. Is the scope of the project sufficient for a contribution to the long-term plan?"

"If we have a reference Architecture we can use it for decisions about application selection."

“We judge projects only on the basis of the AS IS IT landscape. It fits today, but no idea whether it contributes to the future. It might be a waste of resources.”

“The reference on which a project Architecture is judged seems very important to me”.

“Insight in the TO BE Architecture might lead to a visible added value”.

Analysing those quotes it can be noted that most of those quotes are about the TO BE Architectures. The reason is that the AS IS Architectures are useful for determining the starting point, to determine a gap. As mentioned in paragraph 4.2.2 there is no other reason to create AS IS Architectures. Over time the TO BE Architectures will become AS IS Architectures, and the Content Framework will be filled.

It is mentioned that an overview of the current and future IT landscape is useful to support implementation of IT and business strategy. Several quotes are concerned about the judgement of projects, it should be based on a TO BE Architecture. Terms in the quotes such as “implementation issues”, “wasting resources” and “visible added value” indicate that the benefit Improve Cost Efficiency is at the end of this relation.

The diagrams are included in a larger format in Appendix B.1 and B.2.

Content Framework:

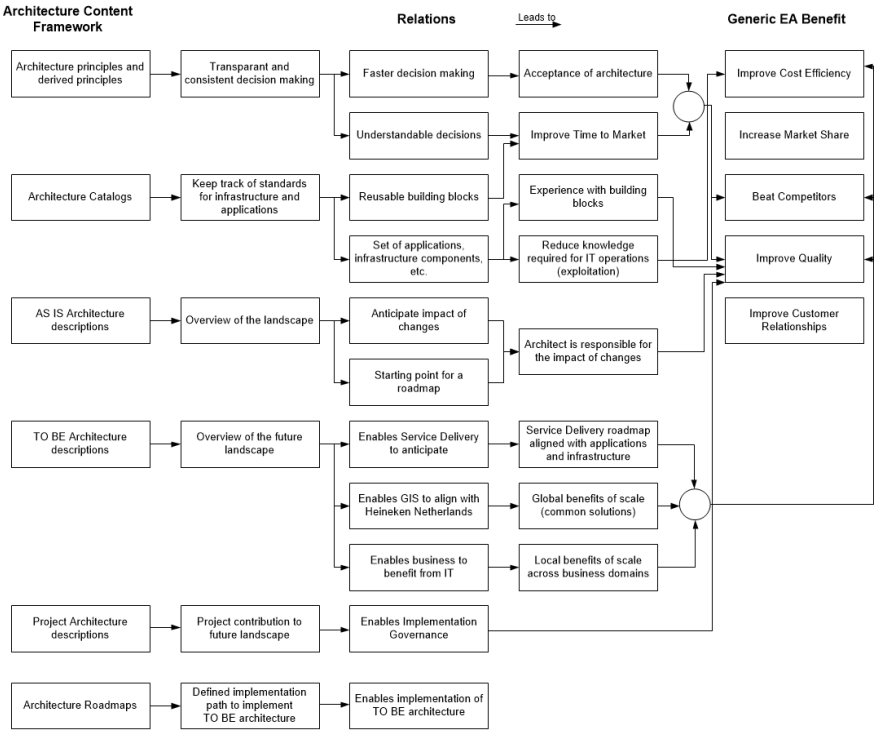

Figure 12 Relations between the Architecture Content Framework and Generic EA Benefits (See Appendix B.1)

Governance Framework:

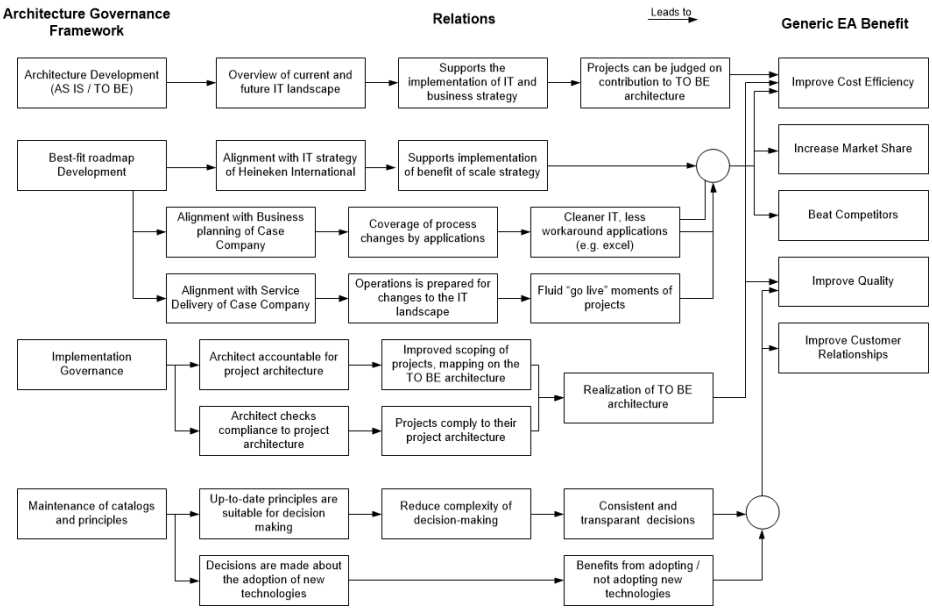

Figure 13 Relations between the Architecture Governance Framework and Generic EA Benefits (See Appendix B.2)

5.2.4 Measuring benefits

At the case company the question arose what KPI's (Key Performance Indicators) we should use to measure the results of implementing an Enterprise Architecture Content and Governance Framework. As discussed in paragraph 5.1, theory tells us that there are different schools of thought about KPI's. This ranges from measuring the business result such as profit or revenue to measuring performed actions of the Architect.

Through discussion with the Architects and the manager of the Project Management Office I've discovered that the KPI's should be related to the Architecture Maturity Level. The rationale is that if we want to measure our Architecture performance, we should measure it around the level at which we perform Architecture. By introducing a content and governance Framework we aim for Level 3 of the Architecture Maturity Model. At this level, called established, management controls on processes. This leads to three KPI's:

1. Percentage of projects under Architecture governance.
2. Percentage of derogations.
3. Number of roadmaps vs. number of domains.

The ambition of the case company is to reach level 4 of the Architecture Maturity Model, where management controls on results. To identify the moment that the processes are producing results, it was decided to add three more KPI's to measure the results of Architecture.

4. Number of applications.
5. Total Cost of Ownership. (One time + Recurring cost)
6. Implementation status of roadmaps.

A requirement that was considered in selecting those KPI's was the measurability. The case company wanted KPI's that can be measured without generating overhead. While some overhead by recording KPI's is inevitable, it is minimized by choosing KPI's that are easy to measure.

6. Conclusions

The research question was:

"How are the benefits of Enterprise Architecture increased by applying an Enterprise Architecture Framework?"

This research question was split into these sub research questions:

R1: "What are the relations between the Enterprise Architecture Content Framework and benefits?"
R2: "What are the relations between the Enterprise Architecture Governance Framework and benefits?"

To answer those questions I executed four steps.

Step 1: Obtain the current state of the Architecture Content and the Architecture Governance Framework

The Architecture principles and available products have been collected. It was concluded that there were no target Architectures. On the catalog level target standards for the infrastructure layer were defined. The Architects did have a vision of the future IT landscape in their mind, which was used to guide Architecture decisions. Architecture governance processes were not documented.

Step 2: Determine Architecture Maturity, based on the current state of the Architecture Content and the Architecture Governance Framework

It was concluded that the Architecture Maturity level was "Level 2 – Assigned" on the AMM model. The target Architecture Maturity level was "Level 3 - Established". The Maturity targets for the Architecture Content and Governance Frameworks were identified.

Step 3: Determine the improved state of the Architecture Content and the Architecture Governance Framework.

By means of the Maturity targets described in the AMM model and the interview responses, a set of elements from the TOGAF documentation was selected. Selecting a subset from TOGAF, related to

Architecture Maturity, is not described in the TOGAF documentation. These elements form the Architecture Content and Governance Framework that will lead the organization to a higher Architecture Maturity level. A higher Architecture Maturity level leads to a more effective Architecture.

Step 4: Research the benefits of the improved Architecture Content and the Architecture Governance Framework.

The improved Frameworks lead to a more effective Architecture. This will lead to increased Architecture benefits. In this step the relations between the Framework elements and the Architecture benefits were concluded. The diagrams of this step (Appendix B1 and B2) are the answers for R1 and R2.

After performing the four steps of this research, the answer to the research question can be formulated.

A. The benefits of Enterprise Architecture increase as we improve the effectiveness of Enterprise Architecture.

B. The effectiveness of Enterprise Architecture can be improved by increasing our Enterprise Architecture Maturity level.

C. To increase the Enterprise Architecture Maturity level, we need to select a set of relevant Framework elements and construct a Content and Governance Framework. Those Frameworks need to be aligned with the current and destination Architecture Maturity level.

D. By relating the Framework elements to the generic Architecture benefits, we can justify the investment of resources. This is the rationale to implement the improved Architecture Frameworks.

E. When the improved Architecture Frameworks are implemented, the benefits of Architecture can be measured through KPI's. The insight in the performance of Architecture stimulates the investment of resources in Enterprise Architecture. Thereby the Maturity of Enterprise Architecture can be repeatedly increased, which can lead to more benefits.

Research Limitations

This research has been limited to one case organization. This organization had a specific Architecture Maturity level. I have determined the elements that need to be included in the Architecture Content and Governance Framework to advance a Maturity level within the case organization. Future research can be focused on determining the Frameworks required to bridge gaps between the other Architecture Maturity levels. An evolutionary approach to growing an Architecture capability can then be developed. Research on a larger scale will be required to verify that such an evolutionary approach to Architecture Capability Development is usable in multiple, ideally all, organizations.

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Appendix A

A.1 Architecture principles with rationale and implications

In this paragraph I present the seven core principles, with rationale and implications. It is the result of a series of individual interviews and a group workshop.

1. Maximize the benefit to the local operating company of the case company

Description:	All decisions are made to provide maximum benefit to the local operating company of the case company. The interest of the local operating company prevails over the concern of any smaller or larger entity.
Rationale:	Balance Business Effectiveness and Cost Efficiency optimally to maximize the benefit to the local operating company.
Implications:	Cost Efficiency and Business Effectiveness are maximized in selecting IT Solutions. Common Solutions prevail over other Solutions when the benefit for the local operating company is larger.

2. Standardize IT Solutions

Description:	Standardize IT Solutions to cover Business Capabilities. Industry Standard Solutions and Common Solutions are considered in the selection process.
Rationale:	Reduction of IT landscape complexity. Reduction of maintenance and support costs. Reduction of required knowledge in the organization.

Implications:	Reuse Standard IT Solutions whenever possible. Catalogues are used to keep track of the standards. In selecting and evaluating Standard IT Solutions, Common Solutions and Industry Standards are the first to be considered.

3. Maximize IT Solution availability and continuity

Description:	Maximize IT Solution availability and continuity to support Business at all times.
Rationale:	Minimize downtime. IT is accountable for the continuity of IT Solutions. Impact of incidents is minimized.
Implications:	To prevent dependency on a single supplier, multiple suppliers need to be available for maintenance and support of an IT Solution.

4. Maximize data availability, confidentiality, integrity, authenticity

Description:	Maximize data availability, confidentiality, integrity and authenticity by complying to security standards and regulations.
Rationale:	High availability of data supports business continuity. Compliance to law & regulations is mandatory. Security standards provide guidelines to meet the requirements.
Implications:	Some data has higher requirements then the guidelines of the security standard prescribe.

5. Uniform master data definitions

Description:	Master data definitions are in a standard form, as described in the HEIMAMBO data definition standards.
Rationale:	Common data standards contribute to “leveraging global synergies”.

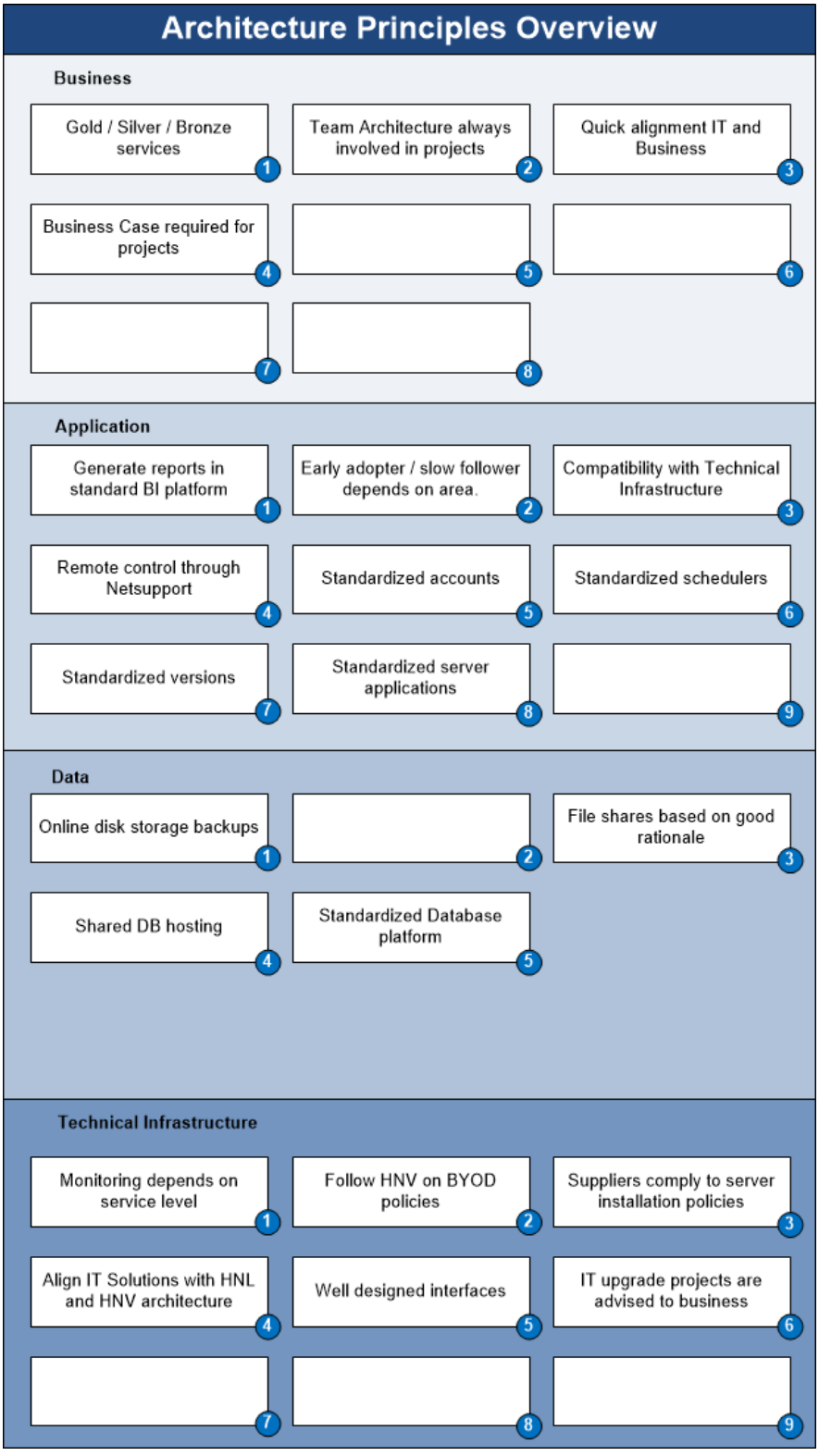
6. Maximize availability and continuity of Technical Infrastructure

Description:	Maximize the availability and continuity of the Technical Infrastructure.
Rationale:	Minimize downtime.

7. Maximize maintainability and flexibility of Technical Infrastructure

Description:	Maximize maintainability and flexibility of the Technical Infrastructure by reusing standard building blocks, using a standardized Technical Infrastructure.
Rationale:	Reduction of IT landscape complexity. Reduction of maintenance and support costs. Reduction of required knowledge in the organization. Improve Business Effectiveness by supporting the flexibility to “Start small, scale fast”.
Implications:	Reuse Standard Technical Infrastructure building blocks whenever possible. Catalogues are used to keep track of the standards. In selecting and evaluating building blocks, eventual Common Solutions and Industry Standards are the first to be considered.

A.2 Principles derived from a single interview



A.3 Derived principles

Principle: Maximize the benefit to the local operating company of the case company.
Long-term business needs are reflected in the Business Solution Roadmap
Business is accountable for new functional requirements
Functional requirements drive the definition of IT Solutions
Maximum fulfilment of functional business requirements
Business processes align with embedded processes of IT Solutions
IT Solutions are integrated
IT Solutions comply to performance requirements

Principle: Standardize IT Solutions
Fit for purpose
Common Solutions before Local Solutions
Maximize alignment with the corporate Roadmap
Reuse before Buy, Buy before Build
Industry Standard IT Solutions prevail

Principle: Maximize IT Solution availability and continuity
IT is accountable for the continuity of IT Solutions
Reduce impact of incidents (Maximal Degradability)
Deploy latest proven technology
Use supported technology

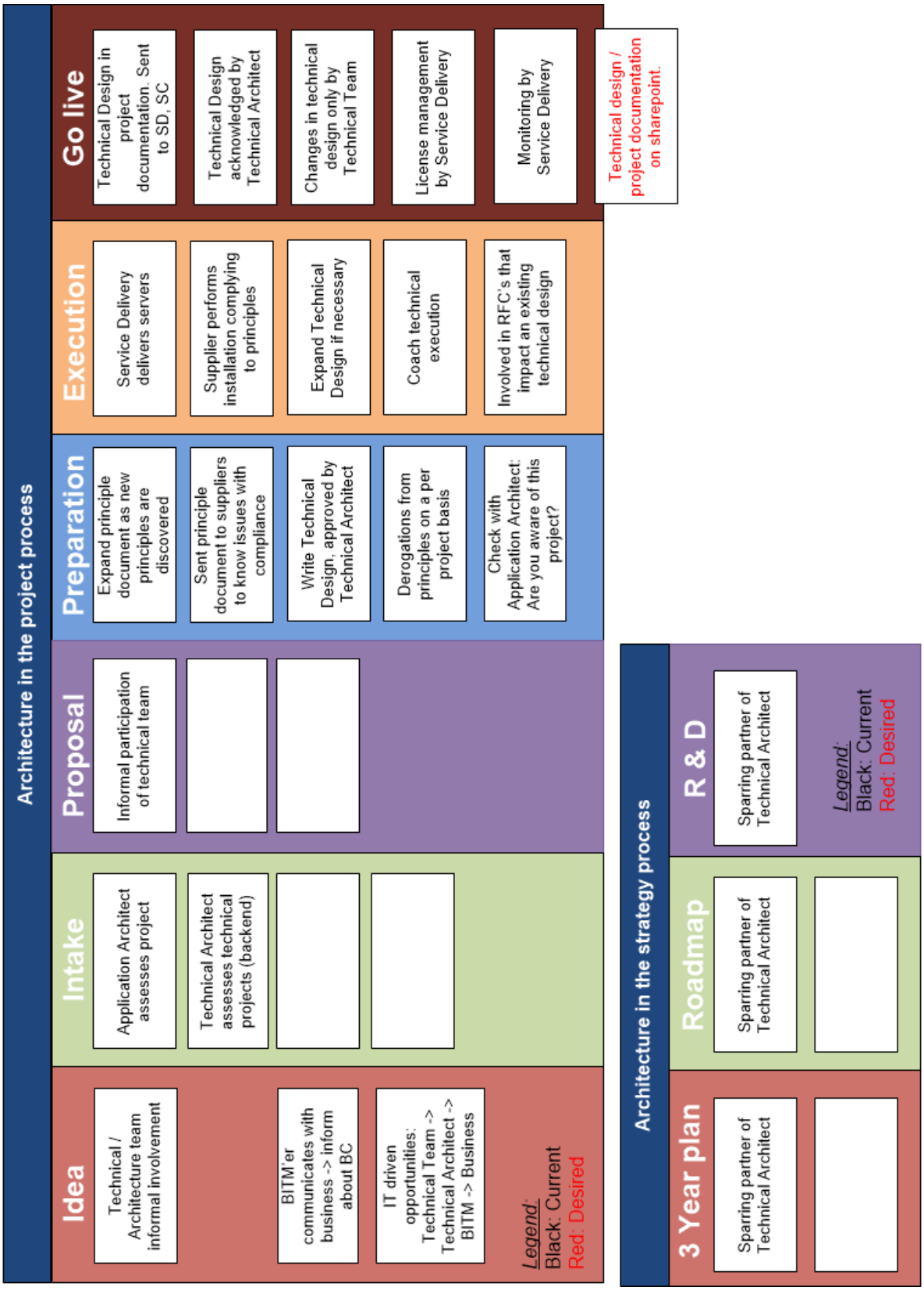
Principle: Maximize data availability, confidentiality, integrity, authenticity
Comply to the applicable security standard
Single source of truth
Data elements have a single owner
Single registration of master data

Principle: Uniform master data definitions
Master data definitions comply to HEIMAMBO standards

Principle: Maximize availability and continuity of Technical Infrastructure
Loose coupling of IT Solutions
Separation of storage and servers
No point to point communication
Data transport through message broker
Virtualization unless
Components should be redundant
Location of infrastructure depends on business continuity requirements
Proactive monitoring of IT Solutions

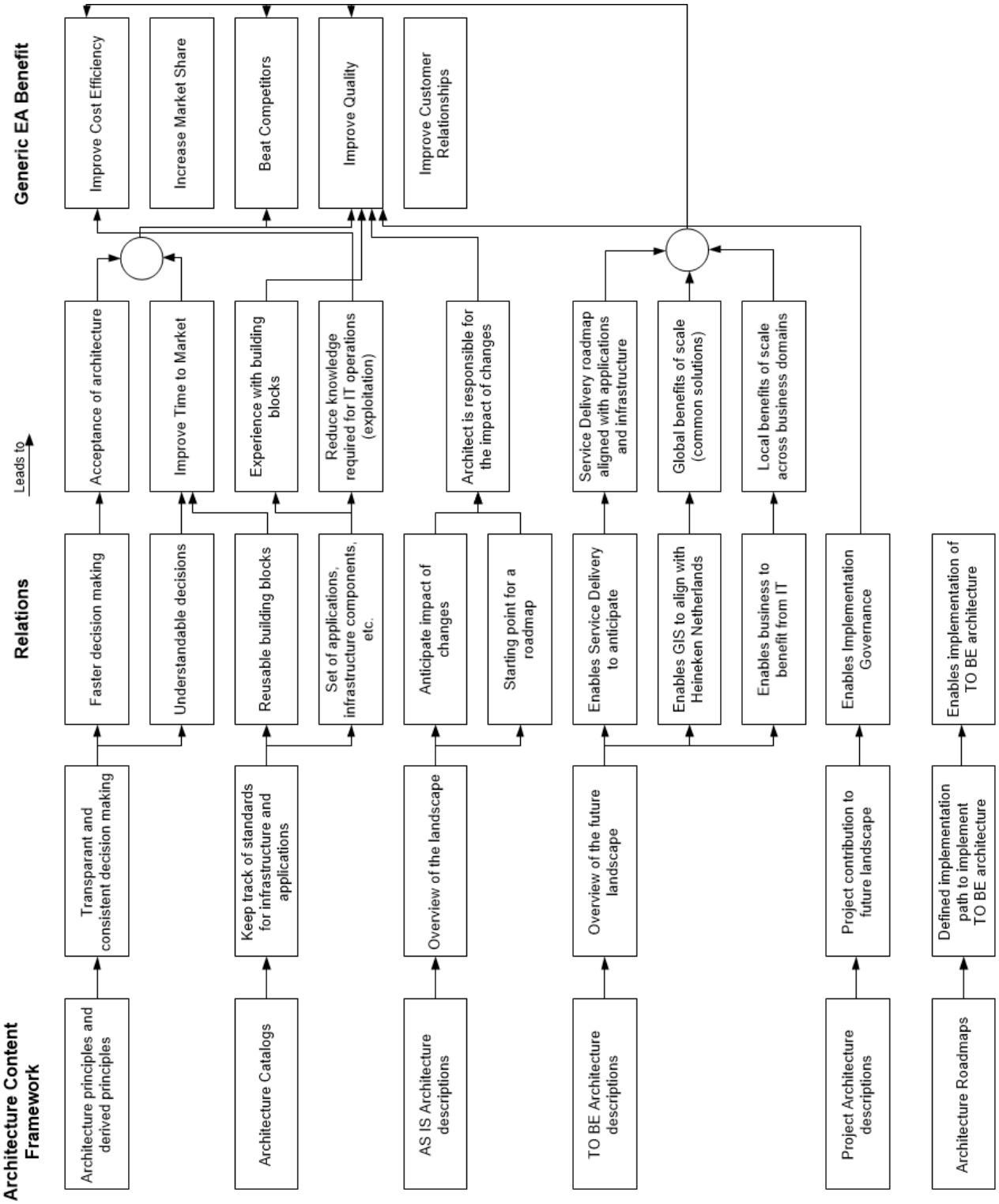
Principle: Maximize maintainability and flexibility of Technical Infrastructure
Apply standard building blocks
Standardize Technical Infrastructure

A.4 Current process model result of a single interview

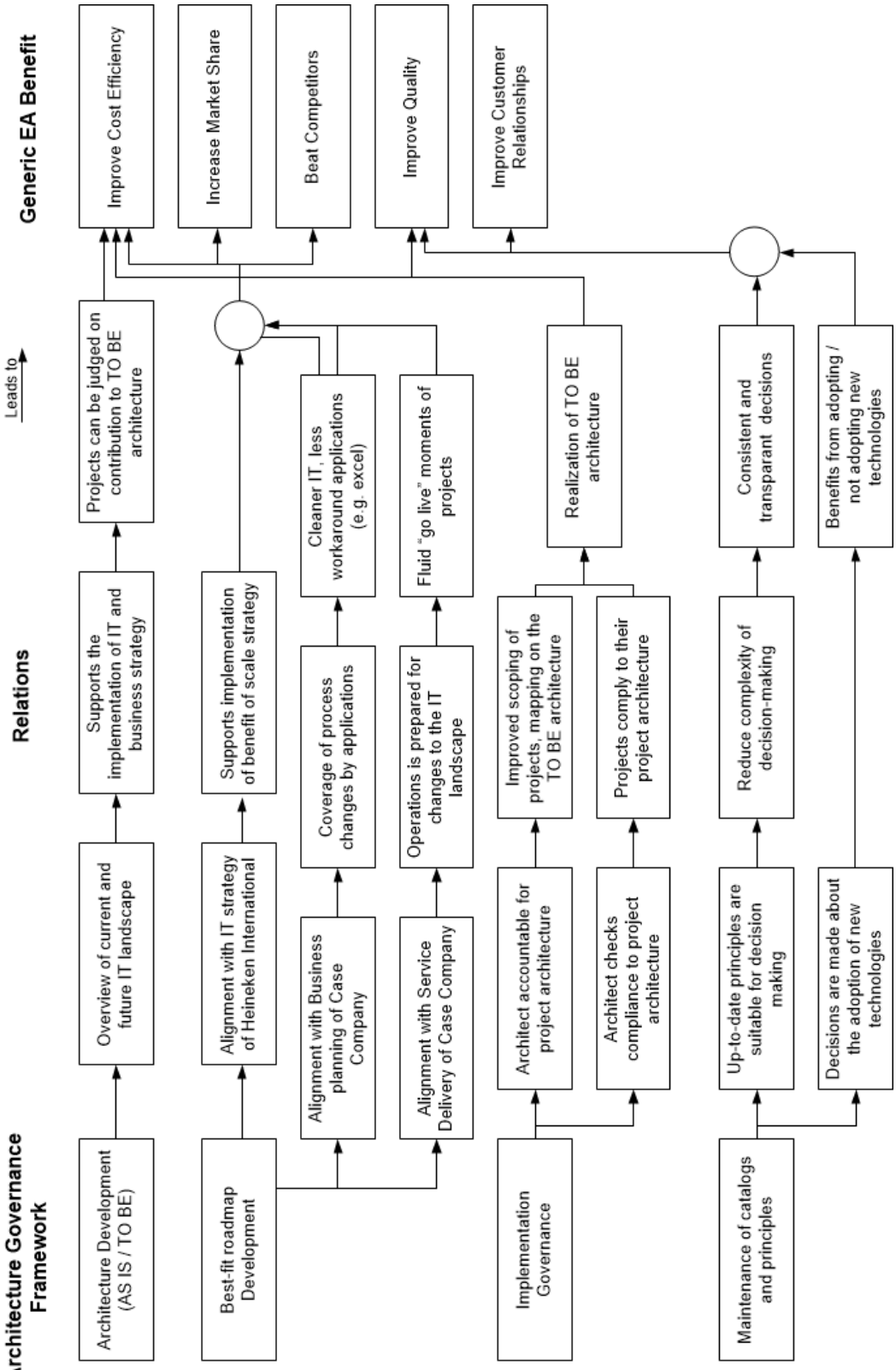


Appendix B

B.1 Benefit relations: Architecture Content Framework



B.2 Benefit relations: Architecture Governance Framework



Appendix C

Semi structured interviews were used to determine the tailored Architecture Content and Architecture Governance Frameworks. I prepared discussion topics about the frameworks. In each discussion topic I asked the interviewee for his ideas. I confronted the interviewee with elements from the TOGAF documentation in the discussion. The interviews were performed in Dutch. I translated the questions in English.

Interview questions

- Introduction: goals of Interview
- Short explanation, what is a Content Framework

Architecture Content Framework

- Architectural Principles
    - Embed in Content Framework?
- Architecture Vision
    - Requirements
    - Constraints
    - Relation of Architecture to Business Strategy
    - Relation of Architecture to IT Strategy
- Business Architecture
    - What do we want to keep track of? E.g. organization, processes, locations, business services.
- Application Architecture
    - What do we want to keep track of? E.g. data, applications, relations between applications and processes.
- Technology Architecture
    - What do we want to keep track of? E.g. platform services, technology components.

Architecture Governance Framework

- Defining Architectural Principles
    - When?
    - Should we?
- Evaluating Content Framework
    - When?
    - Should we?
- Evaluating Architecture Maturity
    - When?
    - Should we?
- Developing Architectures
    - Scoping
        - Drivers, business initiatives, budget and time constraints.
        - What is possible, available resources?
    - AS IS Architectures
        - Level of detail. It is not documented but known by architects. Create and implement TO BE architecture which becomes AS IS architecture? Or document it accurately first? Is there management buy-in, money and time?
        - How, presentation forms. Matrix as used for existing architecture work. Visual representations.
    - TO BE Architectures
        - How do you relate to the Business Planning / strategy process?
        - Presentation form identical to AS IS architecture?
- Developing roadmaps
    - Determine delta: Gap analysis between AS IS and TO BE. Is that clear?
    - Identify business opportunities.
        - Do you know of opportunities in your business domain?
        - What impact do they have, how to benefit from them.
    - Identify constraints.
        - Do you know of (financial) constraints in your business domain?
        - What impact do they have, how to deal with them.

    - Risk validation.
        - In Architecture?
        - Is it done on project level?
    - Benefit Estimation.
        - In Architecture?
        - Is it done on project level?
- Architecture Implementation
    - Project Architectures.
        - How does it relate to technical design.
        - How does it relate to project plans.
    - Compliance.
        - How to assess compliance of projects?