Enterprise Architecture Coming of Age
Increasing the Performance of an Emerging Discipline

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# Contents

1 Introduction .......................................................... 1
   1.1 Enterprise Architecture ........................................... 2
   1.2 Problem Statement ................................................ 2
   1.3 Research Questions .............................................. 4
   1.4 Research Approach .............................................. 6
      1.4.1 Case study 1: EA Functions of Two Divisions of a Large Company 7
      1.4.2 Case study 2: Architecture Maturity of IT & Operations Division 8
      1.4.3 Case study 3: EA Function Efficiency of IT & Operations Division 8
      1.4.4 Case study 4: Stakeholder Perception at Business Division .... 9
      1.4.5 Case study 5: EA Effectiveness of IT & Operations Division 9
   1.5 Research Methods ............................................... 9
   1.6 Outline of this Thesis ......................................... 11
   1.7 Publications .................................................. 12

2 Enterprise Architecture and Beyond .................................. 15
   2.1 Introduction .................................................... 15
   2.2 Data Collection .................................................. 17
   2.3 Applying Grounded Theory ..................................... 18
      2.3.1 Aspects of architecture .................................... 18
         2.3.1.1 Means of Abstraction .................................. 18
         2.3.1.2 Means of Communication ............................... 19
         2.3.1.3 Governance Instrument ............................... 19
      2.3.2 Critical Success Factors .................................. 20
         2.3.2.1 Acceptance of Architecture-Driven Changes ............. 20
         2.3.2.2 Availability of Efficient Means ....................... 21
         2.3.2.3 Proper Usage of Architecture ......................... 22
   2.4 Architecture Alignment Model ................................ 23
   2.5 Comparative Analysis ......................................... 25
      2.5.1 Aspects ..................................................... 25
         2.5.1.1 Means of Abstraction ................................ 26
         2.5.1.2 Means of Communication ............................... 26
         2.5.1.3 Governance Instrument ............................... 26
      2.5.2 Critical Success Factors .................................. 26
         2.5.2.1 Acceptance of Architecture-Driven Changes ............. 27
         2.5.2.2 Availability of Efficient Means ....................... 27
         2.5.2.3 Proper Usage of Architecture ......................... 27
   2.6 Concluding Remarks ........................................... 27
      2.6.1 Results .................................................... 27
      2.6.2 Limitations ............................................... 28
      2.6.3 Discussion ............................................... 29
## 3. The Enterprise Architecture Function

3.1 Introduction ................................................. 31
3.2 Reference Model ............................................ 32
   3.2.1 Objectives of the EA Function ..................... 32
   3.2.2 Products of the EA Function ....................... 33
   3.2.3 EA Sub-Functions .................................... 34
      3.2.3.1 EA Decision Making ......................... 35
      3.2.3.2 EA Delivery Function ....................... 36
      3.2.3.3 EA Conformance ............................ 38
   3.2.4 Organizational Levels .............................. 39
   3.2.5 EA Learning Cycle .................................. 40
   3.2.6 Stakeholders of the EA Function ................ 44
   3.2.7 Bodies and Roles within the EA Function ........ 46
      3.2.7.1 Bodies and Roles within EA Decision Making 46
      3.2.7.2 Roles within EA Delivery ................... 47
      3.2.7.3 Roles within EA Conformance ............... 47
   3.2.8 Outputs of the EA Function ....................... 48
3.3 Case study 1: EA Functions of Two Divisions of a Large Company 49
3.4 Lessons Learned from Case Study 1 ........................ 51
3.5 Conclusions ................................................. 53

## 4. Efficiency of the Enterprise Architecture Function

4.1 Introduction ................................................. 56
4.2 Research Approach ....................................... 57
4.3 Case study 2: Architecture Maturity of IT & Operations Division 58
   4.3.1 Company profile .................................... 58
   4.3.2 Assessment Data ..................................... 59
      4.3.2.1 IT Architecture Function ................. 61
      4.3.2.2 Business Architecture Function .......... 62
      4.3.2.3 Development Center Payment Channels .... 62
      4.3.2.4 Development Center Front Office Channels 63
   4.3.3 Assessment Conclusions and Recommendations 63
   4.3.4 Lessons Learned from Case Study 2 ............ 64
4.4 Evaluation of Existing Assessment Approaches ................ 66
   4.4.1 Related Work ....................................... 66
   4.4.2 Findings ............................................. 67
4.5 EA Function Assessment Model ............................ 69
   4.5.1 Part 1: the Entire EA Function ................. 69
      4.5.1.1 Definition of the EA Function ............ 69
      4.5.1.2 EA Governance ................................ 71
      4.5.1.3 Collaboration & Communication ............ 71
   4.5.2 Part 2: the EA Delivery Function ................ 72
      4.5.2.1 Management & Organization ................. 72
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.4 Stakeholder Satisfaction and EA Effectiveness</td>
<td>107</td>
</tr>
<tr>
<td>5.4.1 Mapping of Stakeholder and Organizational Goals</td>
<td>107</td>
</tr>
<tr>
<td>5.4.2 Difference in Percentages</td>
<td>107</td>
</tr>
<tr>
<td>5.5 Discussion</td>
<td>109</td>
</tr>
<tr>
<td>5.5.1 Related Work</td>
<td>109</td>
</tr>
<tr>
<td>5.5.1.1 Stakeholder Satisfaction</td>
<td>109</td>
</tr>
<tr>
<td>5.5.1.2 EA Effectiveness</td>
<td>109</td>
</tr>
<tr>
<td>5.5.2 Research Limitations</td>
<td>110</td>
</tr>
<tr>
<td>5.5.2.1 Stakeholder Satisfaction</td>
<td>110</td>
</tr>
<tr>
<td>5.5.2.2 EA Effectiveness</td>
<td>111</td>
</tr>
<tr>
<td>5.5.2.3 Stakeholder Satisfaction and EA Effectiveness</td>
<td>111</td>
</tr>
<tr>
<td>5.6 Conclusions</td>
<td>112</td>
</tr>
<tr>
<td>6 Assessor's view on the Enterprise Architecture Function</td>
<td>115</td>
</tr>
<tr>
<td>6.1 Introduction</td>
<td>115</td>
</tr>
<tr>
<td>6.2 Theoretical Framework</td>
<td>116</td>
</tr>
<tr>
<td>6.2.1 The Effective EA Cycle</td>
<td>116</td>
</tr>
<tr>
<td>6.2.2 Performance and Goal Attainment</td>
<td>116</td>
</tr>
<tr>
<td>6.3 Research Approach</td>
<td>117</td>
</tr>
<tr>
<td>6.3.1 Case Description</td>
<td>117</td>
</tr>
<tr>
<td>6.3.2 Respondents</td>
<td>118</td>
</tr>
<tr>
<td>6.3.3 Workshops</td>
<td>119</td>
</tr>
<tr>
<td>6.4 Analysis and Results</td>
<td>119</td>
</tr>
<tr>
<td>6.4.1 Factor analysis</td>
<td>119</td>
</tr>
<tr>
<td>6.4.2 Scale Analysis</td>
<td>120</td>
</tr>
<tr>
<td>6.4.3 Data Analysis</td>
<td>120</td>
</tr>
<tr>
<td>6.4.4 Results</td>
<td>122</td>
</tr>
<tr>
<td>6.5 Conclusions</td>
<td>123</td>
</tr>
<tr>
<td>7 Conclusions</td>
<td>125</td>
</tr>
<tr>
<td>7.1 Revisiting the Research Questions</td>
<td>125</td>
</tr>
<tr>
<td>7.2 Problem Solved</td>
<td>128</td>
</tr>
<tr>
<td>7.3 Future Work</td>
<td>129</td>
</tr>
<tr>
<td>7.4 In Closing</td>
<td>130</td>
</tr>
<tr>
<td>Samenvatting</td>
<td>131</td>
</tr>
<tr>
<td>SIKS Dissertation series</td>
<td>137</td>
</tr>
<tr>
<td>Bibliography</td>
<td>153</td>
</tr>
</tbody>
</table>
Large organizations depend for a great deal on IT for their information processing. Imagine running a company without the ability to run electronic payment transactions, or running a telecom company without an electronic customer database. And this dependency is only growing larger. For example, take e-government developments like the electronic medical file, or the increasing demand for online self service for customers. To enable new developments, over and over, new technologies are introduced. And with each introduction of a new technology, the complexity of organizations grows. This process has been going on for tens of years and has become one of the reasons why an increasing number of organizations suffer from a complex landscape of legacy information systems. This complexity has a disabling effect on organizational change [Kardasis et al., 1998, Ross et al., 2006].

Many organizations are urgently seeking ways to cope with complexity, and regain their flexibility to stay competitive in this fast changing world. About twenty years ago, Enterprise Architecture (EA) started out as a practical means to cope with complexity. During the last ten years, EA rapidly gained acceptance; many organizations employ enterprise architects nowadays. Despite some early fundamental research in the late eighties and early nineties (e.g., [Zachman, 1987, Allen et al., 1991]), the research community did not really pick up on this topic until it became a larger phenomenon of increasing importance for organizations during the late nineties and especially during the new millennium.

Although much is achieved in the last twenty years, when I look back at the five years of practical experience I have with EA, I have my doubts about the true effects EA has had thus far. In Section 1.2 I explain why I have my doubts about the current effectiveness of EA. But to explain this clearly, I first briefly discuss what EA is in Section 1.1. The rest of this chapter is structured as follows. In Section 1.3 I present the research questions I aim to answer in this thesis. Section 1.4 describes the research approach I used and provides a brief description of the case studies I conducted. In Section 1.5 I sum up the research methods I used, and Section 1.6 provides an outline of this thesis. I conclude this chapter with listing the publications this thesis is based on in Section 1.7.
CHAPTER 1. INTRODUCTION

1.1 Enterprise Architecture

There is a wide range of definitions of Enterprise Architecture. This shows there is little consensus about what EA exactly entails. Therefore, I do not provide a definition, but a characterization of the concept of EA, based on descriptions in the literature.

An EA provides the overall design of a complex, multisystem solution [Perks et al., 2003]. An EA acts as the target blueprint that provides a long-term view of an organization’s processes, systems, and technologies [Ross et al., 2006]. An EA provides a means for choosing, from a selection of solution alternatives, the optimal (most feasible) solution to a complex organizational problem [Johnson et al., 2007]. This supports senior management decision making [Simons et al., 2005]. The selected solution alternative is detailed into a target blueprint [Armour et al., 1999]. A target blueprint structures the overall solution into business and information, information systems and technical infrastructure layers [Lankhorst, 2009]. The target blueprint thus abstracts a complex organizational situation into comprehensible and manageable business and IT components. This allows for better communication between the various stakeholders of the organizational problem at hand [Smolander et al., 2002a, Jonkers et al., 2004].

To guide the implementation of the target blueprint, an EA also provides an implementation roadmap. An implementation roadmap describes the steps in a process of the involved projects to reach the organization’s target state as described in the target blueprint [Pulkkinen et al., 2007]. During implementation, the target blueprint provides a means of governance to validate the conformance of the sub-solutions delivered by the project teams to the blueprint [Boster et al., 2000]. This enables senior management to make decisions about which measures to take regarding projects that plan to deliver sub-solutions that deviate from the blueprint. EA thus provides a means for comprehensive and coordinated planning and management of business and ICT development projects [Pulkkinen et al., 2007].

1.2 Problem Statement

A target blueprint describes the to-be situation in which an organization optimally achieves its strategic goals. In practice, although created with the best intentions, a blueprint is often not used from the start of its inception, or dropped halfway [Boster et al., 2000], which makes it ineffective. In some situations this is because the responsible executives never really commit to the blueprint by taking strategic ownership [Bowman et al., 1997]. This decreases the chance of project teams adhering to this blueprint. In other situations the architects insufficiently explain to project managers and solution designers the contents of a blueprint and the rationale behind architectural decisions [Tyree et al., 2005]. This is often combined with blueprints being documents that are hard to read, and applied too rigidly by architects [Boster et al., 2000]. To make things worse, architects often forget to explain to stakeholders how to apply a blueprint, and do not provide them with the often much needed support. This decreases the chance
1.2. PROBLEM STATEMENT

of program management and project teams conforming to a blueprint during the execution of a transformation, which again makes it ineffective. In conclusion, effectively applying EA as a means to help deliver the strategy of a large organization is no easy task.

I have not yet seen an organization that was able to achieve the full set of potential benefits of EA. As a remedy to this problem, many practitioners, as well as researchers, focus on making the architecting process more efficient – e.g., by developing better EA frameworks, analysis methods, and tools. However, being successful with EA requires more than merely creating a target blueprint. It involves the full spectrum of creating a vision, involving the responsible business stakeholders, advising them on the solution directions, developing a target blueprint and implementation roadmap, and providing support and control to ensure the projects adhere to the EA during the implementation phase. During my career as IT governance consultant, I have not seen any organization where this entire process of advice, development of the blueprint, and the actual implementation of the blueprint is fully intact.

The practitioner and academic communities are mainly focusing on improving the efficiency of the architecting process, probably because it is quite complex and time consuming process, and good architects are scarce. Most effort is therefore put into creating new methods, techniques, frameworks, and tools to increase the efficiency of architects. This way more work could be done more accurately by the few architects that are available. However, how effective the outputs of the architects actually are, and whether the effort put into creating these outputs are worth it, is often ignored.

Because the focus is mainly on the responsibilities of the architect, the responsibilities of the non-architect stakeholders that take part in the EA process are often overlooked. These non-architect stakeholders (e.g., senior managers, project managers, solution designers, and administrators) each play a vital role in making EA effective. For example, without the involvement of senior management, architects can create a target blueprint, but it is never formally accepted. In practice, I observed many organizations where stakeholders were not willing to participate in the EA process, because they were not satisfied with how it was being executed. The question what stakeholders expect from architects and how architects should operate so that they help the organization achieve its goals is often not asked.

In my view, the problem is that we (the EA community) are focusing too much on the wrong things – e.g., creating the perfect target blueprint using the best EA framework, methods, and tools. The result of that is that architects become very efficient in doing the wrong things. The focus is also too narrow, often ignoring the stakeholders who should participate in the EA process and benefit from the blueprint and the support they receive from architects. To make things worse, we are sometimes forgetting that Enterprise Architecture is a means to an end, and not the end itself. If we are not able to expand our scopes and improve our focus to consider the overall performance (not just efficiency) of all the stakeholders involved in the EA process (not just the architects), we will not be able to evolve the discipline of EA to become truly effective. In this thesis, my focus is to help this emerging, and potential groundbreaking, discipline come of age.
CHAPTER 1. INTRODUCTION

1.3 Research Questions

My goal with writing this thesis is to explore and validate new theories from practice in order to break the pattern described in Section 1.2. Therefore I focus on the performance of the EA function; the organizational function (including architect and non-architect roles and bodies) responsible for creating, maintaining, ratifying, enforcing and observing the Enterprise Architecture. In this section I introduce my research questions, which I structured in three parts:

A. Explore and define the EA function
B. Investigate performance of the EA function from different perspectives
C. Combine perspectives to investigate the overall performance of the EA function

Figure 1.1 shows, from top to bottom, the sequence of the questions of my research, which I elaborate on in the remainder of this section.

Figure 1.1: Structure of research questions.

To investigate the EA function, we need to understand how EA is perceived and applied in practice. We need to know what EA entails, and better understand its purpose. Also, we need to know what the practical problems with applying EA are, and which critical success factors apply. Therefore, my first research question is:

RQ-1: How is EA perceived and applied in practice?

Next, to be able to study the performance of the EA function, we need to have a thorough understanding of what an EA function is, and what its objectives are. We need to know which elements the EA function consists of, who is involved in running an
1.3. RESEARCH QUESTIONS

EA function, and who performs which tasks. I thus follow with defining the object of my research with answering the question:

RQ-2: *What is an EA Function?*

Then, to fully understand how the EA function should operate in order to be truly effective, we need to know more about its performance. To be complete, we need to consider the performance of the EA function from multiple perspectives. I start with taking an internal perspective on how efficient the EA function operates by answering the question:

RQ-3: *How to determine the efficiency of the EA function?*

Like any product or service, the client (e.g., stakeholders or users) of the EA function determines its success. If the non-architect stakeholders that interact with architects are unsatisfied with what they get, they are likely to ignore EA altogether. We thus need to know how the non-architect stakeholders perceive the EA function; how they expect to benefit from EA. Therefore, to complement the internal efficiency perspective of RQ-3, I take an external customer view by answering the question:

RQ-4: *How do stakeholders perceive the EA function?*

An organization is only likely to invest in EA when it produces visible results. Therefore, we need to know to which degree the EA function contributes to the attainment of organizational goals. Next to the activity-focused perspective I take with RQ-3 on how work is done, we need to also consider the results of EA function that are actually achieved. The third perspective I take is result-oriented, by answering the question:

RQ-5: *How to determine the goal-attainment of the EA function?*

With RQ-3 to RQ-5 I address several performance related topics separately. These performance topics are related to each other. To fully understand the overall performance of the EA function, we need to know how goal-attainment affects stakeholder satisfaction, and how the performance of the EA function affects goal-attainment. With the remaining two research questions I focus on relating these topics to get a holistic view on the performance of the EA function. First, I investigate the relation between stakeholder satisfaction (RQ-4) and goal-attainment (RQ-5) by answering the question:

RQ-6: *What is the relation between goal-attainment of the EA function and the satisfaction of its stakeholders?*

Following, and finally, to get a complete view on how to judge the overall performance of the EA function and its contribution to the achievement of organizational
CHAPTER 1. INTRODUCTION

goals, I take a wide perspective by answering the question:

**RQ-7:** *Is there a connection between the performance of the EA function and the attainment of organizational goals?*

### 1.4 Research Approach

I conducted this research while working for two consulting firms, Capgemini (4 years) and Ernst & Young (1.5 years). Through my practical engagements at various clients, I had access to real-life practical situations to diagnose problems, implement intervening actions, and conduct reflective learning, which are the core elements of the Action Research process [Avison et al., 1999]. Because Action Research and typical organizational consulting contain substantial similarities [Baskerville, 1999], taking an Action Research approach was the logical choice. Therefore, I conducted my research (except for RQ-7) using an Action Research approach.

The EA function is a social system of architects and non-architect stakeholders (e.g., senior managers, project managers, designers, analysts, etc.) working together on designing and realizing an organization’s EA. Action Research is ideal for the type of research I conducted, because this approach contains the crucial elements that work very good within a specific social situation [Checkland et al., 1998]:

- a collaborative process between researchers and people in the situation,
- a process of critical inquiry,
- a focus on social practice, and
- a deliberate process of reflective learning.

The Action Research cycle (see Figure [1.2]) consists of an iteration of five phases [Susman et al., 1978]:

1. **Diagnosing.** Identification – through self-interpretation of the complex organizational problem in a holistic fashion – of the underlying causes of the organization’s desire for change; development of certain theoretical assumptions about the nature of the organization and its problem domain.

2. **Action planning.** Specification of organizational actions – guided by a theoretical framework, that should relieve or improve the problems – including both a desired future state for the organization and the changes that would achieve such a state; establishing a plan that targets the change and provides an approach to change.

3. **Action taking.** Active intervention into the organization by taking actions through a chosen strategy and tactics (action planning) that cause certain changes.
1.4. RESEARCH APPROACH

4. **Evaluating.** Evaluation of the outcomes, which includes determining whether the theoretical effects of the actions were realized, and whether these effects solved the problems. Where the change was successful, the evaluation must critically question whether the action undertaken was the sole cause of success. Where the change was unsuccessful, some framework for the next iteration of the Action Research cycle (including adjusting the hypotheses) should be established.

5. **Specifying learning.** Deduction of knowledge (whether the action was successful or unsuccessful), which provides foundations for diagnosing in preparation for further Action Research interventions, or for changing the future research agenda.

![The Action Research Cycle](image)

Figure 1.2: The Action Research Cycle, taken from [Baskerville, 1999].

Most of my research (except for RQ-1 and RQ-7) was conducted at two divisions of the same large international company, which will remain anonymous. At these two divisions, the IT & Operations (ITO) division and a business division, I conducted five case studies in order to address my research questions. In the remainder of this section I describe, in order of appearance in this thesis, the approach taken for each of the five case studies conducted, including the research questions I addressed while conducting the case studies. Table 1.1 shows a mapping of the case studies onto the research questions.

**1.4.1 Case study 1: EA Functions of Two Divisions of a Large Company**

In Section 3.3 I discuss two case studies I conducted to develop a definition of the EA function (RQ-2). The first case study ran from early 2008 to early 2009. Together with a team of about 25 consultants, I implemented a new EA function at the ITO division. The objective for the client organization was to improve the efficiency and effectiveness of its EA function, in order to improve the stability and continuity of its business processes and IT. Case study 3 (see Section 1.4.3) formed the diagnosis phase
for this case study, and we used the lessons learned from Case study 3 to devise an action plan. Action taking involved designing and implementing the new EA function, which consisted of 8 architecture departments, 1 EA council, and 7 structural management team meetings. This included creating process descriptions and work procedures for the architects and project managers of the international company, training the architects and project managers, and guiding the line managers appointed to lead the 8 new architecture departments.

The second case study I used to develop the definition of the EA function was an assessment of the EA function of a business division mid 2007. Together with a team of three consultants, I assessed the EA function and learned more about the object of research (RQ-2). Due to reasons of confidentiality, I was not allowed to use the efficiency assessment results of the business division in much detail. I used this case study to confirm my findings from Case study 1.

1.4.2 Case study 2: Architecture Maturity of IT & Operations Division

In Section 1.3 I discuss the case study I conducted at the end of 2006, which involved an assessment of four departments within the ITO division. The objective for this assessment was twofold. The practitioners of the company wanted insight in the architecture maturity of the four departments. The research objective was to test and improve the initial version of my EA delivery function assessment framework. The diagnosing phase included determining the scope and objective of the assessment, based on a first scan of the organization regarding its structure, characteristics and primary problems. Based on this diagnosis, an assessment plan was devised. Action taking included conducting semi-structured interviews and a document study, and writing and presenting an assessment report, including an advice for improving the architecture maturity of the four departments. Evaluation of the framework and approach used for the assessment led to specification of learning and improvement of the framework and approach (RQ-3).

1.4.3 Case study 3: EA Function Efficiency of IT & Operations Division

In Section 1.7 I discuss the assessment of the EA function of the ITO division I conducted at the end of 2007. I followed the same approach as I did for Case study 2. We focused our interviews primarily on the architects, but also included several non-architect stakeholders. Case study 3 formed the diagnosis phase for Case study 1, as we discussed in Section 1.4.1 As a result of the specification of learning, I gained knowledge about the performance framework (RQ-3).
1.4.4 Case study 4: Stakeholder Perception at Business Division

In Section 5.2.2, I discuss the assessment of the EA function of the business division I conducted mid 2007. The research approach was similar to the approach taken in Case study 2 and 3. I held more interviews, also with non-architect stakeholders of the EA function. I assessed the perception of the non-architect stakeholders of the EA function. I held an evaluation workshop with the key participating practitioners of the assessment (primary client, sponsor, head of the architecture department, and several lead architects). As a result of the specification of learning, I gained knowledge about how stakeholders perceive the EA function, and what determines their satisfaction with how the EA function operates (RQ-4).

1.4.5 Case study 5: EA Effectiveness of IT & Operations Division

In Section 5.3.3, I discuss the case study I conducted mid 2008 within the ITO division. The objective for the ITO division was to implement a control cycle of structurally monitoring and controlling the effectiveness of the EA function being implemented. The research objective was to devise and qualitatively test a framework for measuring EA function Effectiveness. I followed a similar approach to the case study as I did for Case studies 2, 3 and 4. I skipped the diagnosing phase because the underlying causes of the organization’s desire for change were already clear from Case studies 1 and 3. Action taking involved devising and implementing performance indicators, based on semi-structured interviews. Also, the performance measurements were included as a periodic item on the agenda of the EA council meeting. Evaluation and specification of learning resulted in new knowledge about measuring the goal-attainment of the EA function (RQ-5).

1.5 Research Methods

In Section 1.4 I mentioned some of the research methods I used while conducting my research. Action Research allows for various research methods to be used. All methods I used are generally common to the qualitative research paradigm. Holz et al. provide a list of research methods [Holz et al., 2006], from which I selected the ones applicable to my research. I took two additional research methods from marketing research (means-end chain analysis and laddering technique) to study the stakeholder perception of the EA function (RQ-4). Table 1.1 shows, for each research questions, the research methods I used. Below a brief description of each of the research methods used:

- **Grounded Theory.** “[aims] to develop a theory from data rather than gather data in order to test a theory or hypothesis. This means that qualitative methods are used to obtain data about a phenomenon and that a theory emerges from the data.” [Goede et al., 2003]. Grounded Theory was used in combination with semi-structured interviews to explore how EA is perceived and applied in practice, and to create a starting point for further research on the EA function.
Table 1.1: Overview of case studies and research methods.

<table>
<thead>
<tr>
<th>Research question</th>
<th>Case studies</th>
<th>Research methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ-1: How is EA perceived and applied in practice?</td>
<td></td>
<td>Semi-structured interviews, and Grounded Theory</td>
</tr>
<tr>
<td>RQ-2: What is an EA function?</td>
<td>1</td>
<td>Case studies, and critical analysis of literature</td>
</tr>
<tr>
<td>RQ-3: How to determine the efficiency of the EA function?</td>
<td>2, 3</td>
<td>Case studies, semi-structured interviews, and document analysis</td>
</tr>
<tr>
<td>RQ-4: How do stakeholders perceive the EA function?</td>
<td>4</td>
<td>Case study, semi-structured interviews, means-end chain analysis, and laddering</td>
</tr>
<tr>
<td>RQ-5: How to determine the goal-attainment of the EA function?</td>
<td>5</td>
<td>Case study, semi-structured interviews, and critical analysis of literature</td>
</tr>
<tr>
<td>RQ-6: What is the relation between goal-attainment of the EA function and the satisfaction of its stakeholders?</td>
<td></td>
<td>Data analysis</td>
</tr>
<tr>
<td>RQ-7: Is there a connection between the performance of the EA function and the attainment of organizational goals?</td>
<td></td>
<td>Survey</td>
</tr>
</tbody>
</table>

- **Critical analysis of literature.** “An appraisal of relevant published material based on careful analytical evaluation.” [Holz et al., 2006]. I reviewed relevant literature to create new theories firsthand, or validate research findings (e.g., lessons learned from case studies).

- **Case study.** Examines one or more organizations, groups, or systems in detail; involves no variable manipulation, experimental design or controls; is exploratory in nature [Alavi et al., 1992]. Several case studies were conducted examining EA functions in the course of this research.

- **Interviews.** “An information gathering technique whereby people are posed questions by an interviewer; these interviews may be structured or unstructured.” [Benyon et al., 2005]. In my case studies I used semi-structured interviews, meaning that a list of topics was made in advance with questions placed in a logical order. This provided a high-level structure to steer the conversation, but left sufficient freedom for the interviewer to ask follow-up questions or to focus on new unexplored topics.

- **Document analysis.** “Includes examination of [...] documentation, project technical papers and memoranda...” [Marchionini et al., 1994]. For each of the assessments conducted at the two client organizations I conducted thorough document analysis to validate the findings from the (semi-structured) interviews and gather additional data.
1.6. OUTLINE OF THIS THESIS

- **Laddering.** (Soft-laddering) involves in-depth interviews with respondents following, as far as possible, their natural flow of speech; the researcher seeks to understand the meaning of the given answers and links them to the means-end model [Voss et al., 2007]. I used this interviewing technique to understand the reasoning of stakeholders why they found certain attributes of the EA function important.

- **Means-end chain analysis.** Shows how a stakeholder associates, in its mind, consuming or using a product or service (the means) with achieving a valued state (the ends) [Gutman, 1997]. This method is mainly used in marketing research to create a mind-map of how stakeholders (or consumers) perceive a product or service. I applied this method to create a mind-map of how non-architect stakeholders perceive the products and services provided by the EA function.

- **Survey.** Includes theory formulation, survey design, question formulation, scale construction, hypothesis formulation and testing [Kitchenham et al., 2002]. To combine and empirically validate all theories constructed during my research, I constructed a conceptual model containing various hypotheses. Based on the conceptual model, I created a survey. In a workshop 29 experts in the field of IT governance and EA judged a realistic case description using the survey.

1.6 Outline of this Thesis

The rest of this thesis is structured as follows:

- **Chapter 2.** Provides a characterization of how EA is perceived and applied in practice (RQ-1). This chapter shows that the critical success factors, as perceived in practice, also concern issues other than the efficiency of architects alone. In this chapter, I draw the conclusion that the focus of my research should also be on governance issues, and the scope of my research should also include the non-architect stakeholders of the EA function.

- **Chapter 3.** Provides a definition and description of the EA function (RQ-2), which includes both architects and non-architect stakeholders, and governance elements. Based on the case studies presented, this chapter draws the conclusion that the performance of the EA function is typically quite low. In order to better understand what determines how well an EA function operates, a performance framework and assessment approach is needed.

- **Chapter 4.** Presents a performance framework and assessment approach to determine the performance of the EA function (RQ-3). In this chapter, I draw the conclusion that stakeholders are generally unsatisfied with the performance of the EA function. Also, in this chapter I conclude that many organizations invest in their EA function without knowing how this contributes to achieving organizational goals.
CHAPTER 1. INTRODUCTION

- **Chapter 5.** Presents the mind-map of how stakeholders perceive the products and services provided by the EA function (RQ-4). This chapter also presents a framework and approach to measure the effectiveness of the EA function (RQ-5). Furthermore, in this chapter I describe the relation between the goal-attainment of the EA function and the satisfaction of its stakeholders (RQ-6).

- **Chapter 6.** In order to describe and empirically validate the relation between the performance of the EA function and the attainment of organizational goals (RQ-7), this chapter describes the conceptual model, survey construction and data analysis of the validation experiment conducted. In this chapter I draw conclusions about how independent assessors (i.e. IT Governance and EA experts) judge the performance of the EA function, and how these assessors perceive the contribution of the EA function to organizational goals.

- **Chapter 7.** This chapter concludes this thesis by revisiting the research questions, explaining the contributions of my research, looking back at the problem statement, and discussing potential future work regarding the performance of the EA function.

1.7 Publications

The research presented in this thesis has either been published previously or is currently submitted for publication.

Chapter 2 is based on the following publication:


Chapter 3 is based on the following publication:


Chapter 4 is based on the following publications:


1.7. PUBLICATIONS


Chapter 5 is based on the following publications:


Abstract:
Based on interviews with a number of architects and managers from a wide range of organizations, we characterize how EA is perceived and applied in practice. The key aspects of how EA is perceived in practice are that EA is: a means of abstraction, a means of communication, and a governance instrument. The key critical success factors for applying EA in practice are: the acceptance of EA driven organizational changes, the availability of efficient EA means, and the proper usage of EA. We identify three groups of organizations that differ with respect to their level of architectural maturity and alignment: organizations where architecture awareness starts with either business management or the IT department, and consultancy firms. Analysis of the interviews indicates that these three groups differ in the architecture aspects and critical success factors they emphasize. Our results provide a starting point for assessing architecture maturity and alignment within organizations, and can be used to help harmonize different architectural tunes being played within organizations. The results presented in this chapter show that merely focusing on improving EA as a means of abstraction, and developing more efficient EA means is not enough. Other aspects and critical success factors are perceived to also play an important role in successfully applying EA as a means in practice. Therefore, we conclude that to be effective with EA, it is essential to have better understanding of all the elements that constitute the organizational function responsible for composing and implementing the EA, the EA function.

2.1 Introduction

The business community has been using EA in the context of a wide range of complex organizational and technological problems, from designing new business operating models to building large software and information systems. This diversity in use easily results in incomprenhension and misunderstandings between different architecture users, for example between business management and the IT department of an organization.
The software engineering community has spent much time trying to define software architecture. Though there is a plethora of definitions around – see [SEI, 2003] for a compilation – these definitions do have a lot in common. There is little consensus when it comes to what EA entails however. For instance, there is a large variety in the types of information included in EA frameworks [Greefhorst et al., 2006]. Also, little research is done on the practical perception of EA and the typical problems encountered when applying it.

The objective of this chapter is to get a better idea of how EA is perceived in practice by various organizations, mostly large organizations like banks, insurance companies, and government agencies, but also supplying parties like consulting firms and IT vendors. Our hypothesis is that different organizations have a different perspective on what EA entails. These differences manifest themselves in different architectural issues being emphasized by different organizations.

This is an exploratory study, based on 41 semi-structured interviews with architects and managers, conducted at 27 different organizations within the Netherlands. Using these data, we characterize how EA is seen in practice. We do so by applying Grounded Theory. This results in the identification of three key aspects of EA, and three critical success factors for applying EA. The key aspects identified are that EA is: a means of abstraction, a means of communication, and a governance instrument. The key critical success factors are: the acceptance of EA driven organizational changes, the availability of efficient EA means, and the proper usage of EA.

We next characterize the organizations with respect to their level of architectural maturity and the alignment of business and IT on architectural issues, and visualize the results in our Architecture Alignment Model. This visualization allows us to identify and characterize different organization types with respect to architecture maturity and alignment. These organization types turn out to also differ considerably in the EA aspects and critical success factors they emphasize.

In a few organizations where we interviewed more than one person, these persons voiced quite different issues and concerns. In many organizations also, we interviewed one person only. So, the views expressed need not reflect those of the whole organization, but might only hold for the organizational unit whose representatives we happened to have interviewed. Since architecture affects not only the IT department, but cuts across the whole organization, it is important that different views on what architecture is and what it is good for be understood and bridged. Only then will EA mature and truly become successful. Viewed this way, the results presented in this chapter provide a starting point for assessing EA maturity and alignment within organizations, and can be used to help harmonize different architectural tunes being played within an organization.

This chapter is organized as follows. Section 2.2 describes the data that the research is based on. Section 2.3 discerns the major issues that accrue from the set of interview data using Grounded Theory. Section 2.4 characterizes the organizations interviewed using a visualization model. Section 2.5 analyses the differences in perception of the major issues between different types of organizations. Section 2.6 contains our concluding remarks.
2.2 Data Collection

Our analysis is based on interview data that were gathered during a course in software architecture in the fall of 2002. The general aim of the course was to let the students get acquainted with EA as it was perceived and applied across organizations in the Netherlands. The students had to interview practitioners (software architects, enterprise architects, project managers and the like) from a variety of organizations. In total, 27 different companies were visited, ranging from industrial and government organizations to banks, IT vendors and consulting firms. 28 master level students (computer science as well as business informatics) enrolled in the course.

After a general introduction in software and business architecture, the students were trained in applying interview techniques. Since the focus of the course was to get an inventory of how EA is perceived and applied in practice, we used semi-structured interviews, so that unknown EA-related topics would not be excluded. Semi-structured interviews are an accepted method for filling the dataset in Grounded Theory (see Section 2.3). To make sure certain topics were addressed, we spent several meetings to get consensus on a set of topics to be addressed in the course of each interview. This set of topics was:

- The working situation and role of the interviewee
- The use of EA within the company
- The role of an architect within the company
- The methods and techniques used for composing an EA
- The personal experience of the interviewee with EA

The 14 pairs of students were each given three persons to interview. One interview had to be cancelled because of time constraints. The analysis thus is based on 41 interviews. The interviewees were selected by the course supervisors using their contacts. Most of the interviewees were knowledgeable in the field of EA, had attended workshops on the topic, the Dutch national architecture conference, or similar meetings. The students prepared a report of each interview. These reports were in many cases – though not always – sent to the interviewee for approval. The reports varied in length from a mere two to over five pages. The students of course were inexperienced in the field. This in itself not a problem. Grounded Theory prefers interviewers that are not very experienced, because they need to set aside, as much as possible, theoretical ideas and notions, so that the analytic, substantive theory can emerge [Backman et al., 1999]. Experts as interviewer are more likely to directly analyze the observations during the interviews, which will influence the resulting theory. The variability between the interviewers is partly mitigated by the effort taken to get a consensus on topics to be addressed, but cannot be fully ruled out.
2.3 Applying Grounded Theory

While going through the interviews, the frequency with which two issues recurred in the interviews – aspects of architecture, and critical factors for successfully using architecture – caught our attention. In order to further underpin this observation, we applied Grounded Theory. The Grounded Theory method is a qualitative approach to inductively distil theory from a dataset [Calloway et al., 1991, Corbin et al., 1998]. This approach is not fit to test an existing hypothesis, but provides a method for emerging a theory from collected data. The basic idea of Grounded Theory is to read and reread some textual database, and iteratively ‘discover’ and label a set of concepts and their interrelationships. Next, these findings are compared with existing theory from the field.

In our case, we started with two concepts: aspects of architecture, and critical success factors for using architecture. These concepts were selected as core categories. We used these core categories to bring structure in and reduce the enormous amount of data. For each core category we constructed a tree structure with subcategories, sub-subcategories, etc.

While going through all the interview notes, the trees slowly expanded. During this growth stage of both trees, a new category was added to the tree in question whenever a new topic was mentioned. Whenever an existing category was mentioned in an interview, the name of the interviewee was linked to that category. This way, we were able to count the number of occurrences of each category in the set of interview notes. These numbers are later used to analyze differences between groups of organizations and the concepts they emphasize.

After several iterations over the set of interview notes, both tree structures stabilized. We interpret the contents of both tree structures below. In Section 2.5 we discuss how the attention paid to the various concepts differs between the clusters of organizations identified.

2.3.1 Aspects of architecture

The tree of aspects of architecture that we encountered in the data is depicted in Table 2.1. In the following, we give our interpretation of the contents of the various sub-trees of the aspects category and relate this to existing views in the field. Overall, the aspects encountered match existing literature pretty well.

2.3.1.1 Means of Abstraction

Large organizations often have difficulties organizing their complex internal and external structures, processes and systems. By abstracting these in models and descriptions, architecture has an important role in organizing and structuring complex problems [The Open Group, 2009, Bass et al., 2003]. In abstracting reality, architecture focuses on three areas:

1. the business structures and processes (business architecture),
2.3. APPLYING GROUNDED THEORY

2. the use of information systems facilitating the business processes (IT architecture),
3. the alignment of the information systems to the business processes.

A business architecture gives a description of the present and future business model, products and services, functions and roles, processes, and information requirements of an organization. The business architecture is based on the organizational structure and business goals, particularized in the vision and mission statement and the business strategy. The IT architecture is based on the IT strategy to help the organization reach its information requirements, and the strategy for meeting these IT goals. It also gives an overview of the present and future information systems and the infrastructure for being able to reach the IT strategy and meet the organization’s information requirements, together with the planning for their development [The Open Group, 2009].

Aligning the information provision of IT systems with the information requirements and business goals of an organization – also called business-IT alignment – is one of the main goals architecture tries to achieve [Henderson et al., 1993; Wieringa et al., 2003].

Our findings indicate that in practice relatively little is known about how to realize alignment, since this category does not have any subcategories, meaning that our respondents did not articulate more detailed information about what alignment entails, or how to achieve it. Yet, alignment is generally considered an important issue [Papp et al., 1998].

2.3.1.2 Means of Communication

Clear communication between technicians and business experts is critical for business and IT alignment. Without clear communication, they cannot exchange ideas or come to unambiguous requirements. By abstracting complexity in models and descriptions, it becomes more manageable. This improves communication and the decision making process. Architectural models and descriptions form a central reference point; they act as a contract between stakeholders [Bass et al., 2003].

2.3.1.3 Governance Instrument

Large organizations often have no central strategy for implementing the desired information systems and meeting the organizational information requirements. Information systems are developed piece by piece, which results in systems that do not fit together and are not able to interoperate. EA provides a central strategy and a long-term planning of all business and IT solution development projects. Structuring the information system development process and making it more efficient, is a problem in many organizations. Architecture structures this development process by prescribing rules and guidelines [The Open Group, 2009]. By managing development knowledge and experience, architecture enables the reuse of knowledge from the past. This makes it possible to develop information systems in less time and against lower costs, making the development process more efficient.
Table 2.1: Tree with Architecture Aspects.

<table>
<thead>
<tr>
<th>Means of Abstraction</th>
<th>Vision, mission and strategy</th>
<th>Organization Processes Information needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>Strategy</td>
<td>Requirements</td>
</tr>
<tr>
<td></td>
<td>IT</td>
<td>Application portfolio Coupling of components Infrastructure</td>
</tr>
<tr>
<td>Alignment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means of communication</td>
<td>Explain something</td>
<td>Give advice Exchange ideas</td>
</tr>
<tr>
<td></td>
<td>Stakeholder communication</td>
<td>Intern (inside the organization) Extern (outside the organization)</td>
</tr>
<tr>
<td>Governance instrument</td>
<td>Knowledge Methods and techniques Solutions</td>
<td>Rules Guidelines Principles</td>
</tr>
<tr>
<td></td>
<td>Development process</td>
<td>Planning Decision Making Quality Control Audit Consistency Constraints</td>
</tr>
</tbody>
</table>

2.3.2 Critical Success Factors

The success of using architecture depends on a lot of factors. We again applied Grounded Theory to our set of 41 interviews to determine which factors are most important in making EA work in practice. From this analysis, it appears successful use of architecture mainly depends on the following three factors:

1. acceptance of organizational changes initiated by the EA,
2. availability of efficient EA means, and
3. proper usage of EA.

The tree of topics related to success factors is depicted in Table 2.2.

2.3.2.1 Acceptance of Architecture-Driven Changes

Changes initiated by the use of architecture generally affect the entire organization, especially its employees. Full acceptance of all organizational changes is important in making
2.3. APPLYING GROUNDED THEORY

successful use of architecture. The acceptance of changes initiated by the EA has many similarities with Kotter’s eight stage process to achieve successful change [Kotter, 1996]. As a change process, architecture is not all that different from other change processes.

2.3.2.2 Availability of Efficient Means

The interviewees consider skilled architects more important than efficient methods. A good method can be misused by a bad architect. Architects should have practical experience and have knowledge about the problem domain. Also, communicative and social skills are important in spreading architectural knowledge, and explaining the urgency of the EA within an organization [Hofmeister et al., 2000].

Table 2.2: Tree with Critical success factors.

<table>
<thead>
<tr>
<th>Acceptance of architecture-driven changes</th>
<th>Create and explain urgency of changes</th>
<th>Involve leading parties</th>
<th>Vision and strategy</th>
<th>Create support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>Management</td>
<td>Authorized to make changes</td>
<td>Develop it</td>
<td>Amongst developers</td>
</tr>
<tr>
<td>Authorized to make changes</td>
<td></td>
<td></td>
<td>Communicate it</td>
<td>Amongst users</td>
</tr>
<tr>
<td>Short term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Make results visible</td>
<td>Short term</td>
<td>Cost decrease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost decrease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Let architecture evolve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anchor architecture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In development process</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anchor architecture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In management process</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anchor architecture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In innovation process</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anticipate future changes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effective means</th>
<th>Methods &amp; techniques</th>
<th>Architects</th>
<th>Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Skills</td>
<td>Skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Responsibilities</td>
<td>Responsibilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Qualities</td>
<td>Qualities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Practice-oriented</td>
<td>Practice-oriented</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Situational</td>
<td>Situational</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Top-down and bottom-up</td>
<td>Top-down and bottom-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prescriptive</td>
<td>Prescriptive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Widely usable</td>
<td>Widely usable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reasonable costs</td>
<td>Reasonable costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Architecture (models and descriptions)</td>
<td>Comprehensible</td>
<td>Satisfy requirements</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Based on standards</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Complete</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 2. ENTERPRISE ARCHITECTURE AND BEYOND

<table>
<thead>
<tr>
<th>Room for creativity</th>
<th>Maintain architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alignment</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
</tr>
<tr>
<td></td>
<td>Not just cost reduction</td>
</tr>
<tr>
<td>Focus on</td>
<td>Simplicity through abstraction</td>
</tr>
<tr>
<td></td>
<td>Long term</td>
</tr>
<tr>
<td></td>
<td>Contents</td>
</tr>
<tr>
<td>View on architecture</td>
<td>More than just description</td>
</tr>
<tr>
<td></td>
<td>Prescriptive, not descriptive</td>
</tr>
<tr>
<td></td>
<td>Inter-organizational</td>
</tr>
<tr>
<td></td>
<td>Means, not a goal in itself</td>
</tr>
<tr>
<td></td>
<td>Management instrument</td>
</tr>
<tr>
<td>Proper usage</td>
<td>Deployment</td>
</tr>
<tr>
<td></td>
<td>Not in small projects</td>
</tr>
<tr>
<td></td>
<td>Only when needed</td>
</tr>
<tr>
<td></td>
<td>Only for what it’s for</td>
</tr>
<tr>
<td></td>
<td>On all organizational levels</td>
</tr>
<tr>
<td>Responsibilities</td>
<td>Assign properly</td>
</tr>
<tr>
<td></td>
<td>State clearly</td>
</tr>
<tr>
<td>Centralize</td>
<td>Terminology</td>
</tr>
<tr>
<td></td>
<td>Architecture methodology</td>
</tr>
<tr>
<td>Account for</td>
<td>User requirements</td>
</tr>
<tr>
<td></td>
<td>Legacy systems</td>
</tr>
<tr>
<td></td>
<td>Modifiability, flexibility</td>
</tr>
<tr>
<td></td>
<td>Security</td>
</tr>
<tr>
<td></td>
<td>Standardization</td>
</tr>
<tr>
<td></td>
<td>Maintainability</td>
</tr>
</tbody>
</table>

Although skilled architects are important, they should also have efficient tools at hand: methods that fit the specific requirements and situation of a company. These methods should not constrain the architect in his work and creativity. The architectural models and descriptions an architect produces should be understandable and unambiguously interpretable by all stakeholders [IEEE, 2000]. It is also important that these models and descriptions are practical, easily translatable to the practice of developing and implementing business and IT solutions. Otherwise the EA will exclusively be used by the architects.

2.3.2.3 Proper Usage of Architecture

EA is a means which should be used properly. Often, a lot of time is spent on finding the best methods and modeling languages, which takes the attention away from the real purpose of architecture. This way EA becomes a goal, though it should be used as a means. Another threat is to focus too much on getting positive results on the short term. This is important in convincing senior management that the use of architecture pays off, but could make an organization lose track of its long term concerns.

In order to perform their tasks properly, architects should not be subordinate to project managers who have to defend the planning and budget of individual solution development projects. If this happens, the quality improvement of operations – one of the main goals of architecture – will likely not be achieved.
Standardizing EA methods, descriptions, methods, and terminology within an organization is important in improving the adjustment of different projects to each other, and making sure business processes and information systems fit together, and into the entire architecture. By making decisions about interfaces, security, the integration of new solutions with legacy processes and systems, usability, and maintenance, this central architecture makes the entire set of business processes and information systems within an organization operate properly [The Open Group, 2009].

2.4. Architecture Alignment Model

The amount of data available calls for a compact visualization of the results. We looked for a simple visualization that would highlight the differences in architecture maturity of all the organizations visited. Wagter et al. describe one such model [Wagter et al., 2001], where the level of architectural thinking is contrasted with organizational embedding. Although these two aspects are important, this representation ignores an important aspect that struck us in the interviews. The origin of the ‘architecture lobby’ within an organization turned out to play an important role. An organization where architecture awareness originates with business management has different ideas about architecture and faces different problems than an organization where architecture awareness starts in the IT department. We visualized these differences in our Architecture Alignment Model; see Figure 2.1. This model not only visualizes architecture maturity, but also the alignment of business and IT on architectural issues.

The Architecture Alignment Model relates architecture maturity on the horizontal axis with organizational alignment on the vertical axis. It is important to note that the vertical optimum is at the midpoint of the axis. Only fully aligned organizations will appear on the middle ‘horizon’ of this model. In organizations which are positioned above this horizon, architecture awareness started from business management, while architecture awareness originated with the IT department in those organizations that are positioned below the horizon. The optimum of this model is the middle-right point. Here, full alignment is combined with a high level of architecture maturity. The shaded triangle in the model represents an area in which almost all interviewed organizations are positioned; apparently some sort of growth path can be defined. We construe that architecture awareness originates from either the business or the IT department, with no alignment yet. When architecture maturity increases, alignment becomes more important, and organizations get ‘on the move’ towards the point that indicates full alignment and architecture maturity.

All 27 organizations are positioned in the model in Figure 2.1. Two of the authors independently did so. We did not have objective measures to rate organizations with respect to their level of architectural maturity or alignment. We assessed them based on our global impression as it accrued from the interview notes. The differences between the assessments were minor; one of the authors consistently assessed the level of architectural maturity a bit higher than the other. Most organizations are represented by a single dot
The y-axis depicts organizational alignment. Organizations where employees see architecture as being imposed by business management make up the business management segment of this axis. Business management uses architecture to give structure to the organization, emphasizing the business aspects of architecture. They have difficulties convincing employees of the benefits of architecture. The other extreme on this axis is the type of company where the awareness of architecture starts at the IT department, which uses architecture to structure the development process and the information systems it produces, focusing on the IT aspects of architecture. The IT department has difficulties convincing the business management to use architecture. The middle point of this axis represents the type of company where the focus of architecture lies evenly on the IT and business aspects, resulting in the alignment of business and IT goals.

The x-axis depicts architecture maturity. Architecture has many aspects which are meant to solve various business and IT problems. Companies using only one or a few aspects of architecture have a low maturity level. They often use certain architecture
2.5. COMPARATIVE ANALYSIS

aspects separately and unconsciously to address specific problems. When the number of architecture aspects being used increases, companies start to realize they should be connected, which shifts their focus to making it a unity. Also they try to spread the use of architecture to other parts of the company. These companies make up the middle segment of the maturity axis in our model. The companies where the full range of architecture aspects forms a unity and is being used company-wide, have the highest level of maturity.

What strikes the most in Figure 2.1 is that there seem to be three obvious clusters: there are clearly discernable groups of organizations where architecture awareness starts with either business management or the IT department. And there is a third group which runs in front of the herd. This latter group turned out to contain all consultancy firms we interviewed. The latter are indicated by a ⊙.

2.5 Comparative Analysis

The three main groups of organizations distinguished in Section 2.4 each have a different perspective on architecture. Each group emphasizes certain aspects and critical success factors. To determine those emphases, we counted the number of times the different aspects and critical success factors for the respective groups of organizations as identified in Figure 2.1 are mentioned in the interviews. Our assumption is that a higher frequency implies more emphasis (see Table 2.3 and Table 2.4). The analysis below is based on these numbers, as well as on the number of times subordinate nodes in the respective trees are mentioned.

<table>
<thead>
<tr>
<th></th>
<th>awareness with business</th>
<th>awareness with ICT providers</th>
</tr>
</thead>
<tbody>
<tr>
<td>total # of occurrences</td>
<td>42</td>
<td>86</td>
</tr>
<tr>
<td>means of abstraction</td>
<td>43%</td>
<td>41%</td>
</tr>
<tr>
<td>means of communication</td>
<td>7%</td>
<td>15%</td>
</tr>
<tr>
<td>governance instrument</td>
<td>50%</td>
<td>44%</td>
</tr>
</tbody>
</table>

2.5.1 Aspects

The employees of consultancy firms we interviewed (mostly architects) emphasize architecture as a means of abstraction. They do not pay much attention to the communication and governance aspects. The two user groups, with their use of architecture originating from either business management or the IT department, mainly emphasize architecture as being a governance instrument and to a slightly lesser extent its abstraction aspect.
Table 2.4: Number of occurrences of critical success factors for different groups of organizations.

<table>
<thead>
<tr>
<th></th>
<th>awareness with business</th>
<th>awareness with ICT</th>
<th>IT service providers</th>
</tr>
</thead>
<tbody>
<tr>
<td>total # of occurrences</td>
<td>64</td>
<td>124</td>
<td>114</td>
</tr>
<tr>
<td>architecture-driven changes</td>
<td>42%</td>
<td>24%</td>
<td>23%</td>
</tr>
<tr>
<td>effective means</td>
<td>27%</td>
<td>38%</td>
<td>40%</td>
</tr>
<tr>
<td>proper usage</td>
<td>31%</td>
<td>38%</td>
<td>37%</td>
</tr>
</tbody>
</table>

2.5.1.1 Means of Abstraction

The Consultancy firms emphasize the abstraction aspect of EA most often. They give attention to abstracting both the business and IT parts of an organization. This is often part of the architectural framework they advocate. The two groups where architecture awareness started with business management or the IT department mainly focus on abstracting the business and IT part of the organization, respectively.

2.5.1.2 Means of Communication

It is striking that communication, essential for realizing business and IT alignment, is mentioned least often by all three groups. This is especially so for organizations where architecture awareness has its origin in business management.

2.5.1.3 Governance Instrument

Organizations where the use of architecture has its origin with business management emphasize the governance aspects of architecture predominantly. They want to make the organization, and its complex problems, more controllable and manageable. The group where architecture has its origin in the IT department tries to make the solution development process, and the business and IT solutions they develop, more manageable by using EA. Consultancy firms are little concerned with the governance aspects of EA, probably because they are hired to develop the EA, and not for the implementation of the EA.

2.5.2 Critical Success Factors

Consultancy firms and organizations where architecture has its origin in the IT department have much in common where it comes to mentioning the critical factors for successfully reaching the goals set for using architecture (see Table 2.4). Organizations where architecture has its origin with business management differ predominantly in that they put more emphasis on change management as opposed to the availability of efficient means.
2.5.2.1 Acceptance of Architecture-Driven Changes

Organizations where the use of architecture started with business management emphasize the acceptance of organizational changes. They have to make the results of using EA visible to themselves and to the employees that depend on these changing circumstances. Firstly, to ensure themselves EA is reaching its goals. Secondly, to convince the rest of the organization architecture does work, which improves the support of the company policy by the employees. Regarding acceptance of architecture-driven changes, consultancy firms differ from the other two groups. They less often mention the forming of a leading coalition to carry through changes. On the other hand, they indicate the importance of composing and communicating a vision and strategy for implementing an EA more often than the other two groups. This is probably because they want to differentiate themselves from competing consultancy firms through their vision and strategy for using architecture.

2.5.2.2 Availability of Efficient Means

Consultancy firms and organizations where the origin of using architecture is with the IT department emphasize the availability of proper means, such as architects and EA methods. This is not surprising since they are responsible for composing the EA. Organizations where the origin of architecture is with business management find it less important to have skilled architects at their disposal. They instead emphasize the comprehensibility of architectural models and descriptions, for it is their job to make sure their ideas and decisions are properly reflected in these models and descriptions.

2.5.2.3 Proper Usage of Architecture

Overall, the different user groups put the same emphasis on the proper use of architecture. Consultancy firms and organizations in which the use of architecture started at the IT department emphasize that the quality of business processes and information systems should not be subordinate to budget and planning issues of the development projects that realize those processes and systems. Those two groups are responsible for composing the EA and ensuring its quality. Because of this responsibility, these two groups also point out that an organization should focus on the long term benefits of EA, like improving quality and alignment. Also, the technical aspects of architecting business processes and information systems are very important to them.

2.6 Concluding Remarks

2.6.1 Results

In this chapter, we analyze a set of 41 interviews with architects and managers from a variety of organizations in the Netherlands. We applied Grounded Theory to determine the major aspects and critical success factors of EA as they accrue from these interviews.
CHAPTER 2. ENTERPRISE ARCHITECTURE AND BEYOND

These match existing literature well. We positioned all organizations in a two-dimensional model, thus visualizing architecture maturity and the alignment of business and IT on architectural issues. From this model, we observe that there are three obvious clusters of organizations:

- organizations where architecture awareness starts with the business,
- organizations where architecture awareness starts with the IT department, and
- Consultancy firms.

This latter group seems to run in front of the herd, where it comes to alignment and architecture maturity. Apparently, it is easier to preach the gospel than to actually sing it. Interesting observations can be made when we analyze how the different clusters of organizations stress the major aspects and critical success factors:

- Consultancy firms emphasize architecture as a means of abstraction, and pay less attention to communication and governance aspects.
- The groups where architecture awareness starts with either business management or the IT department emphasize architecture being a governance instrument.
- Consultancy firms and organizations where architecture has its origin in the IT department emphasize the availability of proper means, such as architects and architecture methods.
- Organizations where architecture has its origin with business management stress the importance of change management.

2.6.2 Limitations

There is a potential bias in our study. We may distinguish people-oriented and task-oriented leadership styles [Blake et al., 1964]. In organizations in the Netherlands (and, e.g., also in Scandinavia), the prevalent leadership style is people-oriented. This means employees in the Netherlands can participate more in decision-making and management than employees in other countries, like for instance the US [Hofstede, 1980]. To realize changes in an organization in the Netherlands, the majority of the employees need to accept them. So the acceptance of architecture-driven changes is an important issue, quite likely more so than in some other countries.

Our results provide a means to assess organizations with respect to their architecture maturity and alignment. The classification as presented in this chapter is still rather subjective. The global separation into three distinct clusters has a merit of its own, especially where it comes to the differences between those clusters. Assessing different units within an organization that have a stake in architecture using this model may help harmonize different architectural tunes being played.
2.6. CONCLUDING REMARKS

2.6.3 Discussion

The results presented in this chapter show there is quite a difference between organizations with respect to their architecture maturity and alignment. Our results also show that there are two possible origins of architecture within organizations, which represent a top-down and bottom-up approach to introducing EA as a means. Organizations where the IT department started using EA to run their solution development projects in a better way, and try to convince business management by showing the added value represent a bottom-up approach. Organizations where business management started using EA to improve their decision making regarding the complex problems of their organization, and try to get the rest of the organization to follow EA by explaining the urgency represent the top-down approach. Our results show that these two groups are not yet aligned. Apparently, in practice it is hard for EA to help organizations connect the strategic decision making of business management with the solution development of the IT department.

To build a mature EA function where these two groups are aligned, we need more refined instruments. The research and practitioner communities currently focus mainly on improving the architecting process by researching EA as a means of abstraction, and developing new and more efficient EA means. The results presented in this chapter show that other aspects and critical success factors are perceived to also play an important role in successfully applying EA as a means in practice. For example, getting organizational acceptance for the EA, or implementing EA governance to ensure proper usage and effectuation of the EA. It is essential to have a better understanding of what the organizational function responsible for composing and implementing the EA, the EA function, entails. Therefore, in Chapter 3 we describe a reference model for the EA function in its full scope, which addresses all the aspects and critical success factors as we discussed in this chapter. For example, the model describes the cycle of EA related work processes that connect the strategic decision making of senior management with the implementation of changes by business and/or IT projects and operations.
The Enterprise Architecture Function

Abstract:
The EA community sees EA primarily as a means of abstraction, and focuses mainly on developing efficient architecture means. In Chapter 2, we discussed that other aspects and critical success factors, which reach beyond the development of the EA are essential in applying EA effectively. For example, the roles and responsibilities of the non-architect stakeholders responsible for EA decision making and conforming to the EA. To apply EA effectively, we need to have a holistic and integral view on what the organizational function responsible for EA (the EA function) entails. In this chapter we define the EA function as: “The organizational function comprised of all roles and bodies responsible for creating, maintaining, ratifying, enforcing, and observing EA decision-making – established in architectures and EA policies – interacting through formal (governance) and informal (collaboration) processes at enterprise, domain, project, and operational levels.”

We describe the objectives, products, structure, activities, process model, outputs, and roles that constitute the EA function. We describe Case study 1, which we conducted at a large international company to illustrate and test the model in practice. We provide some lessons learned about the governance and process aspects of building a mature EA function. These lessons learned are that: (1) formal governance and informal collaboration must go hand in hand, (2) no steps in the EA cycle we present in this chapter should be omitted, (3) EA decision making and EA conformance reviews should be transparent and consistent, and (4) EA governance bodies must represent all EA stakeholder groups.

We end this chapter with the conclusion that to compare a specific EA practice with our integral EA function reference model and determine the efficiency of the EA function, we require an assessment model.

3.1 Introduction

Up till now, the research and practitioners communities have put much effort into developing the various separate elements that make up the total package of activities, resources, skills, and competences to perform an efficient architecting process – e.g., proper tools [Peyret et al., 2007], frameworks [The Open Group, 2009] Mulholland et al., 2006]
CHAPTER 3. THE ENTERPRISE ARCHITECTURE FUNCTION

and architects [Clerc et al., 2007]. However, the activities of the EA function reach beyond merely composing the EA. An organization will only build an effective EA function when there is formal and informal interplay between architects and the non-architect stakeholders of the EA function responsible for making the architectural decisions (i.e. senior management) as well as conforming to the EA (i.e. project managers and designers responsible for implementing organizational changes and developing solutions). Otherwise EA will not bridge the gap between senior management and the departments responsible for developing new business and IT solutions, as we discussed in Section 2.6.3. All roles and responsibilities participating in the EA function must be properly integrated into the overall organizational and governance structures in order to be effective.

Currently, the literature lacks a complete reference model of the EA function. Existing EA capability maturity assessment approaches (e.g., [META Group, 2000; van den Berg et al., 2006]) have incorporated a reference model into their maturity model, but this model is often limited to the responsibilities of the architects. Other practitioner’s literature (e.g., [Peyret et al., 2007; van den Berg et al., 2006]) provides a fragmented view of elements of the EA function. In this chapter we provide a clear definition and integral description of the EA function, established into our EA function reference model. This reference model describes the norm for building an efficient and effective EA function.

Section 3.2 of this chapter contains our reference model of the EA function. Section 3.3 contains Case study 1 that shows how a large international company has implemented its EA function. In Section 3.4 we discuss the lessons learned regarding our EA function reference model based on this case study. Finally, in Section 3.5 we draw our conclusions.

3.2 Reference Model

Based on scientific and practitioner’s literature, and various case studies we created an integral description of the EA function. We define the EA function as: “The organizational function comprised of all roles and bodies responsible for creating, maintaining, ratifying, enforcing, and observing EA decision-making – established in architectures and EA policies – interacting through formal (governance) and informal (collaboration) processes at enterprise, domain, project, and operational levels.”

In Section 3.2 we describe our EA function reference model based on this definition. Section 3.2.1 describes the objectives of the EA function, Section 3.2.2 the products the EA function produces, Section 3.2.3 the structure and sub-functions of the EA function, Section 3.2.4 the organizational levels of EA, Section 3.2.5 the EA learning cycle, Section 3.2.6 the non-architect stakeholders of EA, Section 3.2.7 the bodies and roles involved in EA, and finally Section 3.2.8 describes the outputs of the EA function.

3.2.1 Objectives of the EA Function

To keep up with or stay ahead of competitors, many organizations strive for organizational agility, which is defined as “the ability to sense environmental change and respond
appropriately” [Overby et al., 2005]. To achieve agility, organizations typically react to environmental change by running organizational transformations [Suarez et al., 2005]. An objective of an organizational transformation may be to align the business infrastructure and processes with the business strategy, which is called strategic fit [Henderson et al., 1993]. Another objective of an organizational transformation may be to align the IT infrastructure and processes with the business infrastructure and processes, which is called functional integration [Henderson et al., 1993] or business and IT alignment [Luftman et al., 1993].

The EA function helps solving complex organizational problems, like organizational transformations, effectively and efficiently. Alignment and agility are the two main organizational objectives the EA function contributes to [Hoogervorst, 2004]. The EA function helps to achieve agility, for example by monitoring developments external to the organization (e.g., new technologies), and advising business owners in devising new, feasible business ideas (e.g., using available new technologies). The EA function helps to achieve business and IT alignment, for example by providing a target blueprint of the integral solution to a complex organizational problem, including both business and IT elements [Jonkers et al., 2004]. The EA function helps to achieve vertical alignment (strategic fit) between strategy and operations, for example by facilitating senior management in making rational decisions based on a trade-off analysis between feasibility – taking into account the limitations of the current business and IT landscape – and desirability [Johnson et al., 2007].

3.2.2 Products of the EA Function

There are generally two types of EA products: (1) architectures and (2) EA policies [Ross et al., 1996]. An architecture document provides an abstraction of what a complex environment looks like, and acts as a means of communication and governance regarding that environment, as we discussed in Chapter 2. Three types of architecture documents exist: (1) target state (to-be, soll) blueprint that provides an abstraction of the desired situation, (2) current state (as-is, ist) architecture that describes the current operational environment, and (3) roadmap that describes a realization path from the current state to the target situation. These types of architecture documents aim at one or more of four aspect areas: (1) business structures and processes, (2) information requirements, (3) information systems, and (4) technical infrastructure [Lankhorst, 2009]. The first two dimensions represent the business aspects of an organization; the latter two represent the IT aspects. In our view, Enterprise Architecture comprises both the business and IT aspects of an organization, and the alignment between them, as we discussed in Chapter 2.

EA policies prescribe how projects should implement organizational changes across various Lines of Business (LoBs) and Business Divisions (BDs) through unified principles and practices. EA policies may be specified in two possible forms: (1) standards and (2) guidelines. A standard must be adhered to, and a guideline may be deviated from, provided a waiver has been granted. Enforcing EA policies enables organizations
to influence the change activities of subunits without dictating exactly how they handle all of their operational activities [Boh et al., 2007]. Keeping up-to-date with industry standards allows organizations to change in a predictable way as a response to external developments [Bird, 1998], such as market changes, technological innovations and regulatory changes.

EA products typically have a life cycle, which starts with receiving the formal status ‘approved’. It will then go through the validity statuses: future, actual, confined and obsolete, before receiving the formal status ‘retired’.

3.2.3 EA Sub-Functions

Figure 3.1 shows the primary activities of the EA function, allocated as accountabilities to the three sub-functions of the EA function: (1) EA decision making, (2) EA delivery, and (3) EA conformance. EA decision making (i.e. senior management) is responsible for making and communicating EA decisions. EA delivery (i.e. architects) provides advice to support senior management in making EA decisions, and create and maintain the target blueprint. Architects also provide support to projects in applying the target blueprint, and monitor and control the conformance of the projects with the EA decisions. EA conformance (i.e. projects & operations) is responsible for implementing changes in conformance to the target blueprint. Projects and operations should also provide feedback regarding the practical applicability of the EA products. Sections 3.2.3.1 to 3.2.3.3 describe the three sub-functions in more detail.

A sub-function may delegate the responsibility for performing an EA activity to another sub-function, but remains accountable for the result of that activity – e.g., senior
3.2. REFERENCE MODEL

management (EA decision making sub-function) may delegate the responsibility for communicating EA decision making to an architect (EA delivery sub-function), but remains accountable for the degree to which project managers (EA conformance sub-function) are informed about EA decision making. In order to run an efficient and effective EA function, secondary activities (e.g., management of the EA delivery function, or professionalizing the architects through training and coaching) are also required. These activities are not shown in Figure 3.1 but are addressed in Section 4.5.2.

There are many forms in which the above three sub-functions can be implemented. For example, the EA delivery function can be organized as a temporary task force or a permanent department. EA decision making may be done in an existing management team meeting, or a special architectural board may be created. Regardless of the organizational forms chosen, all three sub-functions should be implemented and should properly perform their activities as described by our reference model in order for the EA function to be effective (see Chapter 6).

3.2.3.1 EA Decision Making

The EA decision making sub-function is responsible for making strategic architectural decisions (e.g., by approving new EA products or changes to existing EA products) and communicating the EA decisions made. EA decision making also includes handling EA escalations – e.g., by resolving conflicts between the various bodies and roles within the EA function, or handling issues of non-conformance. Furthermore, the EA decision making sub-function defines the objectives of the entire EA function and is responsible for its overall performance and goal-attainment.

The accountability of this decision making is typically assigned to senior management, but may be delegated to a decision making body (e.g., EA council) with representatives from the key stakeholder groups within the organization (e.g., business unit managers, IT managers, program managers). Examples of possible EA decision making bodies are a management board with senior managers responsible for the performance of the business or technology domains within the organization, an EA council with the chief and domain architects mandated to represent the various business and technology domains within the organization, or a combination of managers and architects. In large organizations, it may be required to have EA decision making bodies at several hierarchical levels – e.g., EA decisions made by a management board of domain managers have to be ratified by the senior management board.

Having such governance bodies in place – with a proper structure, escalation lines and representation from various stakeholder groups (see Section 3.2.6) – results in better perceived importance, involvement and support of both management and other stakeholders, and it improves effectiveness of the EA function [Boh et al., 2007]. EA governance bodies vary in the degree to which they have an advisory or formal decision making authority [Peterson, 2004]. A governance body may provide a noncommittal advice, provide a binding advice that accountable management can only overrule by taking full responsibility, or make a final decision.
The accountabilities of the members of the EA decision making sub-function are:

1. **Make EA decisions:**
   - Choose, from a selection of solution alternatives presented by the EA delivery sub-function, the optimal (most feasible) solution to a complex organizational problem
   - Ratify or reject EA products created and maintained by the EA delivery sub-function
   - Take ownership of (accountability for) all EA products

2. **Handle EA escalations:**
   - Ratify or reject proposals of the EA delivery and EA conformance sub-functions regarding escalations, issues of non-conformance and other EA related conflicts

3. **Communicate EA decisions:**
   - Communicate the decisions made by the EA decision making sub-function to the EA stakeholders within the organization
   - Monitor the execution of those decisions

The EA decision making sub-function may invite, when required to discuss a specific architectural topic, guest speakers/advisors from inside (e.g., enterprise architect or subject matter expert) and outside the organization (e.g., business partner or external supplier). These invited guests do not have a vote in EA decision making, and act purely as advisor to the EA decision making sub-function.

Continuous accountabilities of the EA decision making sub-function are:

- Identify cross-domain synergy possibilities from an architectural perspective
- Act as a sponsor for the EA function
- Monitor and control the efficiency and effectiveness of the EA function
- Request and manage budget for the EA function

### 3.2.3.2 EA Delivery Function

EA delivery is responsible for providing advice to guide EA decision making at strategic and tactical level, as well as creating and maintaining EA products. At tactical and operational levels, EA delivery also validates solutions and operational changes to see whether they conform to the EA, and provides support in applying EA products. The EA delivery function is often organized as a separate department or team [Boh et al., 2007], typically as an organizational staff function. Architects may also take part in a temporary program structure or task force. Depending on the size of the organization, the
3.2. REFERENCE MODEL

EA function may also consist of one or more individually operating architects. An EA department or team is sometimes led by a chief architect \cite{Boh2007}. The origin of the EA function may differ, resulting in a difference in focus on either business aspects or IT aspects, as we discussed in Chapter \ref{chapter:architecture}.

Regardless of the organizational position, structure and focus, there are generally four types of accountabilities of the EA delivery sub-function:

1. **Provide advice to support EA decision making** by:
   - Helping in building a vision and strategy for the organization, based on its relation with its external environment regarding social, environmental and market developments, technological innovations, regulatory changes, etc.
   - Describing decision alternatives regarding the target situation \cite{Simonsson2005}, and performing an impact analysis on pre-defined evaluation criteria and indicators (e.g., financial, regulatory) to determine the consequences of those alternatives in order for management to select the most desirable and feasible one \cite{Johnson2007}.
   - Explaining the impact (e.g., continuity or financial impact) of not conforming to the EA while handling escalation requests, and advising about how to resolve issues with minimal impact and risk.

2. **Create and Maintain EA products** that describe the:
   - Current state architecture, which provides insight in the current state of the operational environment, together with its bottlenecks and accompanying risks.
   - Target blueprint, based on the vision and strategy, describing the chosen decision alternative in detail, which is assessed on its ability to cope with possible internal and external changes using various future scenarios.
   - Roadmap from the current state to the target state, in which the mutual relation and impact of the elements in the architecture is described, and the sequence of implementation steps is given \cite{Pulkkinen2007}.
   - Portfolios of current architectural components (e.g., the application portfolio) and required solutions, based on which solution development projects are defined.
   - EA policies based on up-to-date knowledge of industry standards and developments within the organization, and determine their potential impact \cite{Bird1998}.

3. **Validate EA conformance & handle waiver requests** by:
   - Reviewing the solutions of programs and projects, and operational changes on their compliance with the applicable.
CHAPTER 3. THE ENTERPRISE ARCHITECTURE FUNCTION

- Target blueprints at enterprise and domain levels [Foorthuis et al., 2009], to ensure that organizational changes contribute to achieving the strategic goals of the organization and the target state described in those blueprints
- EA policies, to ensure that all organizational changes contribute to achieving the standardization and integration goals set with EA
- Current state architectures, ensuring the operational readiness of organizational changes before they are deployed, thus safeguarding the continuity of the operational processes and systems
  
  • Handling waiver requests, assessing the implications of allowing programs, projects, and operations to deviate from EA guidelines

4. Provide support in applying EA products for programs, projects, and operations (e.g., through training and coaching) in:
  
  • Creating solution designs and operational change requests based on the target blueprints and EA policies at domain and enterprise levels
  
  • Conforming to the target blueprints and EA policies in running programs and projects, and implementing operational changes

3.2.3.3 EA Conformance

EA conformance is responsible for implementing organizational changes through solutions and operational changes as described in the target architecture. While implementing these changes, EA conformance is accountable for complying with the EA policies, and providing feedback on the applicability of the EA products to the EA delivery function. EA conformance typically involves members of the organization who are affected by the EA products [Smolander, 2002] while running change programs or projects (e.g., program or project managers and designers) or implementing operational changes (e.g., operational maintenance) at tactical and operational level.

The accountabilities of EA conformance are:

1. Conform to EA products by:
   
   • Creating change proposals, by means of solution designs and operational change requests, that conform to the target blueprints, roadmap and EA policies that apply within the organizational domain impacted by those change proposals
   
   • Providing the EA delivery function with proof (e.g., by means of solution or change documentation or test reports) of implementation in conformance with the target blueprints, roadmap and EA policies that apply

2. Provide feedback on EA products by:
   
   • Explaining the practical experience with the applicability and quality of the EA products
3. REFERENCE MODEL

- Proposing applicability and quality improvements to the EA products

3. Report EA exceptions when there is an issue of non-conformance by:

- Explaining the issue of non-conformance in factual terms, including the reasons why the project or operational change cannot comply with the EA product
- Proposing a solution to resolve the issue of non-conformance
- Requesting a waiver, or escalating the issue

3.2.4 Organizational Levels

Pulkkinen describes three organizational levels for enterprise architecture planning: (1) enterprise level, (2) domain level, and (3) systems level [Pulkkinen, 2006]. Decisions made at higher management levels are made explicit in EA products that flow downwards to lower levels, introducing more detail. The architectures and EA policies at higher organizational levels set the boundaries for decision making and implementation at lower levels. From our practical experience with implementing EA functions, this has proven to be an appropriate model. However, based on our practical experience and an exploratory study on the stakeholder’s perception of EA performance (see Section 5.2), we altered and extended these organizational levels.

At the domain level, we make a distinction between permanent (e.g., business process chains, BDs, or LoBs) and non-permanent (e.g., large programs) domains. However, it is also vital to make a distinction between specific and generic business domains because of their conflicting operating models as a result of different optimization principles. A specific domain typically entails a customer facing LoB, which provides a specific product or service, servicing a specific market or client segment, or operating within a defined geographical region. It therefore optimizes its operating model in order to fine tune its services to the needs of its customers [Moore, 2005]. On the other hand, a generic business domain (e.g., a shared service center) offers generic or infrastructural services to various LoBs and BDs within an organization – thus acting as a cost center – optimizing its structures, processes, systems and procedures so it can minimize its operational costs [Janssen et al., 2004]. In order to best deal with the horizontal integration of specific and generic domains, EA decision making may be centralized, decentralized or implemented in a federated model, depending on the organizational characteristics [Smolander et al., 2002a].

We changed the name of ‘systems level’ into ‘project level’. This leaves open what type of solutions projects deliver. The term ‘systems level’ suggests that EA decision making and implementation always results into an IT solution [Pulkkinen, 2006]. However, within the business and information areas [Lankhorst, 2009], projects may also deliver business process solutions, because it is not always possible to fully automate business processes into Straight Trough Processing (STP) [van der Aalst et al., 2003] – e.g., case handling processes that require human involvement and physical information flows (through paper forms).
CHAPTER 3. THE ENTERPRISE ARCHITECTURE FUNCTION

Also, we added an operational level to the process model, because of the conflict in decision making regarding organizational changes at project level, and organizational stability and continuity at operational level [Leana et al., 2000]. Decision making about exploiting a continuous and repeating operational environment aims at refinement, through predictable small impact changes, to maximize its continuity and stability. Decision making at project level often is different in nature, because it concerns realizing less predictable high impact changes in the operational situation, potentially compromising the continuity and stability at operational level.

In practice, other models are possible – e.g., the domain level may not be implemented depending on the size of an organization. Only implementing an EA function at the enterprise level has the risk of creating an ivory tower however.

| Table 3.1: The Organizational Learning premises taken from [Crossan et al., 1999] specified to the Enterprise Architecture construct space. |
|---|---|---|
| Premise | Organizational Learning (OL) | Enterprise Architecture (EA) |
| 1 | OL involves a tension between assimilating new learning (exploration) and using what has been learned (exploitation). | EA involves a tension between creating new EA products (exploration), and implementing and improving these EA products (exploitation). |
| 2 | OL is multi-level: individual, group, and organization. | EA is multi-level: enterprise, domain, project, and operational. |
| 3 | The three levels of OL are linked by social and psychological processes: intuiting, interpreting, integrating, and institutionalizing. | The four levels of EA are linked by formal (governance) and informal (collaboration) processes. |
| 4 | Cognition affects action, and vice versa. | Theory (EA products) affects practice (change projects and operational structures, processes and systems), and vice versa. |

3.2.5 EA Learning Cycle

As the circular arrows in Figure 3.1 indicate, the activities performed by the different subfunction as described in Section 3.2.3 together form a learning cycle. This EA cycle starts with architects (EA delivery) providing advice, followed by management (EA decision making) making EA decisions. Then architects write down these decisions in EA products (e.g., blueprints). This is followed by projects (EA conformance) using these EA products to implement changes. The architects then monitor and control the conformance of these projects to the EA products and receive feedback on the practical problems that occur. Based on the conformance issues and feedback from the projects, architects suggest
changes to the EA products for management to decide about. This is the start of a new cycle. Below we elaborate on this EA learning cycle.

Enterprise-wide decision making – as is the case with EA – should encompass feedback from group and individual levels to ensure continuous improvement [Crossan et al., 1999]. However, in practice such a feedback process is hardly performed. EA decision makers (e.g., senior management) feel that a one yearly decision making cycle is adequate in managing changes [Baker, 1995]. The EA process model incorporates a learning cycle with a downstream flow of decisions (feed-forward), and an upstream flow to feed the successes and constraints of implementing those decisions at lower levels back to higher levels (feedback) [Pulkkinen, 2006]. We elaborate on these concepts using the organizational learning framework of Crossan et al. [Crossan et al., 1999]. We translated the four underpinning key premises of their framework to the situation of EA to enhance the EA process model (see Table 3.1).
Table 3.2: EA functions and activities performed at enterprise, domain, project, and operational levels; at each level input and output is fed forward or back, creating the EA learning cycle.

<table>
<thead>
<tr>
<th>Organizational level</th>
<th>Functions &amp; activities</th>
<th>Formal processes</th>
<th>Informal processes</th>
</tr>
</thead>
</table>
| **Enterprise**       | EA decision making & EA delivery | **Feed-forward:**  
(Out) Lay enterprise level decisions down in EA products  
(Out) Ratify domain level EA products | **Feed-forward:**  
(Out) Communicate enterprise level EA products  
(Out) Provide support in applying EA products at domain level |
|                      |                        | **Feed-back:**  
(In) Validate domain level EA conformance  
(In) Handle domain level EA escalations and waiver requests | **Feed-back:**  
(In) Use feedback to maintain enterprise level EA products  
(In) Use operational expert knowledge and data in EA decision making |
| **Domain**           | EA decision making & EA delivery & EA conformance | **Feed-forward:**  
(Out) Lay domain level decisions down in EA products  
(Out) Ratify project and operational level EA change proposals | **Feed-forward:**  
(Out) Communicate domain level EA products  
(Out) Provide support in applying EA products at project and operational level |
|                      |                        | **Feed-back:**  
(In) Validate project and operational level EA change proposals  
(In) Handle project and operational level EA escalations and waiver requests  
(Out) Submit domain level EA products for validation and ratification  
(Out) Escalate domain level EA exceptions, and file waiver requests towards enterprise level | **Feed-back:**  
(In) Use feedback to maintain domain level EA products  
(In) Use operational expert knowledge and data in EA decision making  
(Out) Provide feedback on existing or potentially new EA products |
### 3.2. REFERENCE MODEL

<table>
<thead>
<tr>
<th>Organizational level</th>
<th>Functions &amp; activities</th>
<th>Formal processes</th>
<th>Informal processes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project</strong></td>
<td>EA conformance</td>
<td>Feed-forward:</td>
<td>Feed-forward:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(In) Conform to domain level EA products</td>
<td>(In) Utilize support in applying EA products</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Out) Provide support in deploying the project result</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Feed-back:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Out) Submit project level change proposals for validation and ratification</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Out) Escalate project level EA exceptions, and file waiver requests</td>
<td></td>
</tr>
</tbody>
</table>

| **Operational**      | EA conformance         | Feed-forward:    | Feed-forward:     |
|                      |                        | (In) Conform to domain level EA products | (In) Utilize support in deploying the project result |
|                      |                        | Feed-back:       |                  |
|                      |                        | (Out) Submit operational change proposals for validation and ratification |                  |
|                      |                        | (Out) Escalate operational level EA exceptions, and file waiver requests |                  |

In parallel with the organizational learning theory, the EA practice experiences a tension between exploration of new possibilities and exploitation of old certainties [March, 1991]. EA exploration takes place during decision making at enterprise and domain levels, and results in new architectures and EA policies being created and approved. Following, these EA products, describing how changes should be implemented, are fed forward to project and operational level, where these are to be interpreted and followed. The EA delivery function plays a vital role, as mediator between EA decision making and EA conformance, in getting this shared understanding and common behavior. It requires a more pro-active attitude than merely writing down the central decisions and publishing them so that they are available to lower levels. Having an integrated and effective roll out and acceptance plan is vital for the EA delivery function to realize this organizational change [Kotter, 1996].

Feedback is vital in respecting the constraints and problems that arise at project or operational level with applying the EA products prescribed. These may not have been anticipated during EA decision making at domain or enterprise level. Informal feedback during the collaboration between architects and EA stakeholders involved in implementing changes (at project and operations levels) allows continuous improvement of EA products through refinement of EA decisions (at enterprise and domain levels). This ensures their practical applicability and prevents them from being exclusively used by
Formal feedback through escalation of EA conformance exceptions and waiver requests also provides vital information for improving the EA products; the number of escalations and waiver requests regarding a specific EA product acts as a quality indicator of that product.

Also, feedback allows incorporating what has been learned at project and operational levels, through exploration, experimentation and innovation, into EA products prescribed at enterprise and domain levels. Best practices (e.g., a proof-of-concept of a new, innovative technology) at project or operational level are identified and evaluated on their generic applicability \[\text{Pulkkinen, 2006}\] so that they can be incorporated into EA products at domain or enterprise level.

Figure 3.2 shows the EA learning cycle constructed of formal and informal EA processes at the various organization levels. Table 3.2 describes the input and output regarding the feed-forward and feedback of these formal and informal processes.

### 3.2.6 Stakeholders of the EA Function

EA stakeholders are individual or grouped representatives of the organization who are affected by EA products \[\text{Boh et al., 2007}\]. EA stakeholders either provide input to EA decision making or should conform to the EA products. Typical EA stakeholders are senior management, program and project managers, solution designers, and enterprise architects. Based on their specific role within the EA function, the organizational level at which they operate, and the aspect area they focus on, EA stakeholders actively pursue specific objectives. These objectives are potentially conflicting, and may not help to meet the organizational objectives \[\text{Peterson, 2004}\]. However, regarding the attributes of the products and the services of the EA function, each stakeholder expects these to help achieve their goals \[\text{Gutman, 1997}\]. In Section 5.2 we further discuss the expectations of EA stakeholders.

We used the key software architecture stakeholder roles described by Smolander et al. to create a 4 by 4 matrix of EA stakeholders shown in Table 3.3 \[\text{Smolander et al., 2002a}\]. The columns represent the four EA aspect areas \[\text{Lankhorst, 2009}\] and the rows represent the four organizational levels, as we discussed in Section 3.2.4. We omitted the architect role in Table 3.3 since we focus on the non-architect EA stakeholders in this section. Architect roles exist at the various organizational levels, and have one or more aspect areas of responsibility.

At the enterprise level, management is responsible for EA decision making regarding the target enterprise architecture. This involves creating a strategy for the aspect area these stakeholders are responsible for. The Chief Information Officer (CIO) is responsible for business and IT alignment \[\text{Lindström et al., 2006}\], i.e. that IT supply meets business information demand. Therefore, the CIO is concerned with both information and information systems aspect areas. The Chief Technology Officer (CTO) is responsible for decision making regarding technology components and platforms. The board of directors, responsible for overseeing the activities of an organization, should ensure the organization has an enterprise architecture and its management understands and uses
3.2. REFERENCE MODEL

Table 3.3: Key non-architect Stakeholders of the EA function, including their aspect areas and organizational levels.

<table>
<thead>
<tr>
<th></th>
<th>Business</th>
<th>Information</th>
<th>Information Systems</th>
<th>Technical Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enterprise</strong></td>
<td>CEO, CFO, COO, Board of directors.</td>
<td>CIO.</td>
<td>CIO.</td>
<td>CFO.</td>
</tr>
<tr>
<td><strong>Domain</strong></td>
<td>Head of LoB/BD, Business change manager.</td>
<td>DIO, IT change manager.</td>
<td>DIO, IT change manager.</td>
<td>Platform manager, Platform subject matter expert.</td>
</tr>
<tr>
<td><strong>Project</strong></td>
<td>Business project manager, Business analyst.</td>
<td>Information analyst.</td>
<td>Software development project manager, Software designer.</td>
<td>Infrastructure project manager, Infrastructure engineer.</td>
</tr>
</tbody>
</table>

it to determine the impact of their decisions. For example, does management understand the impact of an integration of business activities due to a merger with another organization on the operational continuity of the organization before they make a final decision.

Domain level EA stakeholders are typically domain owners and change managers who coordinate or manage change programs within that domain. Within the business aspect area, a domain owner is the head of a Line of Business (LoB) or Business Division (BD), who is responsible for the operational performance of his/her domain. Like the CIO, the Division Information Officer (DIO) [Peterson, 2004] is responsible for the business and IT alignment, but then for a specific business domain. A DIO therefore focuses on both information and information systems aspect areas. Within the technical infrastructure aspect area, the platform manager is responsible for the operational performance of a platform or infrastructure domain. The platform subject matter expert guides all changes on that platform or domain.

At the project level, EA stakeholders are responsible for running projects and implementing changes to the operational environment. For example, the business project manager is responsible for delivering, within time and budget, a solution that fits the business requirements. The business analyst is responsible for determining the business requirements and the design of the business processes of the solution.

EA stakeholders at the operational level are responsible for the stability and continuity of the operational environment. For example, the operational manager is responsible for day-to-day operations and reporting. Business process, data, application, and infra-
structure administrators perform day-to-day maintenance and improvement activities to optimize continuity and stability.

3.2.7 Bodies and Roles within the EA Function

EA stakeholders perform EA related activities (see Section 3.2.3) and follow the process model of the EA function (see Section 3.2.5). In this section, we describe the EA related roles and responsibilities of EA stakeholders, and their participation in EA related decision making bodies.

3.2.7.1 Bodies and Roles within EA Decision Making

The EA governance bodies within the EA function are responsible for decision making about EA products, and handling escalations of non-conformity. An effective EA governance body at any organizational level should: (1) be composed of the various roles that represent the potentially conflicting interests that occur at that organizational level, (2) perform transparent decision making based on objective criteria, and (3) have the proper mandate to enforce the decisions at that organizational level.

An EA council at the enterprise level acts as a steering committee [Boh et al., 2007]. This council aims to achieve horizontal integration for coordinating of EA decision making [Peterson, 2004]. It is comprised of representatives of the domains within the organization, the chief architect, and a chairman. Both the chairman – a key EA sponsor – and the chief architect – responsible for the quality and effectiveness of the overall EA – should act in the interest of the enterprise-wide structures, processes, systems and procedures to achieve the corporate strategy. The domain owners are concerned with optimizing their specific domains to achieve their domain specific strategies. When issues cannot be resolved within the EA council, they are escalated towards senior management sponsoring the EA council for final decision making.

At the domain level, there may be a formal authority or informal advisory EA governance body (e.g., domain architecture council), which is responsible for EA decision making within that domain. Membership is similar to the EA council, only the roles stay within the domain. The domain architecture council handles the ratification of domain specific EA products and handles the escalations regarding non-conformity with those EA products. When disputes regarding non-conformity cannot be resolved within the domain architecture council, or the impact of decisions made by the domain architecture council reaches beyond that domain, this issue will be escalated towards the EA council at enterprise level. This reduces the workload for the EA council to only the hard-to-resolve, domain overarching issues.

At the project level there is typically no formal EA governance body. The project steering committee may act as an informal EA governance body, which means EA related issues may be discussed but cannot be decided on by the steering committee. Issues of non-conformity that cannot be resolved and may lead to a project deviating from the enforced EA products will be escalated towards the domain architecture council. At the
3.2. REFERENCE MODEL

At the enterprise level, the EA delivery function usually consists of a central EA team [Boh et al., 2007] or staff department [van den Berg et al., 2006], comprised of an EA manager, the chief enterprise architect, and various enterprise architect roles. Each enterprise architect is responsible for one or more specific EA aspect areas (i.e. business, information, information systems, or technical infrastructure [Lankhorst, 2009]), performing the primary activities of the EA delivery function (see Section 3.2.3.2). The chief enterprise architect [Boh et al., 2007] typically acts as the functional lead of the EA delivery function, overseeing all aspect areas of the enterprise architecture. He or she acts as trusted advisor to the CxO, and is responsible for the quality and effectiveness of the overall EA. The EA manager runs the EA delivery function, performing budget and resource management, planning and coordination, and other operational management tasks.

Organizational domains (e.g., LoBs) typically employ their own specific architects at domain level, who are experts in a specific business or IT area. A domain architect acts as trusted advisor to the domain owner (e.g., head of the LoB). Depending on the size and structure of the domain level EA delivery function, autonomously operating architects, a team of architect-like roles, or a formal architecture department may be present. A domain level EA delivery function may act as a sub-team [Boh et al., 2007] of the central EA delivery function at enterprise level.

3.2.7.3 Roles within EA Conformance

The members of a project team are responsible for managing and running change projects. These projects should deliver solutions that transform specific parts of the organization’s operational environment into the desired situation described in the target blueprint(s) at enterprise and domain levels. Additionally, they should comply with EA policies and follow the implementation roadmap while running the project. A special role is solution designer, who acts as an advisor guarding the quality of the project. He or she provides advice in the start-up phase of a project to discuss the important implementation decisions, and is responsible for the delivery of a solution design which complies with the enforced EA products. Also, the solution designer should provide feedback on the practical applicability of EA products towards the domain level EA delivery function. A solution designer is not member of the EA delivery function. This role has project result responsibility, and can therefore not perform solution validations independently.

At the operational level, the EA delivery function performs a gatekeeper role, performing post implementation reviews of: (1) solutions projects deliver and (2), changes made to the operational environment. In performing these reviews, changes are assessed on operational readiness and EA conformance before being deployed.
3.2.8 Outputs of the EA Function

An effective EA function has two key outputs:

1. improved decision making regarding the solutions to complex organizational problems, and

2. effective and efficient implementation of these solutions conform the decisions made.

The EA function helps improve decision making because the business owners of the problem domain are more likely to make well considered decisions when the architects provide them with advice on the impact of different alternatives in terms of technical and economic viability. Architects write down the EA decisions in EA products, which provide management with a means for communicating and enforcing these decisions throughout the organization [Ross et al., 1996].

EA implementation is the realization of the EA decisions by running change projects and implementing operational changes in conformance to the EA products. Architects contribute to an effective implementation of the solution to a complex organizational problem because they validate the conformance of sub-solutions to the target blueprint of the overall solution. Projects that design a sub-solution that does not conform to the target blueprint are investigated by the architects. The architects provide advice to the business owners of the problem domain about the (technical and financial) impact of the deviating sub-solution. Based on their knowledge of the potential consequences of sub-solutions not conforming to the target blueprint, management can take appropriate measures to keep projects under control and ensure these projects contribute to achieving the organizational objectives.

The EA function helps to solve complex organizational problems more efficiently, because of three reasons. First, architects provide support to project teams in applying the EA in practice, and architects help project teams solve issues they run into. This will decrease the lead time for projects to deliver a high quality solution [Kamogawa et al., 2005]. Second, the standardization of solutions as specified in the EA increases their predictability [Bird, 1998]. Standardization into reusable components may also lead to efficiency improvements [Morganwalp et al., 2004]. The EA also specifies how and why sub-solutions fit together as they do [Allen et al., 1991]. This ensures the integration of the sub-solutions into one overall solution to the complex organizational problem. Third, the architects create an implementation roadmap to the target state [Pulkkinen et al., 2007]. This roadmap describes the plateaus for reaching the target blueprint in controlled and stable implementation steps. Compared to a big bang implementation scenario, this decreases the size of the implementation steps, and consequently the number of implementation risks.
3.3 Case study 1: EA Functions of Two Divisions of a Large Company

We conducted Case study 1 within the IT & Operations (ITO) division of a large international company in 2008. Together with a team of about 25 consultants, we implemented a new EA function within the ITO division. The objective for the ITO division was to improve the efficiency and effectiveness of its EA function in order to improve the stability and continuity of its business processes and IT. As a first step, we assessed the current EA function against our EA function reference model we discussed in Section 3.2. We held fully structured interviews with various roles – i.e. domain owners, EA council members, program and project managers, operational managers, architecture managers, architects, designers, and subject matter experts. To check the findings from the interviews, we studied an extensive set of strategic, project, operational, and communication documents. With these findings we created a current state description of the EA function, and compared this to the reference model described in Section 3.2.

We performed a second case study of the EA function within a business division of the same company using the same approach. This case study had comparable results. For confidentiality reasons, no details hereof can be given. In the case description in this section, we indicate which findings we confirmed with the case study conducted at the business division, and which findings were different.

The EA function of the ITO division had technical infrastructure as the primary focus area. The ITO division consisted of various Lines of Business (LoBs) providing operational and IS services to the front-office of the company. The ITO division also had a technology department providing infrastructural services to the LoBs. The EA function, as part of the technology department, was responsible for creating enterprise-wide infrastructure policies and validating solution designs on their conformance. The EA delivery function consisted of a team of architects, each experts in a specific infrastructural domain (e.g., storage, mainframe, internet, etc.), responsible for creating EA policy and performing conformance validations related to that domain. When a solution impacted several infrastructural domains, it had to be validated by each domain architect responsible for those domains.

The chief infrastructure architect and the infrastructure domain architects held a monthly meeting to approve new infrastructure policies. This was not a formal EA council, and no representatives from the LoBs that were impacted by the infrastructural policies took part in this meeting. This monthly meeting resulted in few policies getting a formal status. There was no standard procedure for policies that received a formal status to store and publish them in one central repository and communicate them to the LoBs that were impacted by those policies.

The business division did have a formal EA council with proper representation from the business within the company. The EA council, however, was also unable to assess and approve EA policy proposals created by the EA delivery function, and provide them with a formal status.
Our assessment of the EA function of the ITO division showed that there was no enterprise infrastructure architecture written down that described the relations and coherence between the infrastructure domains. This resulted in inconsistent and incoherent EA policies across the infrastructure domains. The domain architects provided conflicting advice to the project managers and designers, because they collaborated insufficiently with each other, and did not have an enterprise infrastructure architecture to guide them. This made creating a coherent solution design that complied with the EA policies complex for the designers, which frustrated them. Many designers also had little experience with creating solution designs according to the template provided by the EA function. Many solution designs sent to the EA function for validation were therefore of low quality, and were either found inadmissible or were rejected. The EA function of the ITO division could therefore be characterized as being domain-focused, applying a bottom-up approach, and being staffed with subject matter experts.

The business division did have a target blueprint that described the relations and coherence between domains. However, this target blueprint wasn’t detailed enough to provide a concrete reference for the domain architects. This resulted in similar problems regarding conflicting architectures, policies, and advice by the EA delivery function we found at the international company. The EA function of this business division could therefore be characterized as focused on the enterprise level, applying a top-down approach, and acting as an ‘ivory tower’.

The conflicts of opinions and insufficient collaboration between domain architects within the ITO division caused the validation outcome of solution design to be unpredictable; the result depended on which architect performed the validation. All involved domain architects had to accept the solution design in order for the project to receive a building permit. Projects sometimes had to wait months in order for their design to be accepted, because the domain architects could not agree on the outcome. The feedback projects got – the rationale why a solution was rejected, and the explanation on what to improve in their design in order to pass the validation successfully – was often insufficient.

To deviate from a policy, or request permission to continue implementing the solution when the design was rejected by the EA function, project managers within the ITO division could request a waiver. Decision making about granting projects a waiver was not transparent; they were granted based on undefined criteria, and inadequately communicated to the stakeholders. Domain architects were not always informed about a granted waiver. During the next solution validation they rejected the solution of a project that was granted a waiver. This resulted in projects being stopped even though a waiver was granted, to the frustration of various EA stakeholders, such as the business owner of a project.

The business division had a similar procedure for projects to request permission to deviate from an EA policy. The EA council that handled these requests was not fully effective.

There were too many EA policies within the ITO division. They were unstructured, and the formal status of many of them was often unknown: there was no life cycle and change management for the policies. The EA policies the domain architects created
were often not tested before they were implemented. Because there was no feedback loop from project level upwards, the domain architects were not aware of the practical applicability of the EA policies. There was no central administration of escalations and waiver requests to allow identifying malfunctioning EA policies to be changed. This all resulted in many projects deviating from the EA policies because they were impossible to work with.

The EA policies at the business division were also not tested before they were implemented, and there was no feedback loop from projects upwards. The business division did have a central administration of escalation and waiver requests, but these were not used to identify malfunctioning EA policies for improvement.

3.4 Lessons Learned from Case Study 1

Section 3.3 describes only a fraction of the findings we collected during the EA function assessments we conducted at two divisions of a large international company. However, Case study 1 shows that the EA maturity levels of the EA function within this company required quite some improvement. It also shows it is insufficient to only take EA delivery into account to be truly effective with EA; both EA decision making and EA conformance have to be considered as well. In this section we elaborate on the key lessons we have learned.

1) Governance and collaboration must go hand in hand:

The case study at the two divisions of the international company shows that, if there are no formal and informal structures and processes, it is hard for EA stakeholders to trust each other and to work together. For example, an informal process of architects performing an intake to proactively explain projects that are starting up how to create a solution design that satisfies the desired quality criteria, and conforms to the EA policies may help considerably. This will result in project managers and designers to better understand the purpose and working of solution validations, and deliver high quality designs. However, formal processes are also required – e.g., having a transparent policy approval procedure, and a standard procedure for publishing the policies in a central, well-structured repository. This would make it more clear for the EA stakeholders, who are to conform with the policies, which EA policies apply to them. Therefore, it is vital to have both formal and informal structures and processes in place [Henderson, 1990]. Formal processes ensure proper connection and coordination of EA decision making and conformance. Informal processes stimulate collaboration. Only combining both allows an effective implementation of EA governance in complex and dynamic environments [Peterson, 2004].
2) Don’t omit steps in the process model; keep the learning cycle in tact:
A feedback loop is essential in getting EA products to be accepted and adhered to at project and operational levels. For example, the case study conducted within the ITO division shows that EA policies were not tested, and were not always applicable in practice. Ensuring there is a feedback loop from projects to the domain architects will solve this issue. This feedback loop may be implemented in the formal processes (i.e. make changes to policies based on escalations and waivers), or informal processes (e.g., by having regular meetings between architects who create the policies and designers who use them).

Having architectures at enterprise and domain level that are connected is vital in getting horizontal integration across domains. For example, the case study conducted within the ITO division shows that there was no enterprise infrastructure architecture available for the domain architects in order to integrate the various infrastructural domains. If one or more steps in the EA process model are omitted, the EA learning cycle is broken, which negatively impacts the EA function’s effectiveness (see Chapter 6).

3) Keep decision making and conformance reviews transparent and consistent:
For the EA stakeholders to accept EA decision making and EA conformance validation results, it is vital to be transparent and consistent [Peterson, 2004]. For example, the case study conducted within the ITO division shows that an unpredictable and unexplained validation result leads to frustration with the project manager and designer. This frustration will decrease with a transparent and consistent validation process, providing that proper feedback is given to guide the validation outcome. Regarding EA decision making, again transparency and consistency is essential. For example, the case study conducted within the ITO division shows that EA stakeholders will become frustrated with impractical and conflicting EA policies, and opaque EA decision making. If representatives of a LoB are involved in decision making regarding an EA product, other stakeholders of that LoB are more likely to accept that EA product.

4) Governance bodies must represent all EA stakeholder groups with conflicting interests:
An organization typically consists of various stakeholder groups at different organizational levels that have conflicts of interest, resulting in power struggles and political disputes [Eisenhardt et al., 1988]. For example, in the ITO division there was a conflict of interest between solution delivery centers within the LoBs delivering IT solutions, and the data center that deploys those IT solutions. The solution delivery centers are concerned with providing a solution that best fits the business requirements; the data center wants to ensure the stability and continuity of the data center. The composition of an EA governance body is vital in properly addressing these conflicts of interest in decision making in order for EA governance to be effective [Peterson, 2004].
3.5 Conclusions

Up till now, the literature provided a fragmented description of the EA function. In this chapter, we provided an integral description of the EA function in order to set the norm for building a mature EA function. The case study we discussed in detail in this chapter shows that the maturity level of EA functions is typically quite low, resulting in low performance of those EA functions. A second case study – due to reasons of confidentiality we do not describe this case study in detail in this chapter – confirmed this. To build a well performing EA function, we need to properly identify the essential points of improvement and compose an effective plan for improvement. To identify these points for improvement, we need a holistic perspective on the EA function as presented in this chapter. However, to compare a specific EA practice with our integral EA function reference model and determine the efficiency of the EA function, we require an assessment model describing the standard topics of investigation and a standard scoring mechanism. The next step, in Chapter 4, is to provide such an assessment model for the EA function.
Efficiency of the Enterprise Architecture Function

Abstract:
Although investing heavily in EA, few organizations achieve the desired results, because their EA functions are operating inefficiently. To implement improvements for the EA function, organizations conduct maturity assessments. In this chapter, we present an integral assessment model to determine the efficiency of the entire EA function. We used Case study 2 to improve a preliminary version of our assessment model based on the lessons learned. We found that: (1) making a distinction between architecture awareness and maturity is essential in properly determining the efficiency of the EA delivery function, (2) representing the assessment results using visualization models gives constructive insight in architecture efficiency, (3) there is a difference between the EA delivery function and the non-architect stakeholders of the EA delivery function when it comes to assessing them, (4) the attitude of stakeholders towards EA is a critical success factor in being effective with EA, and (5) aligning IT and business architectures should not always be the aim of the EA delivery function. Based on these findings we constructed a final model, consisting of two assessment models for both the entire EA function, as well as the EA delivery function. The entire EA function is assessed on three essential preconditions for efficiency: (1) a clear and accepted EA function definition, (2) a transparently and consistently operating EA governance model, and (3) proactive collaboration and communication between all functions, bodies, and roles that take part in the EA function. The EA delivery function is assessed on its: (1) management and organization, (2) communication and PR, (3) work processes, (4) human resources and tools, and (5) products. To illustrate the working of our improved assessment model we present Case study 3, which shows that our model fits the specific characteristics of the organization assessed well, and that it provides concrete insights to identify points for improving the EA function’s efficiency. We end this chapter with the conclusions that it is essential to determine the satisfaction of the EA stakeholders to get them actively involved, and that for an organization to justify its investments in EA it must be able to show positive effects of the EA function’s efforts.
CHAPTER 4. EFFICIENCY OF THE ENTERPRISE ARCHITECTURE
FUNCTION

4.1 Introduction

Many organizations have been applying EA for some time, and have one or more teams of enterprise architects working for them [van den Berg et al., 2006]. Typically, enterprise architects are quite experienced employees, often highly valued for their knowledge about the structures, processes, systems and technology of the organization. This architectural knowledge supports various stakeholders in their decision-making [Clerc et al., 2007] and implementation of organizational changes. However, the EA functions of many organizations are not fully efficient yet. This often results into these organizations not being effective in using EA. There are many factors that determine whether the EA function is effective or not. For example, the architects create too abstract and too high-level enterprise architectures, which provide little concrete information to coordinate the projects an organization is running. Architectures created at project level, on the other hand, are often too detailed. They do not provide the required overview of, and insight in the interrelations between, the individual projects as part of a larger organizational transformation. Another common problem is that the organization’s governance structure and processes are immature, making it hard for EA decision making to be enforced in such a way that EA conformance of organizational changes is ensured, as we discussed in Section 3.2. The result is that EA products are often hardly used for what they were intended for; they often end up as shelf-ware and are hardly put into practice [Kruchten, 1999].

The literature provides various models for performing organizational assessments describing factors that determine EA efficiency. Typically, these models focus on the EA delivery function – e.g., [van den Berg et al., 2006] [Bass et al., 2008]. The EA delivery function is the team of architects responsible for creating and maintaining EA products (architectures and EA policies). In our view, the EA function reaches beyond the EA delivery function, and also includes the bodies, roles, structures and processes involved with ratifying, enforcing and conforming to the EA products, as we discussed in Section 3.2. The scope of existing EA assessment models does not typically include these elements.

Most existing EA assessment models focus on determining process maturity, and are therefore process oriented – e.g., [NASCIO, 2003] [Hite, 2003] [US DoC, 2007]. These models describe the characteristics of several maturity phases an EA function passes while becoming more efficient. They describe a typical pattern of EA efficiency development, assuming that a certain maturity phase, regardless of the unique characteristics of an organization, typically involves a specific description of various efficiency topics (e.g., process standardization, linkage to business strategy, management involvement, etc.). However, the development path of EA within organizations may differ for each organization (see Chapter 2), which means in specific situations these patterns may not apply. Also, incorporating various topics into one maturity phase makes it hard, or even impossible, to assess all topics individually in order to identify improvement points.

In this chapter, we present a model for assessing the efficiency of the full scope of the EA function. This model ensures that an assessment provides complete insight in the efficiency of all organizational functions, roles, and bodies involved in creating,
4.2. RESEARCH APPROACH

maintaining, ratifying, enforcing, and conforming to EA decision-making. The model does not link its efficiency topics to specific maturity phases. Our assessment approach combines our EA function reference model, as we discussed in Section 3.2, with the assessment model we discuss in this chapter. Therefore, our model is flexible and can be applied in various situations, providing standard efficiency profiles. These profiles and other outcomes of our assessment approach provide useful insights, based on which points for improvement can be identified to optimize EA function efficiency.

This chapter is structured as follows. Section 4.2 describes our research approach. In Section 4.3, we discuss Case study 2 we conducted to test a preliminary version of our assessment model, and the lessons learned, which we used to improve the model. Section 4.4 contains an evaluation of existing assessment models, and our findings from that evaluation. Section 4.5 provides a detailed description of our assessment model describing the efficiency topics for the entire EA function (Section 4.5.1) and specifically for the EA delivery function (Section 4.5.2). In Section 4.6, we briefly discuss our standard assessment approach. In Section 4.7, we illustrate the final version of our EA function assessment model and approach based on Case study 3. In Section 4.8, we discuss the lessons learned from Case studies 2 and 3. We conclude this chapter, in Section 4.9, with our concluding remarks regarding our EA function efficiency assessment model.

4.2 Research Approach

We created our EA function efficiency assessment model using the following approach. We started with performing a literature review of existing assessment models and approaches – i.e. van den Berg et al., 2006; Bass et al., 2008; NASCIO, 2003; Hite, 2003; US DoC, 2007. We analyzed their strong points as well as, in our view, their points for improvement – e.g., gaps in the assessment models, impracticalities in the approaches, etc. (see our evaluation of related work in Section 4.4). We created an assessment model combining the strong points of the existing models by taking the main assessment variables from these models. We extended these rather high-level variables by adding sub-variables using general theories from business and IS literature, which we adopted to the EA domain. We introduced additional variables based on the aspects and critical success factors of EA we identified during the exploratory study at various Dutch organizations, we described in Chapter 2. This resulted in the first version of our assessment model.

We conducted Case study 2 to qualitatively test the validity of this first version of our assessment model (see Section 4.3). From conducting this case study, we learned that in order to conduct a complete assessment of the EA function, some key elements were still missing. Based on these lessons learned we improved our assessment model, which we discuss in Section 4.5. We conducted Case study 3 to qualitatively validate the model (see Section 4.7).
4.3 Case study 2: Architecture Maturity of IT & Operations Division

To test and improve a first version of our EA function efficiency assessment approach, we conducted the following case study.

4.3.1 Company profile

Early 2006 we conducted an assessment at a large international company. We conducted our assessment within the IT & Operations (ITO) division, which provides operational and IT services for the wholesale and retail activities within the company. At the time of the assessment, two separate architecture functions, one business and one IT focused, were active within different parts of the ITO division. Also, various project portfolio offices and change management functions were organizationally spread out over the ITO division. The ITO division wanted to merge these spread out architecture, portfolio management and change management functions into one central CIO office. The assessment we conducted had to provide insight in the compatibility of the two EA delivery functions, and the gaps to be bridged in order to merge these architecture functions effectively.

The two EA delivery functions that took part in the forming of the CIO office, and thus in the assessment, were:

1. **IT architecture function**: This was a staff function responsible for standardizing application interaction through infrastructure and application architecture.

2. **Business architecture function**: This was a staff function responsible for providing Business Process Management (BPM) services to projects (e.g., creating business process models for projects).

Also, two advanced development centers were involved in the assessment, which were to work according to the EA products created by the above two EA delivery functions:

3. **Payment channels**: This was a development department responsible for payment channels (e.g., Internet).

4. **Front office channels**: This was a development department responsible for front office channels (i.e. Web, phone, offices and Customer Relationship Management).

The objectives with EA within the ITO division were to reduce costs, and improve operational flexibility and customer service. Their target blueprint at enterprise level described different business and application domains. Coherent business activities were logically grouped into business domains. These business domains represented the requirements for software applications and IT infrastructure. The applications aiming to satisfy the business requirements were logically grouped into application domains, which were
mapped onto specific infrastructure services. These business and application domains and infrastructure services laid down the EA. This EA aimed to realize unified services, service centers, distribution channels, and product factories for all business divisions within Europe. To realize this, EA policies provided principles for service-oriented application development and integration. To reach the objectives with EA, all IT projects had to be compliant with these service principles and service descriptions.

Both (payment and front office channels) development centers involved in this assessment ran IT projects, which were expected to comply with the EA policies and business and application domains defined by the target blueprint. Both development centers had several solution designers working together with the architects of the IT architecture function.

The IT architecture function was responsible for creating, maintaining and supervising the realization of the target blueprint, describing the business applications, and infrastructure domains. Also, the IT architecture function was in charge of creating and maintaining the service principles for application development and integration. Finally, the IT architecture function also was responsible for validating projects on their compliancy with the target blueprint and EA policies.

The business architecture function was in charge of creating, maintaining, supervising the realization of, and advising about business process models for projects ran by both the ITO division and business departments outside the ITO division. Accordingly, the business architecture function was responsible for supplying projects with knowledge on business process standardization and the supporting tools. Also, like the IT architecture function, it was responsible for validating projects on their compliancy with the EA products it created.

4.3.2 Assessment Data

We used semi-structured interviews to gather the assessment data. We ensured the topics in our assessment model were addressed during these interviews. Based on these data we characterized all four departments. Using these characterizations, we positioned these four departments in two visualization models. We did not yet have an objective measure to do so. Figure 4.1 shows the four departments we assessed positioned in our Architecture Alignment Model we introduced in Section 2.4. We also positioned the four departments on their level of architecture thinking (architecture awareness) in relation to its ability to put EA into practice (architecture maturity), shown in Figure 4.2.

The y-axis of Figure 4.2 depicts architecture awareness. At the lowest level of architecture awareness, an organization does not have a vision regarding the use of EA. From there, an organization can become more aware of what EA entails, and what it can bring by learning more about the EA vision of a competitor or a consulting firm. The highest level of architecture awareness is realized when an organization is fully aware what it wants to achieve with EA and creates its own vision.

The x-axis of Figure 4.2 depicts architecture maturity, which is the same as the x-axis in Figure 4.1. The lowest level of architecture maturity represents organizations where
architecture as a discipline is absent. Organizations where the architecture process is informally in place make out the middle section. Finally, the highest level of architecture maturity is realized when an organization has formalized EA as a mission critical discipline.

The absolute optimum in Figure 4.2 is around the right top corner, where there is a high level of architecture awareness and a high level of architecture maturity. Note that the optimum might differ for each individual organization depending on the goals they pursue. Figure 4.2 shows there are three general grow paths. The first, which the assessed organization represents, is to first improve architecture awareness, and then architecture maturity. The opposite path is to first improve architecture maturity, and then awareness. The third is to develop both awareness and maturity simultaneously.

In general, these two models are used in the same manner. Individual EA delivery functions (the subjects being assessed) are positioned within the two models. These individual EA delivery functions may be an individual architect, a team of architects active within a specific business unit, or a full architecture department. These EA delivery functions focus on a specific architecture type (in general either IT or business architecture). Gaps between two or more EA delivery functions indicate points for improvement – e.g., there may be a misalignment between two EA delivery functions when it comes to the type of architectures they create (see Figure 4.1). However, conclusions may also be drawn about one single EA delivery function – e.g., the visualization model in Figure 4.2 shows there is quite a difference between an architecture function’s level of architecture thinking and its ability to put architecture into practice.
4.3. CASE STUDY 2: ARCHITECTURE MATURITY OF IT & OPERATIONS DIVISION

Figure 4.2: The four departments assessed in case study 2 positioned on their Architecture Awareness and Maturity.

In the remainder of this section we give a characterization of the four departments in the order in which they have been introduced.

4.3.2.1 IT Architecture Function

On the topic of architecture awareness, this first department was quite visionary when it comes to application and infrastructure architecture. It formed a clear vision on service-oriented architecture quite some years ago, being one of the early adopters of services-thinking. Also, its enterprise and domain target blueprints were quite mature. However, ideas about how to get better organizational acceptance for its architecture vision were less advanced.

In realizing the application and infrastructure architectures it created, still much needed to be done. Therefore, this department did not have a very high level of architecture maturity. For example, the department had insufficiently cooperated – through communication and knowledge sharing – with other departments (i.e. other EA delivery functions and development centers) that were to work according to their blueprints and EA policies.

The IT architecture function focused on application and infrastructure architecture, therefore emphasizing IT architecture aspects. Its blueprint contained application do-
CHAPTER 4. EFFICIENCY OF THE ENTERPRISE ARCHITECTURE

FUNCTION

mains, which were linked to business domains and infrastructure services, incorporating business and IT alignment elements. There was little cooperation with the business architecture function however. For instance, in creating its EA, the IT architecture function had not consulted the business architecture function in order to create the business domains.

4.3.2.2 Business Architecture Function

The second department was quite visionary when it comes to business process architecture. The department was well organized and had clear architecture process descriptions. It was also very aware of the fact that they needed to ‘sell’ their EA products and knowledge by advising projects teams how to improve business processes, giving BPM trainings and sharing knowledge through their intranet site.

When it comes to its ability to put its ideas into practice, this department experienced difficulties in ensuring project compliancy with the business process architectures it created. Also, the architecture process descriptions available remained a paper exercise, since the architects within the business architecture function ignored them while performing their tasks.

This department mainly focused on business process architecture, therefore emphasizing the business aspects of architecture. There was little cooperation between the business architecture function and other architecture functions within the ITO division.

4.3.2.3 Development Center Payment Channels

The third department partly followed the vision of the IT architecture function. The architecture vision, strategy and policy of this specific department had not been clearly and formally written down. This made them freely interpretable, and it made architecture quite a noncommittal activity within this department. The project and program managers within this department were well aware of the advantages of having well-experienced architects participating in projects. However, the role and mandate of architects within this department was not clearly described.

The solution designers within this department had a prominent role by contributing valuable knowledge and experience during the intake phase of projects. However, during project execution, the solution designers had difficulties enforcing that the solutions were developed according to the created solution design, and that the applying EA and service policies were used. One of the reasons why this was so hard was that developing solutions according to the service principles provided by the IT architecture function slowed projects down, resulting in increased costs, which the business owner had to pay. The number of projects that strived to be compliant with the EA and service principles increased slowly, since complexity became an increasing issue.

Since this department develops IT solutions, its emphasis, when it comes to architecture, was on IT architecture. However, this department developed solutions for several business divisions, and thus had business clients. Therefore, this department did strive
4.3. CASE STUDY 2: ARCHITECTURE MATURITY OF IT & OPERATIONS DIVISION

to satisfy the business requirements as much as possible, resulting in a business-oriented focus.

4.3.2.4 Development Center Front Office Channels

This last department also followed the vision of the IT architecture function. It had a good understanding of what architecture is. Nevertheless, it did not have a clear own vision on how architecture could help them improve their IT solution development. There was no clear description of the role and mandate of architects, and architecture processes had not been described. The attitude towards architecture varied per project. Occasionally the target blueprint and the services principles it prescribed were unjustly blamed for practical problems during IT project execution.

In putting architecture into practice, this department faced many issues with making projects comply with the created solution design based on the applying target blueprint and service principles. Solution designers and other team members had insufficient knowledge about how to apply the service principles provided by the IT architecture function. Also, the attitude towards EA within this department was quite negative, partly because the positive results created with architecture were insufficiently communicated. Similar to the other development center, this department developed IT solutions for several business divisions. It therefore had a similar business-oriented focus.

4.3.3 Assessment Conclusions and Recommendations

Overall, the assessed organization had a good architecture vision, and was quite mature in creating high quality EA products. However, the two architecture functions assessed were struggling to put EA into practice. They experienced great difficulties with making sure that projects, performed within the development centers, created solution designs consistent with the target blueprint, and stuck to that solution design. EA was not yet mandatory for these projects. This gap between a high level of architecture awareness and a medium to low architecture maturity is illustrated in Figure 4.2.

As Figure 4.1 portrays, the alignment between the different architecture disciplines (business and IT architecture) was not optimal. The business architecture function was quite isolated from the IT architecture function and the two development centers. For example, in creating its enterprise application and infrastructure architecture, the IT architecture function had not communicated with the business architecture function in order to seek alignment.

To be effective with EA, we provided some recommendations based on the performed assessment. There was not yet a positive attitude regarding EA within the development centers. This was partly because the business owners of the software development projects had to pay for the (initially) increased costs of developing standardized services as part of their IT solutions. To solve this, we recommended a clear cost structure be introduced. This would divide the increased development and usage costs over all business units that used the software application, and not just the business unit that initiated its development.
CHAPTER 4. EFFICIENCY OF THE ENTERPRISE ARCHITECTURE

FUNCTION

The level of acceptance of EA had to be improved, for example by measuring and communicating the effectiveness of EA, as we discuss in Section 5.3. EA should become mandatory for projects. Therefore, EA, as a discipline, should be embedded into the existing organizational processes – e.g., by creating clarity in EA governance and processes, and introducing escalation procedures for solving (natural) conflicts between the EA delivery functions and development centers that run projects. This should bridge the gap between EA decision making and the implementations of solutions. Also, architects should be given a clear function description, role and mandate so that they can operate more effectively. Furthermore, the IT and business architecture functions should improve their knowledge transfer and support of applying their architectures and principles towards the project teams – e.g., by introducing a coaching structure, where enterprise and domain architects support solution designers in their work, by reviewing their work and providing constructive feedback.

4.3.4 Lessons Learned from Case Study 2

Based on the case study discussed in this section, we learned several lessons:

1) There is a difference between architecture awareness and maturity:
The distinction between the level of thinking about EA (architecture awareness) and the ability to put EA into practice (architecture maturity) is essential in properly determining the efficiency of the EA delivery function. In practice, there appears to be quite a difference between architecture awareness and architecture maturity. It seems that, in general, members of an organization – whether they are part of senior management or operate within a solution delivery project – agree that having an EA is good for the organization. As long as the decisions made in the EA are general in nature, and they involve long term decisions, all is good. However, as soon as the EA is put into practice and the EA decisions become more concrete and start to affect stakeholders personally, they start to oppose. Stakeholders seem to judge goal relevance differently considering them from a business versus a personal viewpoint [Hoorn et al., 2006]. For example, a business owner of an IT project may notice that the project has a longer start-up phase because of the extra EA activities that have to be performed. That same business owner was convinced the EA was a good thing a few months ago. However, now the business owner is personally affected by the EA because it is threatening to result in a cost and time overrun of the project. So, as long as it involves general and long-term business goals, EA is a good thing and awareness is high. But as soon as it becomes concrete and starts to affect individuals, resistance starts to increase and maturity remains low. Therefore, in our assessments, we make a clear distinction between the level of architecture thinking (awareness) and the ability to put the EA into practice (maturity).
2) Using visualization models results in constructive insight in EA efficiency:
We found that representing the assessment results using visualization models, which provide a customized characterization of the departments involved in the assessment, gives constructive insight in architecture efficiency. Most assessment models assign a general, predefined maturity or alignment level to the organization assessed, in the same manner as the Capability Maturity Model Integration developed by SEI [Ahern et al., 2004]. These levels each have a set of general characteristics, which do not necessarily reflect the specific organization being assessed. Representing the assessment results in such a way does not allow for creating a customized advice for improvement. Assigning a level of maturity or alignment may result in it becoming a goal to reach the next level, which may not necessarily be the best level for that organization. Therefore, we do not assign a generic predefined level of architecture awareness, alignment, or maturity to EA delivery functions, but position them in visualization models combining these various perspectives.

3) Both EA delivery and the entire EA function should be assessed on their efficiency:
We experienced a difference between the EA delivery function and the non-architect stakeholders of the EA delivery function when it comes to assessing them. In positioning the two EA delivery functions within the visualization model shown in Figure 4.2, there was no complete clarity about the basis on what we positioned them. For example, regarding architecture maturity, we implicitly positioned the two architecture functions based on the level in which their architectures were being put into practice by the two departments running solution development projects. Therefore, we will make a more clear distinction between the EA delivery function and the affected stakeholders. The EA delivery function is responsible for creating and maintaining the EA, and providing support for management and project teams. The affected stakeholders should work according to or be supported by the EA products created by the EA delivery function (EA conformance as described in Section 3.2.3). This constitutes the external environment of the EA delivery function, which could be a specific business unit, an IT department, or an entire company. The EA delivery function should supervise and provide guidance to those who are to work according to, or be supported by these EA products; the non-architect stakeholders of the EA function. This made us decide that the scope of the EA function is wider than just the EA delivery function, and also include the non-architect stakeholder in our EA function reference model we discussed in Section 3.2. To assess the non-architect stakeholders, we need different assessment criteria, based on their roles and responsibilities, as we discussed in Sections 3.2.4 and 3.2.7. In Section 4.5.1 of this chapter, we discuss the assessment criteria for the entire EA function, including its non-architect stakeholders.

4) The right attitude of stakeholders towards EA is critical in being effective with EA:
This is vital in realizing organizational acceptance. If stakeholders are satisfied with
the EA function, they are more likely to accept the EA and to change their behavior (the way they perform their work) by complying with the EA. Therefore, we need to complement our assessment model with a means for determining EA stakeholder satisfaction. Stakeholder satisfaction concerns the attitude of the stakeholders towards the ideas and actions of the EA function. The level of satisfaction depends on how the EA function operates, which results it achieves, and how it actively tries to increase the satisfaction of its stakeholders. For example, by clearly communicating what EA entails, how it helps the organization improve, and which results have been realized with EA. In Section 5.2 we discuss how stakeholders perceive the EA function, and how their satisfaction can be determined.

5) Aligning IT and business architectures should not always be the aim of the EA function:
Whether an EA function should strive for architecture alignment depends on the goal with EA. For example, if an organization’s objective with EA is to reduce IT complexity, and has no desire to alter the business, then the focus should solely be on IT architecture. In that case the architecture maturity of the IT architecture function might be of a high level, without it focusing on architecture alignment. Therefore, we decided to remove alignment as an assessment criterion from our model. Apparently, alignment is an optional goal which may be strived for, depending on the objectives of the organization, and not a mandatory element that each EA function should contain. In Section 5.3 we further discuss alignment as an objective of the EA function.

4.4 Evaluation of Existing Assessment Approaches

We conducted an evaluation of existing assessment models. We also used the findings of this evaluation to improve the first version of our EA function efficiency assessment approach.

4.4.1 Related Work

The Enterprise Architecture Management Maturity Framework (EAMMF) has been developed by the United States General Accounting Office [Hite, 2003]. The framework describes 31 core elements, which are descriptions of a practice or condition needed for a mature EA delivery function. The framework associates each core element to one of five hierarchical maturity stages, and one of four types of management attributes, referred to as critical success attributes. Because it uses several maturity stages to assess a specific EA function, EAMMF assumes that typical patterns of core elements and management attributes apply to a generic maturity stage. To our experience, the development path of EA may differ for each organization, as we discussed in Chapter 2. Therefore, in specific situations these patterns may not apply. Also, linking specific elements and attributes to generic maturity levels makes it hard to perform an integral assessment on all relevant topics to identify improvement points.
4.4. EVALUATION OF EXISTING ASSESSMENT APPROACHES

Two models comparable to EAMMF are the Enterprise Architecture Maturity Model (EAMM) created by the National Association of State Chief Information Officers [NASCIO, 2003] and the Enterprise Architecture Capability Maturity Model (EACMM) created by the United States Department of Commerce [US DoC, 2007]. Both models have a comparable background as the EAMMF. They include some elements of the entire EA function, but provide much less detail and do not refer to any guiding documents. Like EAMMF, these models also describe a hierarchy of 5 maturity stages.

Ross et al. describe a vast number of practices for building a mature EA function [Ross et al., 2006]. These management practices are divided into two categories: processes and roles. They do not provide a means to perform maturity assessments based on these management practices, plus these management practices are related to 4 maturity stages.

Van den Berg et al. provide a practical guide to building an EA capability, focusing mainly on the EA delivery function [van den Berg et al., 2006]. Besides many practical methods, techniques and tools, they provide a practical approach to assessing the maturity of the EA delivery function by applying a staged maturity model. Their approach does not provide a separate reference model of the EA function. Also, their approach is positioned as a self-assessment, which is likely to result in a biased outcome.

Bass et al. describe an approach for evaluating and improving the architecture competence of the EA delivery function [Bass et al., 2008]. The approach incorporates four models to assess: (1) the duties, skills and knowledge of architects, (2) the competences of the EA delivery function, (3) the cooperation between architecture teams, and (4) the learning cycle in the architecture design process. They provide a framework for building an assessment instrument, but do not provide one standard, ready-to-use assessment instrument as well as a separate EA function reference model.

4.4.2 Findings

Based on this literature analysis we found the following:

1) Existing EA assessment approaches focus on determining the maturity of EA delivery:
These existing approaches focus primarily on improving the efficiency of the team or department of architects responsible for creating EA products. As we discussed in Chapter 3, other functions and roles within organizations also have tasks and responsibilities in the EA function. For example, senior management has an important responsibility regarding EA decision making. Project members such as project managers, analysts and designers have the responsibility of working according to the EA products. Therefore we increased the scope of our EA function assessment model to also include these elements of EA decision making and EA conformance.
CHAPTER 4. EFFICIENCY OF THE ENTERPRISE ARCHITECTURE FUNCTION

2) The governance elements of EA are insufficiently described in the literature:
As a result of their too narrow scope, existing assessment models do not clearly describe required governance, collaboration and coordination structures and processes for the entire EA function. Also, they do not explicitly take into account the key parameters of an EA function to determine how it should function in order to be efficient and effective — e.g., the positioning of the EA function in the organization chart, and its coverage of architectural domains. Therefore, we included these key parameters for the entire EA function, including its positioning, governance, and collaboration and coordination, into our assessment model (see Section 4.5.1).

3) There is no standard reference model for the EA function in the literature:
Existing EA assessment approaches do not explicitly describe a separate reference model for the EA function. They make no clear distinction between the EA function assessment measure (the topics to be assessed) and the EA function reference model (the norm to compare a specific EA function with). Therefore, we separated the reference model (see Section 3.2) that describes a generic model of the EA function from the assessment model (see Section 4.5) that may be used to determine the gap between a specific EA function and the generic reference model.

4) Building an efficient EA function takes more than just implementing mature processes:
We evaluated the definition and structure of the capability maturity model concept. SEI defines capability maturity as: “a process improvement maturity model for the development of products and services. It consists of best practices that address development and maintenance activities that cover the product lifecycle from conception through delivery and maintenance” [SEI, 2006a]. A maturity model consists of standard process descriptions for the process areas of a capability (e.g., the software development capability) based on best practices. SEI states that maturity appraisals “focus on identifying improvement opportunities and comparing the organization’s processes to […] best practices” [SEI, 2006a]. This means that the outcome of such an appraisal only indicates the gaps between the processes of a specific organization and the generic process descriptions of the capability maturity model. This implies that when an organization has implemented the standard processes of the maturity model the capability is mature. However, in our view, having standard processes in place is not what is important. What we are actually striving for is an efficiently operating EA function that produced effective output and achieves its objectives. Therefore, we discuss EA effectiveness in more detail in Chapter 5 where we take an external perspective on the EA function.
4.5. EA Function Assessment Model

5) EA efficiency concerns building a high quality EA cycle that is fast and accurate:

Efficiency of the EA function concerns the quality of the EA work processes in terms of speed (execution time) and accuracy (number of errors made). Several ways to increase efficiency of the EA function are to standardize its processes, train its architects, and improve its management and communication capabilities. In the remainder of this chapter, we focus on the internal processes of the EA function in terms of efficiency instead of maturity.

4.5 EA Function Assessment Model

In this section we discuss the final version of our EA function efficiency assessment model, which we divided into two parts. Part 1 describes, at the level of the entire EA function, the essential preconditions for having an efficient EA function (see Section 4.5.1). Part 2 describes the efficiency variables that are specific for the EA delivery function (see Section 4.5.2).

4.5.1 Part 1: the Entire EA Function

The EA function needs to be clearly defined regarding its position, strategy, structure and operating model, and all stakeholders involved must be made aware of this definition. Also, the three sub-functions of the EA function (see Section 3.2.3) should operate as one unity, and thus needs to be well governed.

Peterson describes three essential capabilities for a well governed organizational function - structural, process, and relational capabilities [Peterson, 2004]. We used Peterson’s fundamental work in the field of IT governance to set up the governance, collaboration and coordination aspects of our EA function reference model, as discussed in Section 3.2. We translated these capabilities into three essential preconditions for EA function efficiency: (1) a clear and accepted EA function definition, (2) a transparently and consistently operating EA governance model, and (3) proactive collaboration and communication between all functions, bodies, and roles that take part in the EA function. We used these three key preconditions to construct our EA function efficiency assessment model shown in Figure 4.3.

4.5.1.1 Definition of the EA Function

The EA function should have a well described strategy, which states its mission, purpose and objectives. The strategy should be aligned with the corporate strategy - e.g., for the IT & operations (ITO) division of a large international company we assessed (see Section 3.3), complexity of the operational information systems and infrastructure are the primary concern. The EA function’s mission is to ensure that projects and operational changes add to the simplification of the operational environment. Typical objectives of an EA function are to reduce costs, complexity and risk, and increase flexibility and quality.
of service regarding change projects and the operational environment [Ross et al., 2006]. We discuss how the EA function contributes to achieving organizational objectives in more detail in Section 5.3.

To realize its strategy, the EA function should have the right position within the organization. The EA function’s positioning consists of three variables: (1) organizational scope, (2) organizational levels, and (3) architectural focus. First, the organizational scope describes which part of the organization the EA function covers. For example, the EA function may cover the entire organization, it may focus on one business division, or it may even reside within one department. Second, as we discussed in Section 5.2.2, there are four organizational levels the EA function may operate at, depending on its: (1) enterprise, (2) domain, (3) project, and (4) operational. Enterprise level is the highest organizational level, at which decision making aims at setting a long term strategic direction for the organization, and achieving horizontal alignment between domains. At the domain level, decision making aims at setting domain specific objectives and optimizing the domain in order to achieve those objectives. A domain may be a specific business division, but may also be a generic functional domain that ranges over several divisions. For example, Customer Relationship Management (CRM) may be defined as a functional domain that provides a CRM generic service to several lines of business within one company. At the project level, decision making focuses on realization of the enterprise and domain level strategies by running change programs and projects that develop solutions. At the operational level, decision making aims at maximizing stability and continuity of the operational environment, such as systems, processes, and procedures. Third, the architectural focus of the EA function indicates which of the four aspect areas it covers: (1) business structure and processes, (2) information needs of the business,
4.5. EA FUNCTION ASSESSMENT MODEL

(3) information systems delivering information services, and (4) technical infrastructure [Lankhorst, 2009].

Based on its positioning and strategy, the organizational structure states whether the EA function is centralized, decentralized, or follows a federated model [Peterson, 2004]. It gives an overview of the purpose, tasks and responsibilities of all functions, bodies and roles within the entire EA function.

The operating model describes the working of the EA function. In order to support EA decision making and ensure EA conformance, the EA delivery function may operate in three ways: (1) providing informal advice, (2) providing formal advice, or (3) acting as a formal gatekeeper. Providing informal advice is the most noncommittal approach in which architects provide advice and support, but have no means available to enforce EA products and stop projects that do not conform to those EA products. When architects provide formal advice, management is obliged to examine their advice. Management is responsible for EA decision making, and must sign responsibility for potential consequences stated in the advice. If the EA delivery function is a formal gatekeeper, architects are fully mandated to take EA decisions and enforce EA products by stopping projects that deviate from EA products.

4.5.1.2 EA Governance

The EA governance structure describes how the EA functions, bodies and roles are integrated into the governance structure of the organization. For the governance bodies of the EA function it describes which functions and roles take part in those bodies. For example, the EA council at enterprise level typically has representatives of the various domains involved in EA decision making. There may also be an integrated project review committee comprised of architects and subject matter experts who validate project deliverables and operational changes. In line with the EA governance structure, the responsibilities and authorizations describe in detail the RACI-elements (Responsible, Accountable, Consulted, and Informed) of the EA functions, bodies, and roles.

The governance processes of the EA function describe how EA decision making is formalized and how EA products are approved and enforced. For example, it describes where in the project life cycle solution deliverables must be validated on their EA conformance. It also describes how issues of non-conformance are handled through granting or rejecting escalations and waivers. The rules and procedures involved with EA decision making and EA conformance describe the forms, templates, guidelines, and criteria that apply regarding EA decision making and EA conformance (e.g., a waiver template or solution validation criteria). When properly observed, procedures and rules enable transparent and consistent EA decision making and EA conformance, which is vital for the acceptance of the EA function’s outcomes, as we discussed in Section 3.4.

4.5.1.3 Collaboration & Communication

Relational integration is the voluntary and collaborative (informal) behavior of the various stakeholders of the EA function to clarify differences and solve problems in order
to find integrative solutions [Peterson, 2004]. Active stakeholder participation in the EA function is vital for its efficiency. Mechanisms to facilitate such relational integration are social networks (e.g., architecture community), and joint performance incentives.

Structural, transparent, and consistent information exchange between the various stakeholders of the EA function, with different functions and roles, is a critical success factor for the EA function. Information exchange involves both the communication of EA decision making and the reporting of the operational performance of the EA function – e.g., regarding the EA conformance of projects, or the functioning of the EA delivery function.

There should be an adequate strategic dialogue in order to properly facilitate EA decision making, such as identifying synergy opportunities, and resolving diverging perspectives and conflicts between various stakeholders within the EA function. A strategic dialogue involves exploring and debating ideas and issues outside formal EA decision making, incorporating various perspectives and views [Peterson, 2004].

Shared learning among the stakeholders representing the various functions, roles, and bodies within the EA function allows a continuous learning and improvement cycle. Such a learning cycle is created by incorporating a feed-forward and feedback loop in the processes of the EA function. The feed-forward loop includes EA delivery providing pro-active support on applying EA products. The feedback loop enables stakeholders at project and operational level to share their practical experience with applying the EA products and suggesting improvements, as we discussed in Section 3.2.5.

4.5.2 Part 2: the EA Delivery Function

To assess the EA delivery function’s effort and efficiency, we created the model shown in Figure 4.4. As we discussed in Section 4.3.4, there is a gap between theory (architecture awareness), which shows how well an idea or plan is described, and practice (architecture maturity), which determines how well the idea is executed. One of the reasons for this is the tendency of EA delivery functions to suffer from the ivory tower syndrome [Kruchten, 1999]. In our approach we assess the EA delivery function on both their levels of thinking and ability to put into practice.

4.5.2.1 Management & Organization

The strategy of the EA delivery function describes its mission, strategic objectives, activities, and added value. It should be based on a stakeholder analysis, and must be aligned with the strategic goals of the organization and the entire EA function. The structure of the EA delivery function describes its internal structure – e.g., architect roles, task descriptions, architecture teams, etc. In order to ensure this structure is followed in practice, EA management must supervise whether the architects act according to the defined structure. Demand management requires the EA delivery function to know how much work of which type is requested by the stakeholders. For example, knowing the number of validations of project proposals for the coming month is essential, since the workload may fluctuate. Based on the demand, architecture management can perform
planning and coordination in order to prioritize and divide the EA delivery activities over the architects. Finally, architecture management is responsible for the budget and billing of the EA delivery activities. Getting the required budget involves creating a business case that shows the benefits of having an EA function exceeds the costs.

### 4.5.2.2 Communication & Public Relations

The starting point for service delivery and communication of the EA delivery function should be the stakeholder expectations. Stakeholder expectancy management requires the EA delivery function to perform a stakeholder analysis in order to adapt its service provision to its stakeholder’s expectations (see Section 5.2). Important to note is that these expectations should be in line with the goals as part of their formal role, and not with their personal and political goals. Active propagation of EA products is essential to keep the stakeholders up-to-date regarding the products and services of the EA delivery function. As we discussed in Section 3.2.3, communication of EA decision making is the accountability of responsible management, but responsibility is often mandated to architects. This activity should be part of an integral communication and acceptance plan which describes how the architects explain the purpose of EA, positively influence the attitude of the stakeholders towards the EA function, and get the stakeholders to comply with the EA products as second nature. Measuring and communicating the effectiveness
CHAPTER 4. EFFICIENCY OF THE ENTERPRISE ARCHITECTURE FUNCTION

of EA is also part of communication & PR for the EA delivery function. In Section 4.3, we present an EA effectiveness measurement model to be used for this purpose. Providing proof that the objectives with EA are being achieved should improve the acceptance and attitude of stakeholders towards EA. We discuss this relation between EA effectiveness and stakeholder satisfaction in more detail in Section 5.4. In addition to a communication plan, the EA delivery function should have a plan for seeking stakeholder involvement. This involves getting important change agents (e.g., senior management, highly respected subject matter experts, etc.) to positively influence others to accept and actively work together with the EA delivery function. And finally, architects who are aware of and can cope with organizational and political sensitivity are essential in getting organizational acceptance and support for the EA delivery function.

4.5.2.3 Work Processes

As described in Section 3.2.3.2, the EA delivery function has 5 primary activities. First, provide advice to support EA decision making by the EA governance bodies. This involves determining what type of advice the EA decision makers require based on the issues they face and the urgency of those issues. How the decision makers would like that advice structured and presented to them so that they can comprehend the implications of their decision making. Second, creation of EA products involves gathering the essential EA requirements, devising solution alternatives, analyzing the consequences for each of these alternatives, guiding the decision makers in choosing the best alternative, and performing a scenario assessment of the chosen alternative to determine their behavior in case of a changing environment. Third, maintenance of EA products concerns EA product change management. This includes processing changes to, or issuing the retirement of existing EA products, clearly logging their status and version number throughout their life cycle. Fourth, validating EA compliance involves reviewing organizational changes, implemented by projects and operational maintenance, on whether they conform to the EA products. Fifth, provide support in applying EA products entails pro-actively explaining their purpose, showing how to apply them, and providing feedback, hints and tips for applying them in practice. All five activities described above should be incorporated into a standard EA approach. This approach should frequently be reviewed and improved, and should be integrated with other approaches within the organization – e.g., the project management approach. In order to allow quality of service improvement, the EA delivery function should conduct efficiency assessments, combined with quality of service assessments – e.g., through a stakeholder satisfaction assessment. If the effectiveness or quality of service delivery is too low, the internal activities of the EA delivery function must be changed to improve the effectiveness or service quality level. Proper collaboration within EA delivery is essential for the architects to act as one team and communicate one message to the stakeholders. Therefore, the architects should have frequent meetings. Tools – e.g., an online architecture forum – or other collaboration instruments – e.g., an architecture community – also facilitate cooperation between architects.
4.5. EA FUNCTION ASSESSMENT MODEL

4.5.2.4 Human Resources and Tools

The EA delivery function should have a standard EA framework, which provides the architects with a shared meta model to define the EA artifacts and their relations, and a shared terminology and common language (e.g., [Zachman, 1987], [Lankhorst, 2009]). EA methods and techniques provide the means to perform impact analyses, create models, and implement architectures. For example, TOGAF is a methodology which describes the process of creating an architecture [The Open Group, 2009]. The EA framework, as well as the EA methods and techniques, should be made and kept fit-for-purpose. Regarding tool support, the EA delivery function should use EA tooling for modeling and creating EA products, and performing impact analyses for decision making. A central EA knowledge base should be used to share EA products among architects to work with and reuse when possible. A publication tool should be used to publish EA products for stakeholders to read and use.

The human resources of the EA delivery function (i.e., the architects) are its main asset. The knowledge of the architects should cover the specific aspect areas (see Section 3.2.2) and organizational scope and levels the EA function focuses on (see Section 3.2.4). This knowledge is essential in order to create and maintain high quality EA products. Also, architects typically have a strategic advisory role. The vision of the architects on the business trends, technological innovations, and regulatory developments is essential in providing advice and creating EA products. Architects typically deal with conflicts between long-term strategic decision making, institutionalized in EA products, and the short-term realization of the strategy in programs, projects and operational environment. In order to be effective in their role as strategic advisor and safeguard of EA conformance, the experience and skills of the architects is essential. Finally, to ensure the knowledge, vision and skills of the architects is sufficient, there should be proper Human Resource Management (HRM) for the EA delivery function. This includes competence management, based on profiles for the various roles within EA delivery function and an overall competence profile of entire EA delivery function. A professionalization program including recruitment policy, training program, coaching structure, and mechanisms for personal development plans should also be in place.

4.5.2.5 Products

The EA delivery function should have an EA product portfolio describing which types of EA products it delivers. Each product type in the portfolio should have alignment with the target audience (stakeholders of the EA function) based on their expectations concerning quality and content of the EA products, and their background knowledge. Therefore, there should be standard EA product templates, and the contents of the EA products should be predefined. Regarding the scope of the EA products, the EA delivery function should cover the aspect areas and organizational levels the EA function focuses on. Also, the contents of the EA products should include a description of the strategy, requirements, logical solution alternatives, physical solutions, transformation plan [Mulholland et al., 2006], and EA policies [Boh et al., 2007] for a specific domain or
CHAPTER 4. EFFICIENCY OF THE ENTERPRISE ARCHITECTURE

FUNCTION

the entire organization, depending on the EA function’s positioning.

To guarantee the quality of the EA products, the EA delivery function should have a quality mechanism in place. This quality mechanism involves describing the quality requirements of the EA products (e.g., Recognizable, Comprehensible, Relevant, Up-to-date, Consistent, Coherent, Accessible, Useful, Realistic, Pragmatic, Complete), frequently performing EA product quality audits based on those requirements, and the improvement of the EA product portfolio and the products the EA delivery function produces based on the quality feedback.

4.6 Efficiency Assessment Approach

To conduct benchmark-quality EA function efficiency assessments, we use the Standard CMMI Appraisal Method for Process Improvement (SCAMPI) [SEI, 2006b] tailored to the specific characteristics of the EA function. The SCAMPI approach consists of 3 phases: (1) plan and prepare the assessment, (2) conduct the assessment, and (3) report assessment results. Phase 1 consists of steps to create the assessment plan and prepare the assessment team. Phase 2 contains steps to conduct the assessment by preparing and performing evidence finding (through interviews and document study), validating these findings, and generating the assessment results. The last step in phase 2 includes creating a profile description of the EA function, an overview of the assessment findings, and an EA delivery efficiency profile using standard scoring questionnaires. The final phase consists of steps to present and archive the assessment results, including recommendations and an improvement plan.

Figure 4.5: Deliverable oriented overview of the assessment approach.

Figure 4.5 provides a deliverable oriented overview of the assessment approach. An essential part of the assessment preparation is clearly defining the assessment scope based on the definition of the EA function (see Section 4.5.1). A clear assessment scope
decreases the risk of losing focus, or running over time during the assessment. It also allows clearly identifying which stakeholders should be interviewed, and which documents should be studied to gather the essential assessment findings. A master interview form describes all topics of our EA function efficiency assessment model described in Section 4.5. For each stakeholder the relevant interview topics described in the master interview form are copied into structured interview forms based on their roles and responsibilities regarding the EA function. The documents selected beforehand, and identified during the interviews, provide objective data to cross check the subjective findings from the interviews.

During data gathering through interviews and document studying, it is key to periodically determine how many of all topics in the assessment model have been covered by the data gathered so far. Such an inventory allows you to better focus the coming interviews in order to ensure that all topics in the assessment model have been investigated. This is an essential condition to shift from data gathering to performing the analysis and determining the assessment score.

The assessment analysis involves describing the specific current state of the EA function being assessed, and the gap with the generic EA function reference model. This gap analysis provides the key input for determining the efficiency score of the EA delivery function using the standard scoring questionnaire. For each topic in our EA delivery function efficiency assessment model (see Section 4.5), the scoring questionnaire contains several statements that describe the norm. The assessors score the specific EA delivery function by indicating, on a 5 point Likert scale \[ \text{Likert, 1932} \] (0 = ‘completely disagree’ to 5 = ‘completely agree’), how well it achieves the norm. The scores of all assessors are combined into an efficiency profile consisting of a score for the five main topics in our assessment model (see Figure 4.6), and for each sub-topic as described in Section 4.5. The final step in an EA function efficiency assessment is to define conclusions and present recommendations and an action plan for improvement.

4.7 Case study 3: EA Function Efficiency of IT & Operations Division

We conducted an assessment of the EA function within the ITO division of a large international company at the end of 2007. We conducted the assessment with a team of 6, consisting of one lead assessor, 4 assessors, and 1 scribe. We followed the approach we described in Section 4.6.

The ITO division was responsible for delivering operational IT services to and creating new IT solutions for the European front-office divisions of the company. At the time of the assessment, the ITO division consisted of 8 Lines of Business (LoB), four of which serviced the retail divisions and the other four the wholesale divisions of the front-office. The ITO division of the company had one central technology unit responsible for providing infrastructural services to the LoBs. The technology unit was divided into a strategic and tactical Technology Office (TO), and an operational Technology Services
(TS) department. The EA function we assessed was part of the technology office.

To assess the efficiency of the EA function within the ITO division, we conducted 49 interviews. 28 interviews were conducted with architects and architecture managers. The remaining 21 interviews were with stakeholders of the EA function (i.e., solution designers, project managers, program managers and directors, and various members of the TO management team). The interviews with the architects and architecture managers all lasted 1.5 hours. The interviews with the other members of the EA function lasted between 1 and 1.5 hours. We used fully structured interview forms for all 49 interviews to ensure all required topics were addressed. All interviews were performed by two people, one interviewer and one scribe. During the interview, the scribe took detailed minutes and the interviewer made personal notes. After the interview was finished, the scribe created a draft interview report based on the minutes. The interviewer checked this interview report with his/her personal notes and made required changes. Following, all draft interview reports were sent to the interviewees for review. The interviewers finalized the interview reports based on the feedback of the interviewees.

To validate the findings from the interviews, the assessors analyzed 76 documents (e.g., EA products, EA governance and management documentation, and existing audit reports). The lead assessor facilitated several workshops with all assessors to consolidate all validated findings into one overall description of the entire EA function of the ITO division. Based on this overall description, all assessors filled out the standard scoring questionnaire. These individual scores were consolidated into the final assessment scores.

4.7.1 EA Function Efficiency Assessment

4.7.1.1 Definition of the EA function

The EA function we assessed was part of the Technology Office of the ITO division. The organizational scope of the EA function was the entire ITO division, and its architectural scope is limited to the Technical Infrastructure (TI) domain. The EA function did not cover the TS department and therefore only investigated the change activities of the projects run by the Technology unit. The TI domain covered the entire scope of the ITO division. Therefore, the EA function’s organization level was at enterprise level. The TI domain was divided into 11 sub-domains, such as middleware, security, and networking.

Regarding the strategy of the EA function, its mission was to ensure the TI solutions and services provided by TO were of high quality, and simplified the IT landscape. As part of the EA function, the EA delivery function aimed to contribute to this mission by: (1) creating and maintaining TI policies and TI domain architectures, and (2) validating solutions whether they complied with them. The EA function was not involved in validating operational changes to the technical infrastructure implemented by the TS department on their conformance to the TI policies and architectures.

The organizational structure of the EA function consisted of the EA delivery function with 11 infrastructure domain architects, one for each TI sub-domain, and one chief architect responsible for functionally managing the domain architects. Hierarchically, the domain architects were part of a resource pool of architects, managed by resource
managers. The stakeholders (i.e. project managers, and infrastructure designers and engineers) involved with running projects made out the EA conformance function. There was no separate stakeholder group or body outside the EA delivery function formally responsible for EA decision making.

The operating model of the EA delivery function was to create TI policies and architectures, and performing solution validations without providing pro-active support to projects. The domain architects tried to act as gatekeepers, stopping projects that did not conform to the TI policies and architectures. They did not have the formal responsibilities of a gatekeeper however. The chief architect made the final decision whether a project was allowed to continue.

4.7.1.2 EA Governance

Regarding the governance structure, there were no clear definitions of responsibilities and authorizations for the functions, bodies and roles that were part of the EA function. For example, EA decision making about TI policies and architectures was unclear. There was no formal EA council to approve the EA products. Therefore, the status of many EA products was undefined. There was a TI policy committee that discussed new or changed TI policies. However, this committee had no representation of key stakeholders outside the EA delivery function, and was not mandated to formally approve or reject TI policies or other EA products.

The governance processes within the EA function lacked clear rules and procedures. For example, most solution validations took place at a too late stage of the project life cycle. The first validation of a solution design typically took place when the solution design had been created. In that stage, the project had already been given management approval to start up based on an initial business idea. Therefore, if the solution design of the project was not compliant with the TI policies and architectures, stopping the project was very hard. There was no formal escalation or waiver handling procedure to resolve conflicts or exceptions to TI policies. When a validation outcome was overruled and the project was allowed to continue, this was not transparently communicated to all stakeholders involved.

4.7.1.3 Collaboration & Communication

The EA function we assessed at the end of 2007 has practically no structural relational integration mechanisms to facilitate collaboration, communication, and shared learning between architects and the other roles involved in the EA function.

4.7.2 EA Delivery Function Efficiency Assessment

Based on the interviews with 28 members of the EA delivery function (architects and architecture managers) we created the efficiency profile shown in Figure 4.6.

Figure 4.6 shows that regarding management and organization of the EA delivery function, the gap between theory and practice was relatively large. There was a description
CHAPTER 4. EFFICIENCY OF THE ENTERPRISE ARCHITECTURE FUNCTION

Figure 4.6: Efficiency profile of the EA delivery function in case study 3.

of the strategy and structure of the EA delivery function, but the architects were not fully aware of them. There were means for operational management of the EA delivery function, such as work planning and coordination. There was no insight, however, in the demand for EA support from projects and programs. This made it hard to plan the activities of the architects ahead. Management of the EA delivery function had many ideas and plans for improvement, but these were not being implemented yet.

When it comes to communication and PR, there was no integral communication plan. Most architects had reasonable understanding of the expectations of stakeholders regarding the service provision of the EA delivery function. However, most of the architects were not actively trying to involve stakeholders outside the EA delivery function to participate. The products the EA delivery function delivered were not actively communicated to the stakeholders. The products were statically published at various locations on the company’s intranet, making them hard to find for stakeholders.

The working processes of the EA delivery function may be characterized as bureaucratic and reactive. The architects provided little support in applying the TI policies in practice. Their way of working was highly individualized, and hardly formalized. There was little collaboration and communication between architects. This resulted into conflicting EA products, advices, and project validation outcomes.

The EA delivery function also scored low on human resources and tools. Most architects were highly valued for their technical knowledge of the infrastructure domains they were responsible for. However, their soft skills needed improvement. There was no coaching or training structure to improve this. There was a standard EA framework available, but most architects ignored this framework and there were several other frameworks being used. The architects used a document sharing tool as a knowledge repository, but reuse
4.7. CASE STUDY 3: EA FUNCTION EFFICIENCY OF IT & OPERATIONS DIVISION

of EA products or artifacts hardly took place.

Regarding the products, the total set of TI policies and architectures was ineffective. There were too many policies, and they were inconsistent. There was no standard EA product portfolio available, as well as no standard templates for EA products.

4.7.3 Recommendations

The EA function of the ITO division of the international company was hardly efficient, as Figure 4.7 depicts. There were few elements in place to form a basis for coming with focused recommendations for improvement. We recommended the international company to implement an integral EA function, expanding the organizational scope to the entire ITO division including the 8 LoBs. The architectural focus should also be expanded to include business, information, and information systems aspect areas. We recommended implementing a new EA function following a federated model, in which a central EA function creates, maintains, and enforces central EA products that set the boundaries for the 8 LoBs. Within these boundaries, the LoB specific EA functions may create, maintain, and enforce their own EA products. This provides the 8 specific EA functions with enough space to deal with LoB specific issues, but keeps the 8 LoBs aligned with the enterprise level strategy, architecture, and policies.

Figure 4.7: The EA function assessed in case study 3 positioned regarding its architecture awareness and maturity.
4.8 Discussion

Something is quite striking when comparing Case studies 2 and 3 presented in this chapter. The awareness and maturity levels of the architecture functions in Case study 2 (see Section 4.3) are much higher than the EA function in Case study 3. Both assessments, although conducted almost two years apart, were conducted in comparable situations within the ITO division of the same international company. Apparently, judging the efficiency of an EA function without an objective measurement instrument leads to a too optimistic efficiency score.

We conducted another case study, assessing the EA function of a business division of the same company. The findings from this case study were quite similar to those in Case study 3, and resulted into an almost identical overall efficiency score. This assessment within the ITO division was conducted with a different team of assessors. Apparently, using an objective measurement instrument to judge the efficiency of comparable EA functions leads to comparable efficiency scores.

The assessment model fits the situation of the ITO division very well. We were able to come to a detailed and fully validated efficiency score on all topics in the assessment model. As a result of the assessment performed, we were asked to help implement a new EA function with a wider scope, covering the entire ITO division regarding its business, information, information systems, and technical infrastructure architectural areas.

Based on the findings from Case study 3 we changed our model to be more flexible to fit various situations without having to be altered. As a result, the assessment performed within the ITO division required no changes to the assessment model. Therefore, we have reason to believe our model is flexible enough to fit any situation at any organization. Also, we validated the external validity of the model, because all assessment topics seemed relevant, and we were able to determine an efficiency score for all topics in the model.

The ITO division did score quite low on some assessment topics because they were almost non-existent – e.g., the ITO division had almost no structural relational integration mechanisms to facilitate collaboration and coordination between architects and stakeholders. This does not mean that our assessment model was incorrect or over-complete. It means that the ITO division had to improve these topics dramatically, because their in-existence led to low efficiency. Therefore, an important part of implementing the new EA function within the ITO division involved setting up structural integration mechanisms to improve the collaboration and coordination between stakeholders and architects.

4.9 Conclusions

In this chapter we presented our assessment model to determine the efficiency of the EA function. The model describes the topics on which the current state of an EA function is compared with the EA function reference model we presented in Section 4.2. The assessment model also creates an efficiency profile of the EA delivery function using a standard scoring questionnaire. We used existing EA assessment models, our exploratory
4.9. CONCLUSIONS

study on how EA is perceived and applied in practice, and lessons learned from case studies we conducted to create our model. We used a case study to illustrate how our model works.

Our model provides insight in the current state for both the entire EA function as well as the EA delivery function. For the EA function, the model provides insight in the strategy, role and positioning of the EA decision making, EA delivery, and EA conformance functions. In addition, it aims at determining the formal governance structure and processes, as well as the informal communication and collaboration capabilities. In combination with our EA function reference model, this allows identifying points for improvement in order to build an integral and efficient EA function. The EA delivery function is scored on its management and organization, communication and PR, working processes, human resources and tools, and products in order to determine its efficiency. Having a separate efficiency profile for the EA delivery function enables the alignment of the EA delivery function to the requirements of the entire EA function. This is harder to accomplish with other existing EA assessment models because they provide one efficiency outcome for either only the EA delivery function, or the entire EA function. Existing models apply a staged maturity approach, describing a typical efficiency development path. This results in a less flexible approach which may not apply for some specific situations. The topics in our efficiency assessment model are not linked to maturity phases. This makes our model more flexible.

In practice, we found that few organizations have a truly efficient EA function. Many organizations focus on improving the efficiency of the EA delivery function, but we found that the scope of attention should be increased to the entire EA function (see Chapter 3). For example, more effort should be put into getting the EA stakeholders to actively participate in the EA function. We found that there is a large gap between the expectations of EA stakeholders regarding the efficiency and effectiveness of the EA function and the degree to which they are met [Boster et al., 2000]. This is one of the reasons why the willingness of EA stakeholders to cooperate is low. We recommend frequently holding EA stakeholder satisfaction surveys to get insight into the stakeholder’s expectations and their perception of how well these are met. Based on the results of these surveys, the points for improving EA function efficiency should be prioritized to increase EA stakeholder satisfaction and EA stakeholder involvement. We expect that a better fit between the EA function efficiency and the EA stakeholder expectations will improve their satisfaction and their willingness to participate. Therefore, a next step, in Section 5.2 of the next chapter, is to explore how stakeholders perceive the EA function, and what determines their satisfaction.

We experienced that assessing the efficiency of the EA function results in useful insights. Comparing the current state of an EA function to our EA function reference model allows identifying the strong points and points for improving EA efficiency. However, we also found that we need to assess more than EA efficiency (or EA process quality) to know whether improvements are really worth the investment. Many organizations feel the need to determine the actual results of their EA function; whether the outputs of the EA function actually help attain the organization attain its goals. For an organization to
CHAPTER 4. EFFICIENCY OF THE ENTERPRISE ARCHITECTURE FUNCTION

justify its investments in EA, it must be able to show positive effects of the EA function's efforts [Morganwalp et al., 2004]. To determine the effectiveness of the EA function, an organization has to set clear goals for the EA function and measure the attainment of those goals. We need to better understand the typical goals of the EA function, and know when these goals are attained. A next step, in Section 5.3 of the next chapter, is to develop a measurement model to assess the effectiveness of the EA function.
Abstract:
Effectively applying EA is no easy task. Active participation of EA stakeholders is one of the main critical success factors for EA. This participation depends on the degree to which EA helps stakeholders achieve their individual goals. A highly related topic is effectiveness of EA, the degree to which EA helps to achieve the collective goals of the organization. In this chapter we present our work regarding EA stakeholder satisfaction and EA effectiveness, and compare these two topics. We found that, regarding EA, the individual goals of stakeholders map quite well onto the collective goals of the organization. In two case studies we conducted, we found that the organization is primarily concerned with the final results of EA, while individual stakeholders also worry about the way the architects operate.

5.1 Introduction
To extend our EA efficiency assessment approach, we address two topics in this chapter, namely EA stakeholder satisfaction and EA effectiveness. In Section 5.2 we discuss that collaboration between architects and EA stakeholders is often problematic because EA stakeholders are reluctant to take part in the EA function. This reluctance depends on the satisfaction of EA stakeholders with EA. This satisfaction is determined by the degree to which stakeholders perceive the EA function to help them achieve their individual goals. Current EA literature provides little insight into how EA stakeholders expect the products and services of the EA function to help them achieve their goals. We provide this insight based on Case study 4 we conducted within a business division of a large international company.

In Section 5.3 we argue that many large organizations have doubts about the effectiveness of their EA function. Managers responsible for EA want to determine the organizational effectiveness of their EA function. This effectiveness is determined by the degree to which the outputs of the EA function help the organization attain its collective
CHAPTER 5. RELATION BETWEEN EA EFFECTIVENESS AND STAKEHOLDER SATISFACTION

goals. For this purpose we present an EA effectiveness measurement model, which we applied within the IT and operations division of the same international company.

In general, stakeholders value their individual goals for a system or process more than the collective goals of an organization [Hoorn, 2006]. We see no reason to think this is different for EA. We expect that the positive influence of EA on the attainment of organizational goals also determines, to a large degree, EA stakeholder satisfaction. However, there may also be differences between collective goals of the organization and individual goals of stakeholders. For example, standardization of technologies may be beneficial to the organization, but may hinder a specific department manager, because his department uses non-standard technologies for its business critical applications. If the collective goals of the organization regarding EA coincide with the individual goals of stakeholders, then EA effectiveness determines, to a large degree, EA stakeholder satisfaction. If there are differences, however, other factors determine EA stakeholder satisfaction. In Section 5.4 we compare the individual goals of stakeholders with the collective goals of the organization to determine the relation between EA effectiveness and EA stakeholder satisfaction.

This chapter is structured as follows. In Section 5.2 we explore how stakeholders perceive EA should help them attain their individual goals. Section 5.3 describes our research on a measurement model to determine the degree to which EA positively influences the attainment of organizational goals. In Section 5.4 we compare the concepts of EA stakeholder satisfaction and EA effectiveness. In Section 5.5 we discuss related work and the limitations of our research. In Section 5.6 we give our main conclusions.

5.2 Stakeholder Satisfaction

For the EA function to be effective, architects and EA stakeholders should work together through formal (governance) processes, but more importantly through informal (collaboration) processes [Peterson, 2004]. The foundation for this collaboration between architects and EA stakeholders is the understanding of each other’s perspectives in EA decision making [Peterson, 2004]. EA stakeholders make decisions based on the objectives specific to their roles [Nutt, 1984]. The willingness of EA stakeholders to participate in the EA function depends on their satisfaction with its performance, which is determined by the degree to which they perceive their expectations about the EA function to be met [Zeithaml et al., 1990]. EA stakeholders expect the consequences of the EA function’s products and services (outputs) to help them achieve their goals [Gutman, 1997]. In order to effectively work together with EA stakeholders, architects should have a good understanding of the individual goals of EA stakeholders and how they can positively impact them.

In this section, we provide insight in the mindset of EA stakeholders, showing their expectations regarding the EA function’s products and services, and goal-achievement. Because there is not much available about the topic of EA stakeholder satisfaction in the literature, we decided to perform an exploratory study in order to build the EA stake-
5.2. STAKEHOLDER SATISFACTION

holders mind map. We used techniques taken from consumer research [Gutman, 1997] to get an understanding of the way in which EA stakeholders perceive the EA function.

This section is structured as follows. Section 5.2.1 explains the two core elements of the theoretical framework of this study, stakeholder satisfaction and cognitive structure, and introduces the interview and analysis techniques we used in creating the cognitive map of EA stakeholders. Section 5.2.2 describes the context and characteristics of the company we conducted Case study 4 in. In sections 5.2.3 and 5.2.4 we provide the approach and results of the data gathering and analysis.

5.2.1 Theoretical Framework

5.2.1.1 Stakeholder Satisfaction

Customer satisfaction is defined as the degree to which the customer perceives the expectations regarding a specific product or service to be met [Zeithaml et al., 1990]. The customer service literature has extensively investigated the concept of customer satisfaction. For example, Voss et al. used theory and approaches from the customer service literature to measure the perceived service quality in higher education [Voss et al., 2007]. The concept of customer satisfaction has, to our knowledge, not yet been applied in EA literature.

5.2.1.2 Cognitive Structures

Cognitive structures reflect the sense-making structures of individuals [Weick, 1979]. In customer service literature, cognitive maps are used to study stakeholder expectations and to evaluate their satisfaction [Voss et al., 2007]. Personal cognitive structures typically show the sequence of conscious and unconscious acts directed toward goal achievement [Gutman, 1997]. They contain hierarchically related sets of elements across levels of abstraction; high-visible, short-term goals and low-visible, long-term goals [Brewer, 1983]. For example, the cognitive map of a student may reveal that the high-visible, short-term act of drinking coffee helps in achieving the low-visible, long-term goal of obtaining a master degree; drinking coffee allows the student to stay awake, study longer, and get better grades [Gutman, 1997]. Stakeholder groups typically differ in the goals they pursue, and therefore have different dominant cognitive schemas [Bettis et al., 1993]. Therefore, we expect that different EA stakeholder groups evaluate the EA function service delivery differently.

5.2.1.3 Means-End Chain Analysis

A well-known type of cognitive structure is the means-end chain. A means-end chain shows how a stakeholder associates, in his mind, consuming or using a product or service (the means) with achieving a valued state (the ends) [Gutman, 1997]. The elements in a means-end chain consist of attributes (characteristics of a product or service), consequences (results directly related to the delivery of a product or service), and values
(higher level ends the stakeholder wants to achieve) [Voss et al., 2007]. For example, ‘color’ is an attribute of the product ‘car’; having a red car may help to get a car look sportier. The objective of our study in Section 5.2 is to determine how EA stakeholders associate their ability to attain their goals and values (ends) with the qualities and attributes of the EA function (means).

5.2.1.4 Laddering Technique

The laddering technique provides an approach for building means-end chains. There are two types of laddering techniques: (1) soft-laddering and (2) hard-laddering [Voss et al., 2007]. Soft-laddering involves in-depth interviews with respondents following their natural flow of speech; the researcher seeks to understand the meaning of the answers given and tries to link them to the means-end model. Hard-laddering uses more standardized interview and questionnaire techniques. Because of the exploratory nature of our research we applied the soft-laddering technique. We wanted to leave room for the respondents to introduce their own attributes, and use further questioning to gain more understanding about those attributes, and how they connect these to consequences and values. The approach involves using semi-structured, qualitative, in-depth interviews during which the interviewer asks questions to reveal attribute-consequence-value chains by repeatedly asking questions why an attribute, consequence or value is important to the respondent. The interviewer takes the subject up a ladder of abstraction and follows a process of digging deeper by asking inquiring questions. The answer to a question is a starting point for further questions [Voss et al., 2007]. Table 5.1 shows an example ladder based on an interview with a change manager.

Table 5.1: Attribute-consequence-value ladder of a change manager.

| Respondent: “I want the architects to stop arguing with each other about what the enterprise architecture should look like. This is becoming a limiting factor.” | Code: ‘Collaboration between architects’ (Attribute) |
| Respondent: “Until they reach consensus, the enterprise architecture is still changing and therefore rendered useless.” | Code: ‘EA product quality’ (Consequence) |
| Respondent: “I need to have the enterprise architecture finished, otherwise I don’t know which interfacing standards my project teams should use.” | Code: ‘EA conformance’ (Consequence) |
| Respondent: “If we don’t have these interfacing standards available soon, my projects need to build the interfaces without these standards. This makes it very likely that we will run into problems later, when we connect our applications to those of other LoBs.” | Code: ‘Horizontal alignment’ (Value) |
5.2. STAKEHOLDER SATISFACTION

5.2.2 Case study 4: Stakeholder Satisfaction at Business Division

We conducted Case study 4 within a business division of a large international company. We do not mention the name of the company and have changed some characteristics of the company to keep the case description anonymous.

5.2.2.1 Organizational Context

The business division has four Business Units (BU), five generic domains, and one change organization (see Table 5.2). The BUs focus on different product lines or product-market combinations and make up the operational business units of the division. The five generic domains provide generic supporting services to the BUs.

The change organization guides and executes change activities in both BUs and generic domains. One generic change department is responsible for the changes within the generic supporting services domains. The four BU change departments each serve a specific BU. The Application Management (AM) department performs operational maintenance for all applications. The staff department of the change organization contains the architecture department, amongst others. The business division uses the Technical Infrastructure (TI) services of the company’s ITO division to host its information systems, and perform operational maintenance and change activities regarding the technical infrastructure.

Table 5.2: Organizational structure of the business division of a large international company.

<table>
<thead>
<tr>
<th>Business Units (BU)</th>
<th>Generic Domains</th>
<th>Change Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Line 1</td>
<td>Finance &amp; Control</td>
<td>BU Change Departments</td>
</tr>
<tr>
<td>Product Line 2</td>
<td>Marketing &amp; Sales</td>
<td>Generic Change Department</td>
</tr>
<tr>
<td>Product Line 3</td>
<td>Customer Relationship Management</td>
<td>Application Management</td>
</tr>
<tr>
<td>Product Line 4</td>
<td>Delivery Channels</td>
<td>Staff (Architecture, etc.)</td>
</tr>
<tr>
<td></td>
<td>Corporate &amp; Performance Management</td>
<td></td>
</tr>
</tbody>
</table>

5.2.2.2 EA Function

The EA function is primarily positioned within the change organization and consists of: (1) the EA council, (2) the architecture department, and (3) various roles within the change and application management departments.
CHAPTER 5. RELATION BETWEEN EA EFFECTIVENESS AND STAKEHOLDER SATISFACTION

The EA council consists of management representatives of the change departments and the application management department. The EA council prepares EA decision making, which are made final by the change organization management team. The members of the EA council are also responsible for communicating the enterprise level EA decisions to the rest of the organization.

The architecture department consists of three teams: (1) business and process architecture, (2) technical application and service architecture, and (3) technical infrastructure architecture. The department supports enterprise and domain level EA decision making and creates target architectures and EA policies. The architects should also provide support to stakeholders how to apply the EA products, and ensure that changes are implemented in conformance to the EA products.

Change managers are responsible for domain level EA decision making and coordination of all changes within a specific BU or generic domain. Program managers are responsible for running change programs (consisting of a set of projects sharing a common goal) within the constraints of the enterprise architecture. Project leaders are responsible for running a project within time and budget constraints. Application managers coordinate the operational changes in the information systems to ensure their stability and continuity.

5.2.3 Data Gathering

We created a list of topics to be addressed in the interviews. We first carried out 12 interviews with EA practitioners to gain an understanding of the world of an enterprise architect, and to identify the types of stakeholders enterprise architects work with in practice. Next, we conducted preliminary interviews with 6 non-architect practitioners (2 project managers, 2 program managers, a business and an information analyst) experienced in cooperating with enterprise architects at client organizations. This allowed us to gain an understanding of how those stakeholders perceived their participation in the EA function. We used the information thus gained to create a semi-structured interview form for EA stakeholders. The main objective of the interviews was to ask the respondents: What do you consider important regarding the service delivery of the EA function? And why is that important to you? For example, do you find the products and advice of the architects useful? And what is your experience with working together with the architects?

In total, we interviewed 21 stakeholders of the EA function at the business division: 4 change managers, 4 program managers, 3 project leaders, 5 application managers, 1 information analyst, 2 employees of the sourcing department, and 2 infrastructure architects of the external TI service provider. Interviewing these stakeholders was part of an integral assessment of the EA function. We also interviewed 8 architects and the EA delivery manager of the business division to determine the maturity of the EA delivery function. We used the data from these interviews as background information in our study regarding the stakeholder’s perception of the performance of the EA function.

Two interviewers, trained in applying the soft-laddering technique, conducted the in-
5.2. STAKEHOLDER SATISFACTION

terviews and took notes. The same scribe was present at all interviews to transcribe and double check whether the essential topics of the interview form were addressed. Afterwards, the interviewer checked the interview transcript with his own notes and made adjustments if necessary. A summary of the transcript was sent to the interviewees so they could check whether the highlights came across correctly. After having received feedback from the respondents, we completed the interview transcripts by making final adjustments.

Table 5.3: Attributes of the EA function as perceived by EA stakeholders.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear roles</td>
<td>The demarcation and awareness of all roles within the EA function at the different levels within the organization.</td>
</tr>
<tr>
<td>Governance structure</td>
<td>The responsibilities within the EA function assigned to formal roles and bodies regarding EA decision making, EA delivery and EA conformance.</td>
</tr>
<tr>
<td>Communication</td>
<td>The skills and behavior of architects that makes communication with stakeholders effective.</td>
</tr>
<tr>
<td>Proactive behavior</td>
<td>Architects who act decisively and help stakeholders in applying EA products.</td>
</tr>
<tr>
<td>Vision</td>
<td>The architect having a long-term overarching view and a realistic opinion about the organization and the realization of its business and IT strategy.</td>
</tr>
<tr>
<td>Tenaciousness</td>
<td>The architect being persistent and powerful regarding the architecture vision and principles, leading stakeholders in the planned direction.</td>
</tr>
<tr>
<td>Collaboration between architects</td>
<td>A good cooperation within the architecture team to define clear directions to stakeholders. This includes discussing and sharing important knowledge and consensus about architectural topics.</td>
</tr>
<tr>
<td>Functional knowledge</td>
<td>The architect’s knowledge and insights in software packages/components and their functionality and the way these can be used within the organization to support its business.</td>
</tr>
<tr>
<td>Think along</td>
<td>The ability and willingness of the architect to think along with stakeholders and understand their goals and problems in order to provide the best solutions.</td>
</tr>
<tr>
<td>Market trends</td>
<td>The architect’s knowledge and awareness of the current state of the art technology and innovations within the market regarding packages, tools and solutions.</td>
</tr>
<tr>
<td>Technological knowledge</td>
<td>Detailed knowledge of the technologies used within the organization and the planned technological solutions that will be used in the future.</td>
</tr>
<tr>
<td>Governance processes</td>
<td>The formal processes of decision making and the handling of architectural deviations and exceptions within the EA function.</td>
</tr>
<tr>
<td>Accountability</td>
<td>Architects being responsible for their advice and the outcome of their work.</td>
</tr>
<tr>
<td>Communication structure</td>
<td>The way in which communication within the EA function is formalized (e.g., reporting lines, intranet pages, etc.).</td>
</tr>
</tbody>
</table>
5.2.4 Analysis

5.2.4.1 Attributes, Consequences and Values

We omitted five stakeholders from our analysis. Two of them were external stakeholders with an architect role. We left them out because in this study we focus on non-architect roles. We omitted the information analyst role, since we had access to only one such person. This was insufficient to get a complete enough perspective for that role. We also left out the two employees of the sourcing department, because they both indicated to have no role in the EA function. We used the interview transcripts of the remaining 16 respondents in our analysis.

We analyzed the interview transcripts by labeling new categories and marking the quotes that indicated the recurrence of existing categories. This resulted in a set of labeled categories and accompanying quotes. We restructured and rephrased some categories to sharpen their definitions and to achieve one level of abstraction. We grouped the categories in attributes (desired characteristics of the EA function service delivery), consequences (pleasant results directly related to the EA function service delivery), and values (higher level ends the EA stakeholders want to achieve). Also, for each category we determined how many members mentioned that category in the interviews, which indicates how important an attribute is perceived by stakeholders.

Table 5.3 lists all attributes of the service provided by architects or the EA function as deemed important by respondents. For each attribute, it gives the label and a definition. Some attributes are closely related — e.g., ‘governance structure’ and ‘governance processes’, as well as ‘thinking along’ and ‘proactive behavior’. The three themes ‘technological knowledge’, ‘functional knowledge’ and ‘market trends’ indicate the expectations regarding the knowledge of architects.

Table 5.6 shows how many respondents mentioned each attribute in the interviews. The most important attributes show that stakeholders expect the EA function to have defined ‘clear roles’ and a clear ‘governance structure’. Regarding the architects, stakeholders expect them to have proper ‘communication’ skills and content, as well as ‘proactive behavior’ in providing support in applying EA products.

Stakeholders perceive the attributes shown in Table 5.3 as important, because they result in positive consequences. Table 5.4 lists the consequences the respondents mentioned. Table 5.7 shows how many respondents mentioned each consequence. Every respondent mentioned ‘EA conformance’, either for architectures (designs) or for EA policies, as an important consequence. We found that the EA function is expected to deliver insight in three important aspects: current state (‘as-is insight’), target state (‘to-be insight’), and ‘concrete change plans’ (the translation of strategic plans to concrete solutions outlines). Architects are also expected to support ‘decision making’, and to formalize EA decisions in documents with a high ‘EA product quality’. Stakeholders also find it important to have ‘close cooperation’ with architects in order to achieve the consequences mentioned above. Actively working towards the ‘acceptance of changes’ triggered by architecture is mentioned least.

Stakeholders expect the consequences (lower level goals) shown in Table 5.4 to help
5.2. STAKEHOLDER SATISFACTION

Achieve four distinct values (highest level goals) shown in Table 5.5. The ‘realization of strategy’ is seen as an important goal of creating and implementing the to-be architecture. Also, achieving ‘horizontal alignment’ between generic domains and specific BUs through standardization of change implementation is a key value that stakeholders aim to achieve with EA. Furthermore, stakeholders expect to use EA as an instrument for ‘monitoring’ changes implemented by programs and projects, and to ensure ‘operational continuity’.

Table 5.4: Consequences of the EA function attributes as perceived by EA stakeholders.

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA conformance</td>
<td>Assure that everyone conforms to the EA decisions written down in EA products. Assure that change initiatives and plans are checked for compliance with the to-be architecture.</td>
</tr>
<tr>
<td>Decision making</td>
<td>A fast, effective and well supported decision making process to define a to-be situation or to tackle implementation issues.</td>
</tr>
<tr>
<td>To-be insight</td>
<td>Having insight and a holistic perspective of the long and midterm future situation.</td>
</tr>
<tr>
<td>As-is insight</td>
<td>Knowledge of the current environment, its activities, the IT systems, infrastructure, business units and their mutual coherence.</td>
</tr>
<tr>
<td>Close cooperation</td>
<td>A frequent and close cooperation between architects and stakeholders based on a good business relation and aimed at constructively resolving problems.</td>
</tr>
<tr>
<td>Concrete change plans</td>
<td>The translation of strategic plans into specific implications and solution outlines to support definition and start-up of projects.</td>
</tr>
<tr>
<td>EA product quality</td>
<td>A high quality design (to-be or as-is) or policy regarding the organization’s business and IT assets. Quality attributes are: consistency, coherence, readability, comprehensibility and relevance.</td>
</tr>
<tr>
<td>Acceptance of changes</td>
<td>A positive attitude towards the chosen to-be architecture among organizational members.</td>
</tr>
</tbody>
</table>

Table 5.5: Values as perceived by EA stakeholders.

<table>
<thead>
<tr>
<th>Value</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realization of strategy</td>
<td>Achieving a situation which is as close as possible to the planned to-be architecture and the company’s strategy.</td>
</tr>
<tr>
<td>Horizontal alignment</td>
<td>Coherent and consistent (standardized) implementation of changes among the different generic domains and specific BUs.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>An overview of the current activities (projects and programs) within an organization to supervise change/project status and how these activities can result in a particular future state.</td>
</tr>
<tr>
<td>Operational continuity</td>
<td>Assurance of the quality and effectiveness of the current core and supporting business processes and IT systems.</td>
</tr>
</tbody>
</table>
5.2.4.2 Hierarchical Value Map

We analyzed how the interviewees related categories by building attribute-consequence-value ladders. We used a software tool to analyze ladders and store the accompanying quotes. Figure 5.1 shows the result of our analysis as a Hierarchical Value Map (HVM). A HVM is a graphical representation of means-end chains. The HVM provides the aggregated cognitive map of the 16 respondents. It shows how the four EA stakeholder groups – Change Manager (CM), Program Manager (PM), Application Manager (AM), and Project Leader (PL) – expect the EA function’s service delivery attributes to result in consequences that contribute to achieving their personal objectives.

The HVM consists of nodes which represent the categories perceived as most important by the respondents. The size of the nodes depicts their relative importance. To keep the labels readable, categories mentioned by less than 8 respondents have the same size. The nodes are represented as pie charts indicating how many of each stakeholder group’s respondents mentioned a specific category.

The lines between the nodes represent the positive linkages between concepts. The direction of the relations is from bottom to top. The thickness of the lines between categories indicates how often these categories have been related. To keep the HVM comprehensible, but at the same time ensure its level of detail, we applied a cut-off level of 4 to filter out less important categories and relations.

Figure 5.1 shows that stakeholders perceive ‘clear roles’ within the EA function and ‘proactive behavior’ of architects to be the most important attributes that lead to ‘close cooperation’ between stakeholders and architects. Other attributes (e.g., ‘communication structure’) also contribute to ‘close cooperation’, but are perceived less important. A clear ‘governance structure’ indirectly results in ‘close cooperation’, because it enables a proper ‘communication structure’. This shows that stakeholders expect low level attributes to help achieve higher level attributes.

Stakeholders perceive attributes of the services and products of the EA function result in consequences. There is also stratification in consequences, with ‘EA conformance’ and ‘EA decision making’ as high level consequences that are achieved through the fulfillment of lower level consequence, such as ‘to-be insight’ and ‘as-is insight’.

Finally, consequences are perceived to result in achievement of values – e.g., ‘to-be insight’ results in improved ‘monitoring’ of organizational changes. ‘Acceptance for changes’ as described in the to-be architecture plays a minor role, but is the only consequence that directly links attributes of the EA function (‘governance processes’ and ‘communication’) to values of the stakeholders (‘horizontal alignment’ and ‘realization of strategy’).

5.2.4.3 Results

Table 5.6 to Table 5.8 show for each attribute, consequence, and value the number and percentage of the 16 respondents that mentioned them in the interviews. For example, Table 5.6 shows that all stakeholders mentioned ‘EA conformance’ as a consequence that contributed to achieving their values. This is striking, because enforcing EA conformance
Figure 5.1: The Hierarchical Value Map shows the attributes of the EA function, and their relations with consequences and values as experienced by the EA stakeholders.
comes with restrictions. We expected ‘EA conformance’ to be perceived as a negative
consequence of the EA function, especially from the project leader stakeholder group. Ap-
parently, stakeholders recognize that uniformity and coherence in implementing changes
is critical.

Table 5.6: Number and percentage of respondents that mentioned the attributes.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Number of respondents</th>
<th>Percentage of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear roles</td>
<td>13</td>
<td>81%</td>
</tr>
<tr>
<td>Governance structure</td>
<td>12</td>
<td>75%</td>
</tr>
<tr>
<td>Communication</td>
<td>11</td>
<td>69%</td>
</tr>
<tr>
<td>Proactive behavior</td>
<td>11</td>
<td>69%</td>
</tr>
<tr>
<td>Vision</td>
<td>10</td>
<td>63%</td>
</tr>
<tr>
<td>Tenaciousness</td>
<td>10</td>
<td>63%</td>
</tr>
<tr>
<td>Collaboration between architects</td>
<td>8</td>
<td>50%</td>
</tr>
<tr>
<td>Functional knowledge</td>
<td>7</td>
<td>44%</td>
</tr>
<tr>
<td>Think along</td>
<td>7</td>
<td>44%</td>
</tr>
<tr>
<td>Market trends</td>
<td>6</td>
<td>38%</td>
</tr>
<tr>
<td>Technological knowledge</td>
<td>6</td>
<td>38%</td>
</tr>
<tr>
<td>Governance processes</td>
<td>5</td>
<td>31%</td>
</tr>
<tr>
<td>Accountability</td>
<td>4</td>
<td>25%</td>
</tr>
</tbody>
</table>

Table 5.7: Number and percentage of respondents that mentioned the consequences.

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Number of respondents</th>
<th>Percentage of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA conformance</td>
<td>16</td>
<td>100%</td>
</tr>
<tr>
<td>EA decision making</td>
<td>14</td>
<td>88%</td>
</tr>
<tr>
<td>Target state insight</td>
<td>14</td>
<td>88%</td>
</tr>
<tr>
<td>Current state insight</td>
<td>13</td>
<td>81%</td>
</tr>
<tr>
<td>Close cooperation</td>
<td>13</td>
<td>81%</td>
</tr>
<tr>
<td>Concrete change plans</td>
<td>12</td>
<td>75%</td>
</tr>
</tbody>
</table>

Table 5.8: Number and percentage of respondents that mentioned the values.

<table>
<thead>
<tr>
<th>Value</th>
<th>Number of respondents</th>
<th>Percentage of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realization of strategy</td>
<td>12</td>
<td>75%</td>
</tr>
<tr>
<td>Horizontal Alignment</td>
<td>12</td>
<td>75%</td>
</tr>
<tr>
<td>Monitoring of changes</td>
<td>10</td>
<td>63%</td>
</tr>
<tr>
<td>Operational continuity</td>
<td>6</td>
<td>38%</td>
</tr>
</tbody>
</table>
As a result of our analysis, we concluded that stakeholders have high expectations regarding the EA function. In this case study, it seemed infeasible for the EA function to fulfill all expectations. We found that stakeholder satisfaction with the EA function’s performance differed per stakeholder group, but in general was quite low. Also, we observed a relation between the intensity and efficiency of the cooperation with architects and the level of satisfaction with the EA function’s performance. For example, change managers were less satisfied with the performance of the EA function because EA did not help them in the ‘monitoring’ of changes and the architects did not have a ‘close cooperation’ with them. The members of the application management department were not satisfied with the EA function because architects did not provide ‘as-is insight’ in their operational application landscape, nor did the architects act as gate keepers ensuring ‘EA conformance’ and thus ‘operational continuity’. The project leader stakeholder group was relatively satisfied with the performance of the EA function because the ‘functional’ and ‘technical knowledge’ of the architects helped them in project level ‘decision making’.

5.3 EA Effectiveness

In Section 5.2 we presented our work on the individual goals of EA stakeholders. In this section we shift our focus to the collective goals of organizations, by investigating how to determine whether an organization meets the goals it set with its EA function. Organizations want to know whether they are on the right track with the deployment of their EA function and, if not, in which areas they are underperforming. Current literature provides little guidance on determining the effectiveness of the EA function [Kaisler et al., 2005]. The objective of this section is to develop an EA effectiveness measurement model and to better understand how the outputs (or attributes) of the EA function positively impact the goals set by the organization.

Our EA function measurement model describes the collective objectives realized by the outputs of the EA function. For example, the EA function may contribute to the improvement of IT quality by prescribing standard interfaces and ensuring these are used when creating new IT solutions. Our measurement model provides a means for organizations to determine which non-financial objectives are supported by the EA function. We based our model on existing effectiveness measurement models, translated it into EA terms, and pre-tested our model in Case study 5.

This section is structured as follows. Section 5.3.1 defines our measurement model. Section 5.3.2 provides an overview of how the measurement model is applied when doing an EA effectiveness assessment. Section 5.3.3 discusses the fit of our measurement model to the specific context of a large international company.

5.3.1 Conceptualization and Design of Measurement Model

To construct our EA effectiveness conceptual and measurement models we followed three steps: (1) literature review, (2) definition and structuring of a conceptual model (see
CHAPTER 5. RELATION BETWEEN EA EFFECTIVENESS AND STAKEHOLDER SATISFACTION

Section 5.3.1.2), and (3) construction of the measurement model (see Section 5.3.1.3). But before we describe these two models, we define EA function effectiveness.

5.3.1.1 EA Function Effectiveness

EA function effectiveness concerns the evaluation of the outputs of the EA function and determining their contribution to the achievement of EA objectives [Cameron et al., 1996], [Hoorn, 2006]. This is done by establishing the objectives and devising a method for determining whether or not those objectives have been attained [Morganwalp et al., 2004]. We define EA function effectiveness as: “The degree to which organizational objectives are attained through the outputs of the EA function.” Effectiveness may be objectively measured using organizational performance data related to the implementation of EA decision making. In case of unavailability or inaccessibility of such data, effectiveness may be subjectively determined from the joint perception of all EA stakeholder groups.

5.3.1.2 Conceptual Model

Based on a literature review, we identified alignment and agility as the two main organizational objectives the EA function contributes to [Hoogervorst, 2004], as we discussed in Section 3.2.1. Alignment and agility are two separate concepts that we expect to correlate. There may be causal relationships between alignment and agility, but because of the abstract and multi-level characteristics of these concepts these are hard to hypothesize upfront. For example, the ability to react to environmental changes (agility increase), increases the need to re-align internal functions, processes, structures, and systems to facilitate that change (alignment increase). However, when an organization keeps reacting to external changes quickly (agility increase), such may negatively influence the organization’s ability to internally re-align (alignment decrease).

The EA function helps achieve both alignment and agility through EA decision making and EA implementation as its two main outputs (see Section 3.2.8). EA decision making influences EA implementation – e.g., a central EA policy requires a different implementation process than a target architecture for a specific domain. EA implementation influences EA decision making – e.g., projects providing feedback to architects regarding the feasibility of the EA decisions may result in changes to those decisions.

5.3.1.3 Measurement Model

To operationalize the conceptual model, we constructed the EA effectiveness measurement model shown in Figure 5.2. Based on a literature review, we identified a total of 131 low level objectives of the EA function that potentially contribute to achieving alignment and agility, which we clustered into 11 high level EA objectives. These 11 objectives form the dimensions in our measurement model (the rectangles linked to both alignment and agility in Figure 5.2). Each dimension consists of a number of concrete
measurable indicators (the numbers between brackets in Figure 5.2), specified in Table 5.10 and Table 5.12.

Overby et al. define agility as: “the ability to sense environmental change and respond appropriately” [Overby et al., 2005]. Agility thus concerns aspects on the organizational interface between the external environment and internal organization – e.g., the products and services it provides. External changes include, amongst others, competition, customers, substitute and complementary products or services, government regulations, technological innovations, and the public opinion about social and environmental issues. The dimensions of agility have been derived from an analysis of enterprise agility concepts summarizing the main indicators of agility [Sherehiy et al., 2007]. The dimensions of agility are: ‘external monitoring’, ‘flexibility’, ‘speed’, ‘quality & customization’, and ‘initiation of change’. Table 5.9 describes the dimensions of agility. Table 5.10 shows for each of the agility dimensions the corresponding indicators.

Alignment encompasses horizontal alignment between business units, vertical alignment between strategy and operations, and business and IT alignment. The latter two are referred to by Henderson and Venkatraman as strategic fit and functional integration, respectively [Henderson et al., 1993]. Alignment is achieved when all components of an organization are interrelated coherently. These organizational components include all (business and IT) structures, processes, systems, and people internal to the organization, as well as the raw materials, (semi-finished) products, and services provided by external suppliers. The dimensions to be attained in order to achieve alignment have been derived from Luftman’s Strategic Alignment Model [Luftman et al., 1993] and Business-
Table 5.9: Agility dimensions and contribution of EA in attaining these objectives.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
<th>Contributing output of the EA function</th>
</tr>
</thead>
<tbody>
<tr>
<td>External monitoring</td>
<td>Identification of changes and opportunities, and the ability to translate these to new business and IT ideas.</td>
<td>Architects keep up with the social, market, technological and regulatory developments, and help management in identifying opportunities and required changes.</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Ability to change organizational components without major changes and investments.</td>
<td>Standardized organizational components (through EA products and EA governance) enable easy re-orchestration of components to implement changes.</td>
</tr>
<tr>
<td>Speed</td>
<td>Shortest time-to-market, time to act upon change, educate employees, and run end-to-end operations.</td>
<td>Architects use their domain knowledge to help projects shorten their lead time by identifying reuse of existing organizational components, and helping to integrate the new solutions with the existing organizational components.</td>
</tr>
<tr>
<td>Quality &amp; customization</td>
<td>High quality and customizable products and services of the business and IT.</td>
<td>Architects use their domain knowledge to guide projects in making high quality designs, ensuring the quality requirements of the products and services are realized.</td>
</tr>
<tr>
<td>Initiation of change</td>
<td>Ability and willingness of management (and the workforce) to initiate changes to implement new business ideas or introduce new technologies.</td>
<td>Architects help management in decision making about new business and IT ideas, by creating solution alternatives and analyzing their profitability and feasibility.</td>
</tr>
</tbody>
</table>

IT Alignment (BITA) maturity assessment model [Luftman, 2000]. These are: ‘internal performance monitoring’, ‘communication & understanding’, ‘governance’, ‘partnership’, ‘readiness for change’, and ‘conformance & integration’. Table 5.11 provides a description of the alignment dimensions as shown in Figure 5.2. Table 5.12 shows for each of the alignment dimensions the corresponding indicators.

5.3.1.4 Link Between Output of the EA Function and EA Objectives

The outputs of the EA function – improved decision making and implementation (see Section 3.2.8) – contribute to meeting the organizational objectives of alignment and agility. The EA function helps to increase alignment by taking a holistic perspective on the organization to identify alignment opportunities. For example, a business-oriented architect within a company creates a business and information architecture, describing the business processes, functions, and information needed to provide the products and services to the customer. An IT-oriented architect within that company uses this business and information architecture to describe the supporting information systems and technical infrastructure that deliver the required IT services in order to achieve business and IT alignment. In order to achieve alignment of all organizational components,
5.3. EA EFFECTIVENESS

Table 5.10: Indicators for agility dimensions.

| External change monitoring | 1) Responsiveness to change in customer’s preferences and demands.  
|                            | 2) Responsiveness to market and technological changes and trends.  
|                            | 3) Responsiveness to social, regulatory and environmental issues.  
|                            | 4) Adjustability of business objectives to the changes.  
| Flexibility                | 1) Flexible product model.  
|                            | 2) Flexible IT systems.  
| Quality & customization    | 1) High product quality.  
|                            | 2) High IT quality.  
|                            | 3) Customization of products and services.  
|                            | 4) Customization of IT systems.  
| Speed                      | 1) Shortest time-to-market.  
|                            | 2) Shortest time between identifying necessary changes and acting upon those changes.  
|                            | 3) Shortest time of educating employees.  
|                            | 4) Shortest time of operations (time needed for executing the end-to-end chain).  
| Initiation of change       | 1) Innovation and entrepreneurship by management is the norm.  
|                            | 2) There is high focused change readiness among management.  
|                            | 3) Education and cross-training is possible between management roles.  
|                            | 4) Managers can switch roles.  
|                            | 5) Executives, including CIO and partners, have decision-power.  

including those provided by external suppliers, the EA function also supports external supplier management. The EA function, for example, provides external suppliers with EA products that prescribe: (1) what they should deliver, and (2) the required quality standards. Table 5.11 describes, for each of the dimensions of alignment, how the EA function contributes in the attainment of these objectives.

The EA function contributes to agility by providing insight in the impact of the changes in the products and services an organization provides. For example, an architect may use his knowledge of processes, interfaces and systems to help determine the best solution to swiftly deliver a new web-enabled product or service. Table 5.9 indicates how the EA function contributes to achieving agility.

5.3.2 Effectiveness Assessment Approach

In order to conduct assessments using our measurement model we follow a three phase assessment approach inspired by the Standard CMMI Appraisal Method for Process Improvement (SCAMPI) [SEI, 2006b], similar to our efficiency assessment approach we presented in Section 4.6. These three phases are: (1) plan and prepare appraisal, (2) conduct appraisal, and (3) report results. Please note that we do not use the CMMI model as the reference model for our assessments, but our EA function reference model
Table 5.11: Alignment dimensions and contribution of EA in attaining these objectives.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Description</th>
<th>Contributing output of the EA function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal monitoring</td>
<td>Routine reviews, assessments and benchmarks of operational performance of and changes implemented to business and IT organizational components.</td>
<td>EA products describe the quality indicators of all organizational components, and thus provide input for the specification of performance indicators and service level agreements. Architects perform reviews of solutions and changes implemented.</td>
</tr>
<tr>
<td>Communication &amp; understanding</td>
<td>Common understanding of business and IT through knowledge sharing, and insight in consequences of decision-making.</td>
<td>EA products contain explicit knowledge (descriptions) of business and IT components, which allows knowledge sharing. Architects provide management with insight in, and advice about, the consequences of decision making on existing organizational components.</td>
</tr>
<tr>
<td>Governance</td>
<td>Formal decision-making, monitoring, and control of priorities and budget for both business and IT.</td>
<td>Architects translate strategic objectives to an architectural blueprint and transformation roadmap. Architects ensure that solutions and operational changes conform to these EA products.</td>
</tr>
<tr>
<td>Partnership</td>
<td>Business and IT are trusted partners where the business sponsors IT, sharing risks and rewards.</td>
<td>EA products link strategic plans and organizational components of the business (optimized for value creation) and IT (optimized for business support). By embracing and ratifying these EA products, business and IT management create a sense of partnership.</td>
</tr>
<tr>
<td>Readiness for change</td>
<td>Ability and willingness of the enterprise workforce to change attitudes, opinions, and behavior.</td>
<td>EA products provide insight in the consequences of, and the rationale for, organizational changes. By explaining the consequences and rationale, architects help changing the attitude, opinions, and behavior of the employees impacted.</td>
</tr>
<tr>
<td>Conformance &amp; integration</td>
<td>Consolidation, standardization and integration of organizational components to a coherent, transparent and flexible business and IT landscape.</td>
<td>EA products provide transparent and enterprise-wide coherent architecture and standards. They describe and prescribe the consolidation and integration of organizational components. Architects ensure that all changes and new solutions conform to these EA products.</td>
</tr>
</tbody>
</table>

In this chapter we summarize the essential activities of phase 2. First, the organization’s set of objectives for its EA function is identified by interviewing EA decision makers and analyzing formal documents. By comparing the specific set of objectives to the dimensions and indicators in the generic measurement model, a gap-analysis report of the EA objectives is created. Based on this report, and in collaboration

we presented in Section 3.2 and our EA effectiveness measurement model (Section 5.3.1).
Table 5.12: Indicators for alignment dimensions.

<table>
<thead>
<tr>
<th>Internal monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) IT metrics are available concerning technical performance, cost efficiency, ROI, cost effectiveness and external partners.</td>
</tr>
<tr>
<td>2) Business metrics are available based on functional organization, traditional financial indicators, clients and cooperation with external partners.</td>
</tr>
<tr>
<td>3) Business and IT performance is assessed by using mutually dependent indicators, with respect to external partners.</td>
</tr>
<tr>
<td>4) Service Level Agreements are used throughout the enterprise, extended to external partners.</td>
</tr>
<tr>
<td>5) Benchmarking is routinely performed, with feedback from external partners.</td>
</tr>
<tr>
<td>6) Formal assessments and reviews are performed routinely.</td>
</tr>
<tr>
<td>7) Continuous improvement takes place based on the assessments using routine practices.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Governance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Business strategic planning is integrated across and outside the enterprise.</td>
</tr>
<tr>
<td>2) IT strategic planning is integrated across and outside the enterprise.</td>
</tr>
<tr>
<td>3) There is a federated reporting/organization structure where the CIO reports to the CEO.</td>
</tr>
<tr>
<td>4) IT is seen as a cost and profit center.</td>
</tr>
<tr>
<td>5) Decision-making is steered by partnerships.</td>
</tr>
<tr>
<td>6) Prioritization is based on added value, extended to the added value of external partners.</td>
</tr>
<tr>
<td>7) IT program management is based on continuously improved standards.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Partnership</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Business perceives IT as a partner in creating value.</td>
</tr>
<tr>
<td>2) Business and IT develop the strategic plan together.</td>
</tr>
<tr>
<td>3) Risks and rewards, concerning objective achievement, are shared among business and IT.</td>
</tr>
<tr>
<td>4) Business and IT are trusted partners.</td>
</tr>
<tr>
<td>5) CEO is IT sponsor/champion.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conformance &amp; integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) IT has an external scope and is a driver and enabler for the business strategy.</td>
</tr>
<tr>
<td>2) Enterprise and inter-enterprise standards are specified and maintained.</td>
</tr>
<tr>
<td>3) The EA is integrated vertically (from strategy to operations).</td>
</tr>
<tr>
<td>4) The EA is integrated horizontally (between business units).</td>
</tr>
<tr>
<td>5) The EA is transparent and flexible across the organization (change projects shape EA).</td>
</tr>
<tr>
<td>6) Synthesis of diverse technologies (system integration).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Readiness for change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Innovation and entrepreneurship by the employees is the norm.</td>
</tr>
<tr>
<td>2) There is high and focused change readiness throughout the organization.</td>
</tr>
<tr>
<td>3) Education and cross-training is possible across the organization.</td>
</tr>
<tr>
<td>4) Employees can switch careers across the organization.</td>
</tr>
<tr>
<td>5) Management style is relationship based.</td>
</tr>
<tr>
<td>6) A trusted environment is created by valued partnerships.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication &amp; understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Improved understanding of business by IT.</td>
</tr>
<tr>
<td>2) Improved understanding of IT by business.</td>
</tr>
<tr>
<td>3) Less communication protocols and more informal communication.</td>
</tr>
<tr>
<td>4) Knowledge is shared within and between business IT and extra-enterprise.</td>
</tr>
<tr>
<td>5) Broader and more effective internal and extra-enterprise liaison(s).</td>
</tr>
</tbody>
</table>

with the EA decision makers, a final set of objectives of the EA function is determined. Next, the relevant indicators for each dimension are translated into (objective) metrics.
CHAPTER 5. RELATION BETWEEN EA EFFECTIVENESS AND STAKEHOLDER SATISFACTION

or (subjective) survey questions. For example, the indicator ‘vertical integration (from strategy to operations) of the EA’ is translated into the metric ‘percentage of change projects and operational changes that conform to the EA products’. Next, the objective and subjective data are collected using unobtrusive measurement tools and surveys. The resulting data are analyzed to determine goal-attainment.

5.3.3 Case study 5: EA Effectiveness of IT & Operations Division

We performed Case study 5 to determine the fit of our measurement model with the specific context of the IT & Operations (ITO) division of a large international company. At the time of the assessment, the ITO division was in the process of implementing a new EA function. The ITO division consisted of 8 Lines of Business (LoB) that deliver operational services and IT solutions to the company’s European front-office divisions. ITO has one central technology unit responsible for providing infrastructural services to the 8 LoBs. The new EA function that was being implemented within ITO was responsible for: (1) setting the long term strategic direction for ITO by means of creating and maintaining enterprise and domain architectures and EA policies, and (2) reviewing all solutions developed and changes implemented by ITO as to their quality and conformance to the architectures and EA policies.

5.3.3.1 Approach

We started by interviewing five EA decision makers of ITO’s EA function, who were responsible for its effectiveness. These EA decision makers were each members of the management team of a specific LoB, assigned with the responsibility of running that LoB’s EA function. We interviewed them to identify the relevant objectives of the EA function and possible metrics for meeting those objectives. We sent the transcripts of the interviews to the interviewees for confirmation. We analyzed documents related to the purpose of the EA function, and the reports of two workshops concerning the value of the EA function with the EA decision makers and several stakeholders of two LoBs. We then interviewed four third-party EA experts, all member of the program team responsible for the design and implementation of ITO’s EA function. The interviews with third-party experts allowed us to determine whether additional dimensions would be relevant in this specific context. Also, it allowed us to cross-check the relevance of objectives mentioned by the EA decision makers and documents not explicitly incorporated in the model. We performed an analysis of the gap between the objectives mentioned by both respondent groups.

5.3.3.2 Findings

The scores in Table 5.13 show the result of our analysis. It shows for each dimension in the measurement model the number and percentage of indicators mentioned by the respondents, both for the EA decision makers alone and including the third-party EA experts.
First we only looked at the indicators mentioned by the EA decision makers. Table 5.13 shows that they mentioned 18 out of a total of 55 indicators (33%) of the dimensions in our measurement model. Regarding the dimensions of alignment, ‘conformance & integration’ is mentioned most by the EA decision makers. All 6 indicators (100%) of this dimension were mentioned in the interviews, and most EA decision makers stressed this as the most important objective of ITO’s EA function. For example, according to the EA decision makers, ITO’s LoBs should be both horizontally and vertically integrated, and the various technologies used within ITO should be consolidated. On the other hand, ‘readiness for change’ was not mentioned in the interviews; the EA decision makers apparently did not deem this important.

The EA decision makers clearly mentioned the agility dimensions less in the interviews. For the agility dimension ‘quality & customization’, 2 out of 4 indicators (50%) were mentioned - i.e. quality of the IT systems, and quality of the products and services delivered to the customers. No indicator of both the ‘initiation of change’ and ‘flexibility’ dimensions was mentioned.

Next, we included the indicators mentioned by the third-party experts. They mentioned 12 additional indicators, resulting in a total of 30 out of 55 indicators (55%) mentioned. ‘Conformance & integration’ already had all indicators mentioned in the interviews with the EA decision makers and therefore was not discussed in the interviews with the third-party experts. For ‘communication & understanding’, ‘external monitoring’ and ‘speed’, the third-party experts did not mention any additional indicators. For the ‘readiness for change’ and ‘flexibility’ dimensions, they identified 1 additional indicator. For ‘internal monitoring’, ‘governance’, ‘partnership’, ‘quality & customization’, and ‘initiation of change’, the third-party experts mentioned 2 additional indicators. For ‘internal monitoring’ the experts mentioned that IT metrics (e.g., technical and financial performance) should be available, and benchmarking be routinely performed. For ‘governance’, they mentioned that there should be a federated reporting structure, and that IT program management should be based on continuously improved standards. For ‘partnership’, they deemed it important that the business is sponsor of the IT, and that IT portfolio management is based on standards approved by and continuously improved with the business. For ‘quality & customization’, they mentioned the ability to customize the IT systems, as well as the products and services delivered to the customers as being relevant. Regarding ‘initiation of change’, the third-party experts mentioned that it is important that management is properly trained to understand the impact of changes, and that they have the appropriate decision power to initiate change.

5.3.3.3 Results

The findings show that the EA decision makers of ITO’s EA function mentioned more alignment indicators (39%) than agility indicators (21%). A possible cause may be that the EA decision makers are inclined to focus on the objectives to be achieved with the EA function that have a direct relation to their own scope of responsibilities. The third-party experts expected ITO to also strive for agility with its EA function. Adding the
CHAPTER 5. RELATION BETWEEN EA EFFECTIVENESS AND STAKEHOLDER SATISFACTION

Table 5.13: Number and percentages of indicators mentioned in the interviews for both the EA decision makers alone, and including the third-party EA experts.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>EA decision makers</th>
<th>EA decision makers + 3rd party experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alignment</td>
<td>14 of 36</td>
<td>21 of 36</td>
</tr>
<tr>
<td>Internal monitoring</td>
<td>1 of 7</td>
<td>3 of 7</td>
</tr>
<tr>
<td>Communication &amp; understanding</td>
<td>3 of 5</td>
<td>3 of 5</td>
</tr>
<tr>
<td>Governance</td>
<td>3 of 7</td>
<td>5 of 7</td>
</tr>
<tr>
<td>Partnership</td>
<td>1 of 5</td>
<td>3 of 5</td>
</tr>
<tr>
<td>Readiness for change</td>
<td>0 of 6</td>
<td>1 of 6</td>
</tr>
<tr>
<td>Conformance &amp; integration</td>
<td>6 of 6</td>
<td>6 of 6</td>
</tr>
<tr>
<td>Agility</td>
<td>4 of 19</td>
<td>9 of 19</td>
</tr>
<tr>
<td>External monitoring</td>
<td>1 of 4</td>
<td>1 of 4</td>
</tr>
<tr>
<td>Flexibility</td>
<td>0 of 2</td>
<td>1 of 2</td>
</tr>
<tr>
<td>Speed</td>
<td>1 of 4</td>
<td>1 of 4</td>
</tr>
<tr>
<td>Quality &amp; customization</td>
<td>2 of 4</td>
<td>4 of 4</td>
</tr>
<tr>
<td>Initiation of change</td>
<td>0 of 5</td>
<td>2 of 5</td>
</tr>
<tr>
<td>Total</td>
<td>18 of 55</td>
<td>30 of 55</td>
</tr>
</tbody>
</table>

indicators mentioned by the third-party experts, results in a better balance between alignment indicators (58%) and agility indicators (47%) mentioned.

Based on the mapping of the objectives in our measurement model to outputs of the EA function (Table 5.11 and Table 5.9), and the findings from Case study 5 (Table 5.13), we conjecture that our model fairly describes the EA function’s objectives: on average, 55% of the indicators is mentioned. Other models either do not specifically focus on EA (e.g., [Luftman et al., 1993]), or do not explicitly link the output of the EA function with organizational objectives (e.g., [Morganwalp et al., 2004], [Kamogawa et al., 2005]). Our model helps organizations identify the objectives of the EA function. This allows organizations to determine whether these objectives are met, and use this information to prioritize their efficiency measures (e.g., based on an EA efficiency assessment we presented in Chapter 4) required to optimize the effectiveness of their EA function.

The results of Case study 5 illustrate that our measurement model can be used to analyze the EA function’s effectiveness. No new dimensions were identified, keeping the structure of the model intact. Based on the interviews with the EA decision makers we found 8 new topics, which can all be included as indicators of existing dimensions. However, before we do so, we need to conduct more case studies.

In general, we received positive feedback on our model and approach from the third-party experts we interviewed. They indicated that objectives should be specified according to the time-period in which they are attainable (short-term, mid-term, long-term). The set of objectives and the corresponding target values to be met could be related to the EA function’s stage in its life cycle. The terminology in the model is quite generic. Mapping and specifying the terminology to that used in a specific context could make it easier for respondents to determine the relevance of these objectives to their context.
5.4 Stakeholder Satisfaction and EA Effectiveness

In this section we relate the two topics of EA stakeholder satisfaction and EA effectiveness. We theorize that goal-attainment influences stakeholder satisfaction with the EA function, or may even be a precondition. As described in Section 5.2 stakeholder satisfaction is determined by the degree to which stakeholders perceive the EA function helps them achieve their individual goals (values). We further theorize that if, regarding the EA function, the individual goals of the stakeholders are the same as the collective goals of the organization, and moreover these collective goals are met, the individual stakeholders are satisfied. Therefore, it is interesting to compare the organizational goals of the EA function with the stakeholder expectations regarding the EA function, and determine whether these individual goals of the stakeholders and the collective goals of the organization are the same. If so, it suffices to measure either stakeholder satisfaction or goal-attainment.

In Section 5.4.1 we map the individual goals of the stakeholders and the collective goals and sub-goals of the organization. Based on this mapping, we analyze the differences and similarities between the individual goals of stakeholders and the organizational goals regarding the EA function in Section 5.4.2.

5.4.1 Mapping of Stakeholder and Organizational Goals

We compared the individual goals of stakeholders with the collective organizational goals and sub-goals regarding the EA function. For this we first mapped the (sub) goals of our EA effectiveness measurement model as presented in Section 5.3.1.3 to the values and consequences of EA stakeholders as presented in Section 5.2.4.1. Table 5.14 shows this mapping.

We were not able to map any organizational sub-goal onto the consequence ‘EA product quality’. Apparently, the organization is not interested in the quality of the EA products, but stakeholders are, probably because they have to work with them. From practice, we have learned that stakeholders experience a lot of dissatisfaction when the quality of the EA products is low – e.g. when the readability is bad. We also were not able to map the two organizational sub-goals ‘flexibility’ and ‘speed’ onto a value, consequence or attribute. These two concepts have much to do with a timely realization of the organization’s strategic objectives, and therefore may be mapped to the value ‘realization of strategy’. The attribute ‘market trends’ is mapped onto the sub-goal ‘external monitoring’. Apparently the organization thinks it is an important goal of the EA function to monitor external changes, but stakeholders rather see it as one of the regular activities of the EA function.

5.4.2 Difference in Percentages

The left two columns of Table 5.14 show the percentages of the 16 stakeholders who mentioned their values and the consequences they expect regarding the EA function.
Table 5.14: Difference between stakeholder and organizational objectives regarding the EA function.

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Percentage mentioned</th>
<th>Organization</th>
<th>Percentage mentioned</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA product quality</td>
<td>75%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Flexibility</td>
<td>50%</td>
<td>50%</td>
<td>0%</td>
<td>-10%</td>
</tr>
<tr>
<td>Speed</td>
<td>25%</td>
<td>25%</td>
<td>0%</td>
<td>-25%</td>
</tr>
</tbody>
</table>

What is striking is that at the individual stakeholder level the consequences of the EA function are structurally mentioned more than at the collective organizational level. This may be explained by the fact that, in general, stakeholders value their individual goals more than the collective goals of the organization [Hoorn, 2006]. The EA function seems no exception. One exception, though, is that ‘EA conformance’ and ‘conformance & integration’ are mentioned very much at both the individual and collective level. Apparently, conforming to the EA products is widely considered an important objective.

When comparing the difference between the two main goals in our EA effectiveness measurement model (agility and alignment), it is striking that individual stakeholders mention ‘realization of strategy’ more than the organization mentions its equivalent ‘agility’. On the other hand, the organization mentions ‘alignment’ more than individual
stakeholders mentions its equivalent ‘horizontal alignment’. Apparently, individual stakeholders are much more externally oriented than the organization is. This also explains why individual stakeholders mention ‘market trends’ more than the organization does its equivalent ‘external monitoring’.

What is also striking is that the organization mentions internal alignment more than individual stakeholders do, in combination with the fact that individual stakeholders mention internal monitoring of changes more than the organization does. Apparently, individual stakeholders are concerned with the process of change rather than the result of the change. This may be because the stakeholders want to gain the credits and prestige for successfully managing the change process. The organization may be more concerned with alignment because misalignment may lead to operational problems, potentially harming the ‘quality & customization’ of its operational service or product delivery.

5.5 Discussion

5.5.1 Related Work

5.5.1.1 Stakeholder Satisfaction

Related work on EA stakeholders by Lindström et al. describes how EA frameworks provide the CIO – as the primary EA stakeholder – a means for decision support, addressing his/her highest priority concerns [Lindström et al., 2006]. Although important, the CIO is just one of the stakeholders of the EA function, as we discussed in Section 5.2.4.

Clerc et al. describe the software architect’s mindset they constructed based on several stakeholder-centric use cases [Clerc et al., 2007]. Their work involves elements like identifying stakeholders and communicating the architecture to these stakeholders. Even though they describe elements of importance for the collaboration between architects and stakeholders, they focus primarily on the software architect’s perspective.

Smolander et al. describe stakeholder participation in software architecture design, including their problems in relation to architecture [Smolander et al., 2002b]. They found that stakeholders emphasize the importance of knowing the rationale for architecture decisions. However, they primarily focus on the role of stakeholders from the software architect’s perspective. They do not provide insight in the specific objectives of EA stakeholder who are not architects themselves, and the way in which they expect architecture to help them achieve those objectives.

5.5.1.2 EA Effectiveness

Many existing EA function assessment approaches focus on determining the efficiency of the EA delivery function, as we discussed in Section 4.4. They focus on the EA processes, the quality of the EA products, and the knowledge, skills and experience of the architects (e.g., NASCIO, 2003, US DoC, 2007). Although these approaches provide valuable information that might be used to improve the EA function, these approaches
provide no insight in the degree to which the EA function achieves the objectives pursued with EA. Other existing approaches focus on determining the financial value of the EA function (e.g., [Schekkerman, 2005]). However, there are quite some disadvantages to using traditional financial methods to evaluate EA functions [Hoffman, 2007]. We have reason to believe it is very hard to cost-justify having an EA function [Zachman, 2001]. The focus of EA is mainly on improving the quality of decision making and implementation of organizational changes, to eventually improve the quality of service provided to customers. In general, service quality improvement is hard to translate into financial benefits [Zeithaml et al., 2000]. Furthermore, based on our practical experience, we have learned that organizations are not so much interested in justifying the costs of the EA function. Most managers we have spoken to do not question the EA function’s reason for existence, but want to know whether they are achieving the objectives they have set with their EA function.

Morganwalp et al. summarize the perspectives of several authors on how to measure the effectiveness of EA (in terms of objectives or metrics) [Morganwalp et al., 2004]. Based on the three measurement dimensions and corresponding benefits of Buchanan (Buchanan, 2001), Morganwalp et al. formulate 12 qualitative objectives, with 58 corresponding indicators. 11 of 12 objectives (47 of 58 indicators) appeared to be positively influenced by EA. A limitation of this research is that it focuses on the positive impact of an EA framework and architecture development process. However, this does not measure the positive impact of the quality and implementation of EA decision making on the goals of the organization as we do in our research.

Cane et al. propose a research model to enable empirical testing of the extent to which EA frameworks support the task needs of their users [Cane et al., 2007]. However, they only provide an overview of related literature, and do not qualitatively or quantitatively validate the proposed research model. Also, their focus is mainly on how users perceive the effectiveness of the EA framework, ignoring the governance aspects and non-architect stakeholders of the EA function.

5.5.2 Research Limitations

5.5.2.1 Stakeholder Satisfaction

The study we present in Section 5.2 is a first exploratory study of the stakeholders of the EA function, because, up till now, there was little know-how of stakeholder perception of the EA function. Our exploratory study is based on a limited number of respondents. Our sample of 16 interviews – with an average of 4 interviews for each stakeholder group – turned out to be too small to draw detailed conclusions for each stakeholder group. We have not been able to include all stakeholder groups as described in Table 1, because they were not all available. For example, we omitted the ‘designer’ and ‘Chief Information Officer’ roles. However, the literature already provided insight in the relation of these roles with EA (e.g., [Smolander et al., 2002]), [Lindström et al., 2006]). Also, Case study 4 lacked stakeholders external to the business division, because the EA function was quite internally oriented.
Another limitation is that we conducted this study at one organization, which is insufficient to test the external validity. Future work is to conduct research to get a more in-depth understanding of the expectations of the various stakeholder groups regarding the EA function, across different organizations — e.g., by constructing a standard customer satisfaction questionnaire and assessment approach.

**5.5.2.2 EA Effectiveness**

The research described in Section 5.3 was aimed at developing and validating an EA effectiveness measurement model. A limitation to our work in Section 5.3 is that we have not yet tested the construct and discriminant validity of the measurement model. Future work is to perform additional case studies to collect data both from direct observations as well as from questionnaires and use the gathered data to determine the construct and discriminant validity, before testing the conceptual model as proposed. In order to validate the conceptual and measurement models, we have to take into account the multi-level and longitudinal characteristics of effectiveness measurements.

Another limitation is that we were not able to test the external validity, because we only performed one case study. Different types of organizations are expected to pursue different objectives with EA. The (partial) applicability of the measurement model may differ per organization, or type of organization. The findings from Case study 5 may thus be explained by the specific context of the ITO division and its focus on EA. Future work is directed to conducting multiple case studies by analyzing several organizations (active within different sectors and countries) to test the external validity of the model.

During the interviews, the EA decision makers proposed potential metrics to measure the attainment of the objectives of ITO’s EA function. However, due to time limitations and timing issues, we were unable to come to a final list of metrics approved by all EA decision makers. The EA function was still being implemented in the ITO organization at the time of the assessment. This meant that the precise objectives, scope and responsibilities of the EA function were still shifting, making it hard to get the indicators formally approved. Future work is to test the applicability of our model to specify concrete metrics and determine goal-attainment by conducting additional case studies.

**5.5.2.3 Stakeholder Satisfaction and EA Effectiveness**

A limitation to our analysis in Section 5.4 is that we compare data collected from two case studies conducted at two different divisions of the same company. However, the situations we encountered at the two divisions were very comparable regarding culture, governance, way of working (processes, methods and techniques), etc. Also, the approach we taken to conduct both case studies differed, since our research in 5.2 is exploratory (building a stakeholder mind map from scratch by building attribute-consequence-value ladders) and in Section 5.3 is a qualitative validation (designing a conceptual and measurement model from the literature and validating its applicability in practice). However, both studies had the same EA function reference model as starting point.
CHAPTER 5. RELATION BETWEEN EA EFFECTIVENESS AND STAKEHOLDER SATISFACTION

In Section 5.4, we compare percentages we calculated in different ways. For the stakeholders we counted how many of the in total 16 interviewed stakeholders mentioned a topic during their interview. For the organizational goals we counted the number of indicators of one sub-goal mentioned in all the interviews with 5 EA decision makers and 4 third-party experts together.

5.6 Conclusions

To build an effective EA function, the organization needs to do more than assess and improve the efficiency of the architects. Improving the satisfaction of the EA stakeholders by helping them achieve their individual goals is vital in ensuring they participate in the EA function. Clearly setting goals with the EA function, measuring their attainment and making adjustment to increase the effectiveness is also key. In this chapter we present our research in which we elaborate on both topics, and combine them to show their relation. With this research we build on earlier work regarding EA function efficiency (see Chapter 4).

In Section 5.2 of this chapter, we present the cognitive map of various stakeholder groups that take part in the EA function of a business division of a large international company. We used soft-laddering to build means-end chains that reveal how stakeholders expect the observable attributes of the EA function to help them achieve their objectives. The extent to which they perceive the attributes of the EA function to contribute to their goal-achievement determines their satisfaction with the performance of the EA function. For architects and EA stakeholders to better collaborate and make the EA function effective, there should be proper mutual understanding. The cognitive map of EA stakeholders allows architects to better understand what their stakeholders expect from them. The attributes in the EA function we found form a basis for architects to improve their EA service delivery – e.g., define clear roles, and behave pro-actively in providing support. Improving the service delivery of the EA function will increase the willingness for EA stakeholders to actively participate. Ultimately, this will improve EA function effectiveness, including the quality of the EA products. The cognitive map shows that different EA stakeholder groups pursue different objectives, related to their specific role within the organization. An important conclusion is that it is difficult to satisfy all stakeholders. Their objectives may be conflicting – e.g., the need of change managers for innovation and change versus the pursuit for operational continuity and stability of the operational manager. Based on this study we argue that the architect should prioritize which stakeholder groups to serve, and determine a strategy accordingly. Completely ignoring a specific stakeholder group is not advisable however. The EA function will only achieve maximum effectiveness when all stakeholders collaborate efficiently towards a shared goal.

In Section 5.3 of this chapter, we present a measurement model for EA effectiveness, which describes the generic potential objectives of an EA function. We performed a pre-test of our measurement model using a case study. The case study shows that the EA
measurement model provides guidance in identifying and structuring the objectives of the EA function. We argue that, to be able to measure EA effectiveness, the objectives of the EA function should be directly related to its concrete outputs. The typical error many organizations make is to identify too abstract objectives that the EA function cannot help attain. Our measurement model prevents this, which makes it easier to define concrete metrics and performance indicators in order to measure the effectiveness of the EA function in terms of (non-financial) goal attainment. The case study provides an early indication of the fit of the measurement model in a specific organizational context. Although several indicators may have to be added to and/or omitted from the model, the measurement model provides an early foundation of how to measure attainment of the objectives the EA function contributes to. Additional research has to be performed in order to come to a reliable and valid measurement tool.

In Section 5.4 we compare the concepts of Section 5.2 (attributes of the EA function, positive consequences, and relevant stakeholder values) with the concepts of Section 5.3 (organizational goals and sub-goals of the EA function), to determine the degree to which they are the same. We found that regarding the EA function, the individual goals of stakeholders and the collective goals of the organization map quite well. However, they are not exactly the same. We found that individual stakeholders mention the direct consequences of the EA function more than the collective organization. This means that the organization is more concerned with the final results of the EA function in terms of organizational goal attainment, and less with the way in which the EA function operates. In general, stakeholders are as much concerned with the final results of the EA function, but they also appreciate how efficiently the EA function operates. Therefore, we need to measure both EA effectiveness and stakeholder satisfaction to get a complete picture of the performance of the EA function, because when all goals (individual and collective) are attained, stakeholders may still be unsatisfied with the EA function because of the way it operates.
Assessor’s view on the Enterprise Architecture Function

Abstract:
Most organizations that currently invest in EA are not getting the desired results. We think this is because EA is either too abstract, or too pragmatic. For example, when EA is only used as a management tool for long-term, strategic decision-making, it remains an abstract, academic exercise. When EA is only used as an implementation decision-making tool for projects it remains a pragmatic solution to solve short-term problems. In both situations, half of the entire EA learning cycle, as described in Section 5.2.5, is badly executed or missing. Organizations that want to know whether maintaining a partially operating EA function is worth investing in, ask whether such investment leads to results.

To investigate this, and in essence bring all the topics of the previous chapters together, we asked 29 independent, professional assessors, highly experienced in judging organizational processes, to answer the question: Do you think EA contributes to achieving organizational goals? We asked these assessors to judge two situations where the EA cycle was not intact. We found no statistical correlation between how the assessors perceived the performance of the EA function and their perception of the attainment of organizational goals, which suggests that they do not connect these two topics in their judgment. Because we asked the assessors to judge two situations where the EA cycle was not intact, we conjecture that assessors want the EA cycle to be intact before they start relating this to achieving organizational goals. Furthermore, we found that, while assessing the performance of the EA function, assessors judge bad EA decision making more heavily than a faulty implementation of EA decisions.

6.1 Introduction
As described in Section 5.2.5 the EA cycle involves a combination of EA work processes performed by various EA stakeholders that together form a learning cycle in which EA decision making is developed, implemented and improved. Most organizations do not
CHAPTER 6. ASSessor’s View on the Enterprise Architecture Function

have an EA cycle that is fully intact, and are not getting the desired results with EA – e.g., they are unable to unravel complexity and implement organizational transformations successfully. This is because architects are either too abstract, or too pragmatic. Theoretical architects focus mainly on advising management. These architects act as ‘trusted advisor’ by helping management to make the right long-term strategic decisions, and developing the target blueprint for the organization. These architects, often acting in an ‘ivory tower’, however, forget to involve the work floor in implementing the target blueprint. Pragmatic architects, on the other hand, act as ‘subject matter experts’. These experts provide valuable advice to solution designers in making the right short-term implementation decisions. These experts, however, often fail to provide the organizational oversight and strategic insight into the consequences of long-term decisions that senior management expects from them.

Our aim in this chapter is to determine how assessors, highly experienced in judging organizational processes, view the effectiveness of the EA function. We did this by providing them with a realistic case description of an EA cycle and asking them the question: Do you think this EA cycle contributes to achieving organizational goals?

To answer this research question, this chapter is structured as follows. In Section 6.2, we describe our theoretical framework, and Section 6.3 describes our research approach. We follow with our analysis and results in Section 6.4 and provide a conclusion based on our findings in Section 6.5.

6.2 Theoretical Framework

In this section, we first relate the work processes in the EA cycle (see Section 6.2.1) with the outputs of the EA function (see Section 6.2.2) and the organizational goals EA should help to meet (see Section 5.3.1). We also define the concepts of Performance and Goal Attainment.

6.2.1 The Effective EA Cycle

Figure 6.1 shows that there are two clusters of activities (above and below the dotted line) in the EA cycle that lead to two different outputs. Management level activities involve management and architects working together to make high quality strategic decisions. Project level activities involve projects and architects working together to realize these strategic decisions by implementing changes in conformance to the EA products. These two outputs contribute to the achievement of higher organizational goals (i.e. alignment and agility).

6.2.2 Performance and Goal Attainment

In theory, assessors judge the performance of organizational processes based on three things: (1) Effort, (2) Efficiency and (3) Output Effectiveness (Hoorn, 2006). Effort is the amount of energy or resources put into executing a process [Hoorn, 2006]. For example,
the number of architects that are available to provide support to projects. Efficiency concerns the quality of a process [Cameron et al., 1996]—e.g., how fast and accurately an architect creates his or her advice regarding strategic decisions. Output Effectiveness is related to the degree to which a stakeholder achieves a goal with the output of a process [Hoorn, 2006]—e.g., the degree to which management feels the advice of an architect helps in making the right strategic decisions. As a result of performance, Goal Attainment concerns the achievement of higher organizational objectives with a process [Cameron et al., 1996]. We hypothesize that assessors find that a well performing EA cycle contributes to the achievement of organizational goals—e.g., the implementation of an organizational transformation while using an EA should result in a higher quality solution in shorter time than without.

6.3 Research Approach

6.3.1 Case Description

We created a case description for assessors to judge. This case description resembled a real life situation of an organization (an imaginary company) running a large organizational transformation (implementing an enterprise-wide new risk-management system) using a target blueprint. The case description described how the EA function, as part of the overall program structure, executed the EA cycle while setting up and running this organizational transformation. We started with creating a first version of the case, which described a fully functioning EA cycle. We tested this case description on a test panel.
CHAPTER 6. ASSESSOR’S VIEW ON THE ENTERPRISE ARCHITECTURE

FUNCTION

of three experienced IT governance practitioners. The result was interesting because the test panel did not find the case description realistic. Furthermore, all members of the test panel completed the survey with extremely positive scores. They indicated that the EA function as a whole performed very well and that it contributed highly to achieving the organizational goals of the transformation. This led to such a small amount of variability in their answers that it was a potential danger for the analysis of the data in the main experiment (extreme skewness). Therefore, we decided not to use this first version of our case description.

We continued with two cases that described an EA cycle where things went wrong. Case 1 described a situation where a chief architect successfully acted as a ‘trusted advisor’ who helped management in making well-considered strategic decisions and developed a high-quality target blueprint. Several domain architects failed to act as ‘coaches’ because they ignored to help projects in using the blueprint in practice. These domain architects also were not able to provide the chief architect with feedback how to improve the blueprint (management level performance was high, project level performance was low). Case 2 described a situation where a chief architect was not able to act as a ‘trusted advisor’ for management, but the domain architects succeeded in acting as ‘coaches’ for projects (management level performance was low, project level performance was high). The two cases described the flow of an EA cycle over a period of 6 months. They also described the degree to which EA helped the transformation achieve its organizational goals.

Table 6.1: Profile of respondents.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male (28), female (1)</td>
</tr>
<tr>
<td>Age</td>
<td>29-61, M=45.48, SD=8.34</td>
</tr>
<tr>
<td>Country of origin</td>
<td>The Netherlands (28), Belgium (1)</td>
</tr>
<tr>
<td>Years of work experience</td>
<td>5-42, M=20.88, SD=9.06</td>
</tr>
<tr>
<td>Type of employer</td>
<td>IT consulting (27), technology provider (1), government (1)</td>
</tr>
<tr>
<td>Years with current employer</td>
<td>0.2-22, M=6.78, SD=5.91</td>
</tr>
<tr>
<td>Highest level of education</td>
<td>Bachelor (5), Master (24)</td>
</tr>
<tr>
<td>Profile</td>
<td>IT governance (20), enterprise architect (9)</td>
</tr>
</tbody>
</table>

6.3.2 Respondents

We spent two months calling every IT consulting firm (small and large) within the Netherlands to find participants for the two workshops we organized. In our search, we found 73 practitioners that matched our desired profile, but only 29 practitioners agreed to participate. This means that we had a response rate of 39.7%. Table 6.1 shows the profile of our respondents, who had to be highly trained and experienced in judging the efficiency and effectiveness of organizational processes, such as project management,
software development, or service delivery processes. All respondents had experience with how EA processes work in practice, although some more than others. The average years of work experience among the respondents exceeded 20 years. Most of them worked at IT consultancy firms for, on average, 7 years and performed several IT process audits at client organizations each year. Together these assessors judged the efficiency and effectiveness of processes within hundreds of organizations. From this experience, they had built a wide frame of reference, which they used to judge our two case descriptions.

6.3.3 Workshops

We organized two identical workshops of four hours each. The first workshop had 18 participants, the second 11. In a fully controlled environment, we asked each of the 29 assessors to judge one of the two cases. To capture their judgments, the assessors had to fill out one of four versions of our survey. Each version had a different sequence of the same questions to evenly spread the impact of survey fatigue and test effects over the survey items. The survey contained statements regarding the performance of the EA function; how well the EA function operated (e.g., “The chief architect creates a useful blueprint”). It also contained statements about the goal attainment of the EA function; how much the EA function contributed to meeting the transformation’s objectives (e.g., “EA helps the organizational transformation deliver one integral end solution”). After reading the case description, the assessors judged the performance and goal attainment of the EA cycle. They did so by indicating their level of agreement with the statements in the survey on a 6 point rating scale (0 = ‘completely disagree’, 1 = ‘disagree’, 2 = ‘disagree a little’, 3 = ‘agree a little’, 4 = ‘agree’, 5 = ‘completely agree’). Each statement (e.g., “Management makes well-considered decisions”) had a negatively stated counterpart (e.g., “Management makes thoughtless decisions”). This allowed us to correct for positive or negative answer biases by checking the symmetry of the responses. We stated all items affirmatively and avoided linguistic negations to keep from double negations in relation to the rating-scale labels (e.g., not + disagree).

6.4 Analysis and Results

6.4.1 Factor analysis

In a factor analysis we found that, regarding the EA function, Effort played no role in the performance judgment of assessors. Assessors did not distinguish Efficiency and Output Effectiveness as separate concepts while judging the performance of the EA cycle. Apparently, assessors did not look at the quality of the process or the output separately, but combined them into an overall judgment of the performance of the EA function.

The factor analysis also showed that assessors clearly distinguished the two parts of the EA cycle as shown in Figure 6.1. Items referring to the chief architect working together as ‘trusted advisor’ with management to make strategic decisions were clearly separated from items about the domain architects working together as ‘coaches’ with projects to
implement those decisions. We therefore built two scales regarding the performance of the EA function:

1. **Management Performance**: The combined Efficiency and Output Effectiveness of management and chief architect (as trusted advisor) working together.

2. **Project Performance**: The combined Efficiency and Output Effectiveness of the domain architects (as coaches) and projects working together.

The factor analysis also showed that assessors clearly distinguished the Goal Attainment scale from both performance scales.

### 6.4.2 Scale Analysis

After the factor analysis, we analyzed the items on the scales Management Performance, Project Performance, and Goal Attainment to evaluate their construct validity. Before item analysis, all negatively stated items were reverse-scaled (method recode). In the reliability analysis, item selection was a trade-off among several criteria, where the aim was to establish as many items on a scale as possible. Standardized Cronbach’s Alpha had to be at least >.60, preferably >.70. Corrected Item-Total Correlations were not allowed to be negative and had to be at least >.20. In a factor analysis, items had to correlate over .60 with their own scale and show the lowest possible correlation with other scales. The scores of the items that met these criteria were averaged and these values were used in our data analysis. Table 6.2 shows the results of the thus revised scales, which were at least 7 items long, with Cronbach’s alpha larger than .87, which is excellent. Table 6.3 shows the items we used to build the three scales Management Performance, Project Performance, and Goal Attainment.

Table 6.2: Standardized Cronbach’s alpha, Means and SDs, and the length of the shortened scales (N= 29).

<table>
<thead>
<tr>
<th>Scale</th>
<th>Standardized Cronbach’s α</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Performance</td>
<td>.93</td>
<td>1.86</td>
<td>1.28</td>
<td>8</td>
</tr>
<tr>
<td>Project Performance</td>
<td>.88</td>
<td>2.81</td>
<td>1.18</td>
<td>7</td>
</tr>
<tr>
<td>Goal Attainment</td>
<td>.92</td>
<td>1.94</td>
<td>1.15</td>
<td>8</td>
</tr>
</tbody>
</table>

### 6.4.3 Data Analysis

Across participants, we calculated the grand mean agreement scores to all items in a shortened scale (see Figure 6.2). We ran a GLM Repeated Measures for the 2-leveled between-subjects factor Case (Case 1 vs. Case 2) and the 2-leveled within-subjects factor of Performance (Management vs. Project) on the grand mean agreement-scores to the
6.4. ANALYSIS AND RESULTS

Table 6.3: Items on the Management Performance, Project Performance, and Goal Attainment scales. RS means that scores to negatively stated items were reverse-scaled.

**Management Performance**

1. Management communicates its architectural decisions accurately.
2. The chief architect advises management in making architectural decisions correctly.
3. Management is sloppy in deciding what to do with projects that deviate from the target blueprint (RS).
4. Management is careless in communicating its architectural decisions (RS).
5. Management is slow in communicating its architectural decisions (RS).
6. Management makes accurate decisions about what to do with projects that deviate from the target blueprint.
7. Continuous improvement takes place based on the assessments using routine practices.
8. The chief architect creates a useless blueprint (RS).

**Project Performance**

1. The domain architects accurately assess whether solution designs comply with the blueprint.
2. The projects are quick with providing feedback to the domain architects about the applicability of the blueprint.
3. The projects are slow with providing feedback to the domain architects about the applicability of the blueprint (RS).
4. The domain architects check the conformance of the solution designs with the blueprint.
5. The domain architects know which practical issues projects face while applying the blueprint.
6. The domain architects know which projects deviate from the blueprint.
7. The domain architects ignore the conformance of the solution designs with the blueprint (RS).

**Goal Attainment**

1. EA helps the organizational transformation achieve its objectives.
2. EA helps the organizational transformation deliver an end solution that fits the requirements of the key stakeholders.
3. EA helps the organizational transformation deliver one integral end solution.
4. EA obstructs the organizational transformation in achieving its objectives (RS).
5. EA impedes the organizational transformation to deliver an end solution that fits the requirements of the key stakeholders (RS).
6. EA makes governing the organizational transformation more difficult (RS).
7. EA obstructs the organizational transformation in delivering one integral end solution (RS).
8. EA hinders the organizational transformation in delivering an end solution that fits into the current business and IT landscape (RS).

items in our survey. According to the multivariate tests, the interaction between Case and Performance was significant with a considerable effect size (Pillai’s Trace = .71, F(1,27) = 65.6, p = .000, \( \eta^2_p = .71 \)). This interaction was supported by a significant main effect of Performance (Pillai’s Trace = .40, F(1,27) = 18.3, p = .000, \( \eta^2_p = .40 \)). The main effect of Case was not significant (F < 1).

Further inspection of the interaction effect with paired-samples t-tests showed that across cases, Management Performance (M = 1.86, SD = 1.28) was assessed as significantly lower than Project Performance (M = 2.81, SD = 1.18) (t(28) = -2.51, p < .018). In Case 1, Management Performance (M = 2.85, SD = 1.15) was assessed as signifi-
significantly higher than Project Performance ($M = 2.05$, $SD = .93$) ($t(13) = 2.27, p < .041$). However, this effect reversed in Case 2, where Management Performance was assessed as significantly lower than Project Performance ($t(14) = -11.00, p < .000$), the difference being dramatically larger than in Case 1.

In addition, we ran a multiple linear regression analysis (method Enter) with Management Performance and Project Level Performance as the predictors and the grand mean agreement-scores of Goal Attainment as the dependent. Neither the combination of predictors nor the predictors alone could significantly explain the variability in the agreement scores to Goal Attainment ($R^2 = .05$, $R^2_{adj} = -.03$, $F < 1$).

![Figure 6.2: Grand mean agreement scores to all items in a shortened scale.](image)

### 6.4.4 Results

The insignificant main effect of Case shows that the effect of the two different case descriptions is statistically unreliable. In other words, when we compare the average answers of the assessors who judged Case 1 with those of the assessors who judged Case 2 in an undifferentiated way, we find no significant differences. This means that the assessors were not influenced by the differences in the literal text of the two case descriptions. The significant main effect of Performance, however, indicates that when we do differentiate within the two case descriptions between good and poor Management Performance versus Project Performance (i.e. this is the interaction), there are significant differences. This means that the assessors did not respond to the different cases as such, but to the differences in performance of the architecture, particularly between
Management Performance and Project Performance.

The significant main effect of Management Performance versus Project Performance indicates the following: Independent of the cases, assessors judged that the performance of managers and trusted advisors working together contributed less to the overall performance of the EA cycle than the performance of coaches and projects working together did. The significant interaction shows that only in cases where Management Performance was explicitly presented as optimal (Case 1), Management Performance was able to overpower Project Performance. Yet, as soon as Management Performance was presented as sub-optimal or poor (Case 2), management and their trusted advisors were ‘punished’ severely and the coaches and projects were ‘appreciated’ more strongly for compensating bad Management Performance. When Management Performance was poor, Project Performance was assessed as far better than Management Performance was in cases where Project Performance was poor. This asymmetric pattern in the assessors’ judgment of the EA cycle’s performance was corroborated by the t-tests for the single contrasts. It seems that assessors of EA cycles feel that making bad EA decisions weighs more heavily than making mistakes in implementing those EA decisions.

The insignificant effects of both Management Performance and Project Performance on Goal Attainment mean that we found no statistical correlation between the performance of the EA cycle and the attainment of organizational goals. This indicates that, in the eyes of the assessors, there is no connection whatsoever between the performance of the EA function and the achievement of organizational goals.

6.5 Conclusions

We started this chapter with the question whether it is worth maintaining a partially operating EA function. We asked 29 assessors to judge two situations where the EA cycle was not intact. We did not ask assessors to judge a perfectly operating EA cycle, because they indicated that this did not represent a realistic situation. Yet, we found that assessors perceived no connection between the performance of the EA function and the achievement of organizational goals. As a side note, we did find that the assessors thought that, in general terms, EA was indispensable when it came to meeting organizational goals. We conjecture that assessors find that in general terms (and when applied correctly) the EA function helps to meet organizational goals, but when the EA cycle is not intact, the EA function fails to be effective. This however needs to be validated in future research.

If the assessors are right, their judgment has quite some impact. As we argued in this chapter, few organizations have an EA cycle that is intact. Certain organizations employ architects who help managers in making the right long-term EA decisions, but forget to help projects implement those decisions. Other organizations have architects who help projects to make the right short-term implementation decisions, but forget to guard the consistency of those decisions with the long-term objectives of the organization. It seems that in both cases there would be little return on investment in EA. This raises the
CHAPTER 6. ASSESSOR’S VIEW ON THE ENTERPRISE ARCHITECTURE FUNCTION

question: Why bother maintaining a partially operating EA function if it is plausible that it does not lead to results?
To conclude this thesis, in Section 7.1 I revisit my research questions as presented Section 1.3. I do this by summarizing the answers to these questions as provided by Chapters 2 to 6. I also explain, for each of the research questions, the contribution of my research and the added value of its results. In Section 7.2 I revisit the problem statement I described in Section 1.2 and I comment on, based on my own practical experience, whether I think the problem is really solved. I conclude this final chapter with my suggestions for future work and a closing word.

7.1 Revisiting the Research Questions

RQ-1: How is EA perceived and applied in practice?
The research in Chapter 2 is based on interviews with 41 practitioners with various levels of experience with EA. We interviewed them about how they perceive and apply EA in their work. The interview reports of these respondents were analyzed using Grounded Theory, which is exploratory in nature and aimed at emerging new theories from practice. This study provides insight in the three main characteristics of EA as it is perceived in practice. These are that EA is: a means of abstraction, a means of communication, and a governance instrument. Also, it shows the three key critical success factors of applying EA in practice. These are that: the organizational changes proposed in the EA should be accepted, there should be efficient EA means available, and the EA should be applied properly.

This chapter provides preliminary insights and a simple assessment tool for organizations to improve their architecture alignment and maturity. The findings in this chapter show that being successful with EA involves more than merely focusing on improving EA as a means of abstraction, and developing more efficient EA means; other aspects and critical success factors play an important role in successfully applying EA. This helps organizations and researchers broaden their focus and become aware that in order to be successful with EA, we need good understanding of all the elements that constitute the organizational function responsible for composing and implementing the EA.
CHAPTER 7. CONCLUSIONS

RQ-2: What is an EA function?
Chapter 3 defines the EA function as: “The organizational function comprised of all roles and bodies responsible for creating, maintaining, ratifying, enforcing, and observing EA decision-making – established in architectures and EA policies – interacting through formal (governance) and informal (collaboration) processes at enterprise, domain, project, and operational levels.” This chapter provides a reference model for the EA function describing its objectives, sub-functions, products, activities, process model, outputs, and bodies and roles. This reference model is qualitatively validated through a case study. The lessons learned based on this case study are: formal governance and informal collaboration must go hand in hand, no steps in the EA process model should be omitted, EA decision making and EA conformance reviews should be transparent and consistent, and EA governance bodies must represent all EA stakeholder groups.

The generic reference model of the EA function presented in this chapter, together with the lessons learned presented in this chapter, allows organizations to build an effective EA function.

RQ-3: How to determine the efficiency of the EA function?
Chapter 4 presents an EA function efficiency assessment model, which is based on the findings from Chapter 2, a critical evaluation of the literature, and lessons learned from two case studies conducted within a large international company. The model consists of two parts: the entire EA function and the EA delivery function. The entire EA function is assessed on three essential preconditions for efficiency: a clear and accepted EA function definition, a transparently and consistently operating EA governance model, and proactive collaboration and communication between all functions, bodies, and roles that take part in the EA function. The EA delivery function is assessed on its: management and organization, communication and PR, work processes, human resources and tools, and products.

The model presented in this chapter allows organizations to assess their EA function on its efficiency, and compare it to the generic reference model presented in Chapter 3. This provides organizations with concrete insights to identify points for improving their EA function’s efficiency.

RQ-4: How do stakeholders perceive the EA function?
Section 5.2 shows the cognitive structure (mind-map) of 4 key stakeholder groups regarding the EA function based on interviews with 4 change managers, 4 program managers, 3 project leaders, and 5 application managers. This mind-map shows that stakeholders strive for the realization and monitoring of organizational changes, horizontal alignment between business units, and operational continuity. The 4 stakeholder groups emphasize these potentially conflicting objectives differently, but highly agree about the most important consequences (outputs) of the EA function, namely improved decision making and organizational changes implemented conform those decisions.

The mind-map of EA stakeholders presented in Section 5.2 allows architects to better understand what stakeholders expect from them. It forms a basis for architects to
improve their EA service delivery, which will increase the willingness for EA stakeholders to actively participate in the EA function.

**RQ-5: How to determine the goal-attainment of the EA function?**

Section 5.3 presents an assessment model to measure the effectiveness of the EA function. It does so by determining the degree to which the outputs of the EA function help an organization in meeting its organizational goals: alignment and agility. Agility consists of 5 dimensions, and Alignment of 6 dimensions. To measure goal-attainment, each dimension has 2 to 7 indicators. The model is tested based on a case study conducted within a large international company during the implementation of a new EA function. Alignment is considered slightly more important by the 5 EA decision makers and 4 third-party EA experts that participated in the case study.

The measurement model presented in Section 5.3 allows organizations to determine the effectiveness of their EA function by identifying the gap between the theoretical objectives of a generic EA function and the objectives of a specific EA function. Using the measurement model ensures that the objectives an organization specifies with its EA function are directly related to the output of that EA function. This prevents organizations from identifying too abstract objectives the EA function it cannot help attain. This makes it easier to define concrete metrics and performance indicators in order to measure the effectiveness of the EA function in terms of (non-financial) goal-attainment.

**RQ-6: What is the relation between goal-attainment of the EA function and the satisfaction of its stakeholders?**

Section 5.4 provides a comparison of how individual stakeholders and the collective organization perceive the outputs and objectives of the EA function. The findings show that the expectations of individual stakeholders are quite similar to the collective goals of the organization regarding the EA function. However, unlike the collective organization, individual stakeholders seem to be more concerned with the process of change than the actual results of the change.

The analysis in Section 5.4 shows that individual stakeholders emphasize the direct consequences (outputs) of the EA function more than the organization. In general, individual stakeholders are evenly concerned with the final results of the EA function as the organization, but also appreciate how efficiently the EA function operates. This means that we need to measure EA stakeholder satisfaction, EA goal-attainment, and EA efficiency to get a complete view of the performance of the EA function.

**RQ-7: Is there a connection between the performance of the EA function and the attainment of organizational goals?**

The research in chapter 6 shows how 29 independent assessors view the link between the performance of the EA function and its contribution to goal achievement. We asked these assessors to judge two situations where the EA cycle was not intact by asking them the question: Do you think this EA cycle contributes to achieving organizational
CHAPTER 7. CONCLUSIONS

goals? We found that the assessors saw no connection between the performance of the
EA function and the achievement of organizational goals. Based on this finding, we
conjecture that assessors find that, when applied correctly, the EA function helps in
achieving organizational goals, but when the EA cycle is not intact, the EA function is
not effective and leads to little return on investment. Although our findings made this
hypothesis quite plausible, this needs to be validated in future research however.

If the assessors are right, an inadequate EA cycle leads to negligible results. On the
other hand, the assessors also indicated that, in general terms, EA is indispensable when
it comes to meeting organizational goals. From this we could conclude that, in the
perception of professional assessors, EA is worth investing in only when it is made sure
that the entire EA cycle operated properly. These findings could help organizations to
be critical about how they investment in EA.

7.2 Problem Solved?

Looking back at the problem statement, as I discussed in Section 1.2, I have to conclude
that in terms of a maturity level we have not yet reached adulthood. I would characterize
the current maturity level as adolescent. I still see too many organizations that fit all the
clichés when it comes to their EA function. For example, I recently had a discussion with
a CIO who had some architecture posters stuck to his wall. I complemented him with the
impressive and colorful posters. He proudly told me about the hard work of his architects
and how pleased he was with the end result. I asked him if he could point out which parts
of the architecture where being implemented by projects as we spoke. He then paused
and could not really give a direct answer to my question. The architecture poster looked
like it was very well thought through; architects shine at creating intellectual solutions
for very complex problems. However, the real impact of this specific architecture was
very small. There was no real translation made to the project level, and it was not used
as a means to monitor and control projects.

The insights this thesis provides, give concrete means for organizations to assess and
improve their EA function. With this I tried to contribute to the maturation of EA as an
organizational discipline, and help it become more effective. However, I realize completely
that writing a scientific thesis only has impact when the knowledge that emerged from
my research is put into practice. Just for that reason, I tried to keep my research as
practically applicable as possible. Below I provide some personal comments on how I,
based on my research findings and my practical experience, think the EA community
could take the next step in becoming more mature and effective:

- Make architects co-responsible for the implementation of their EA products, make
  them aware of the higher organizational objectives of EA, and make them more
  result-oriented towards achieving those objectives (e.g., by defining key perfor-
  mance indicators for architects).
- Ensure that architect become more pro-active, that they focus on providing sup-
  port so that their stakeholders can achieve their objectives, and let them explain

128
7.3. Future Work

As I discussed in the previous section, we are not finished yet. In practice, EA is still not fully mature and effective. EA function performance seems to be a relatively undiscovered topic. That is why most of the work presented in this thesis is exploratory in nature. With the research in Chapter 6, I provided some empirical validation of my work, but the individual instruments presented in this thesis all require further validation. The research agenda regarding EA function performance is thus also not yet finished. In this section, I provide several ideas for future work, mainly in terms of further validating the work presented in this thesis:

- Empirically validate the EA function efficiency assessment model as presented in Chapter 4 of this thesis, possibly using the already available survey.
- Develop a standard EA stakeholder satisfaction survey and use this to empirically validate the exploratory study presented in Section 5.2 of this thesis.
- Conduct EA effectiveness assessments to further improve and qualitatively validate the EA function effectiveness measurement model presented in Section 5.3 of this thesis, and empirically validate it.
- Validate the hypothesis that when applied correctly, the EA function helps in achieving organizational goals, but when the EA cycle is not intact, the EA function is not effective, as presented in Chapter 6 of this thesis.

With the EA research community picking up these topics for further investigation and validation, there will be a shift in focus from efficiency towards effectiveness. I think this shift is essential; only when this shift takes place, will we be able to lift EA to the maturity level where we can truly benefit from its full potential.
CHAPTER 7. CONCLUSIONS

7.4 In Closing

In this thesis I focus purely on Enterprise Architecture and the organizational function responsible for its development and implementation. I realize that many other staff functions suffer from similar problems as I address in this thesis. For example, staff functions responsible for project portfolio management, policy making, risk management, governance, etc. I think elements from my research are very well applicable to increasing the performance of those functions as well. With my work, I hope to also contribute to these fields of work.
Samenvatting

Grote organisaties zijn vrijwel geheel afhankelijk van IT voor hun informatieverwerking. Ze kunnen eigenlijk niet meer functioneren zonder IT. Veel van deze organisaties maken al jaren gebruik van IT en hebben een applicatielandschap dat in de jaren erg complex is geworden, bijvoorbeeld door overnames van andere organisaties, of het jaar-na-jaar introduceren van nieuwe technologieën. En dat geldt niet alleen voor het IT-landschap, maar ook voor de bedrijfssprocessen. Een groeiend aantal organisaties gebruikt Enterprise Architectuur (EA) als een middel om deze complexiteit inzichtelijk te maken en gericht te werken aan het consolideren van de bedrijfssprocessen, informatiesystemen en IT-infrastructuur. EA kan gezien worden als een middel voor het strategisch plannen van de ontwikkeling van het bedrijfssproces- en IT-landschap van een organisatie, zodat deze maximaal bijdraagt aan het behalen van de strategische doelen van die organisatie.

Hoewel EA een middel is om onder andere de complexiteit van organisaties te verminderen, is het toepassen van EA op zichzelf ook vrij complex. Veel organisaties hebben moeite om duidelijke resultaten te behalen met EA. Dit heeft vele mogelijke oorzaken. Een voorbeeld is dat de architect vaak wordt gezien als de eigenaar van de architectuur. Een architect is echter vaak werkzaam binnen een stafafdeling en heeft daarom geen lijnverantwoordelijkheid. Een architect heeft dus vaak geen bevoegdheid om besluiten te nemen. De echte eigenaar van een architectuur is de eigenaar van het domein waar deze architectuur over gaat, bijvoorbeeld een divisiemanager voor een domeinarchitectuur, of een algemeen directeur of directeur-generaal voor een concernarchitectuur. Maar een manager of directeur is niet zomaar bereid om het formele eigenaarschap van een architectuur op zich te nemen. Dan moet hij of zij zich ook kunnen vinden in de inhoud van de architectuur en meegenomen worden in de architectuurkeuzes gedurende het ontwikkelproces. En daar gaat het vaak fout, omdat architecten typisch vanuit een ‘ivoren toren’ werken en de betrokkenen onvoldoende meenemen. Ook gaat het vaak fout bij de realisatie van de architectuur. Veel architecten richten zich primaar op het ontwikkelen van de architectuur en vergeten de brug te slaan naar de projecten die deze architectuur zouden moeten realiseren. Dit zijn slechts enkele voorbeelden van de mogelijke oorzaken waarom architectuur vaak onvoldoende resultaat oplevert.

Als ik naar de praktijk kijk, die ik meemaakt vanuit mijn werk als managementadviseur, maar ook naar de wetenschappelijke literatuur, dan valt mij een ding op. Men richt zich heel erg op het ontwikkelen van nieuwe methoden en technieken om steeds geavanceerderdere architecturen te kunnen maken. Maar wat mij ook opvalt, is dat er minder wordt nagedacht over de omgeving waarin de architect acteert en de resultaten die een architect dient op te leveren. De architect is dus het middelpunt van de aandacht. Maar is de architect eigenaar van de architectuur? Is het de architect die de architectuur realiseert? Naar mijn idee spelen er ook andere functionarissen een rol, zoals het hoger management, programma- en projectmanagers, analisten, ontwerpers, ontwikkelers, operationeel management en beheerders. Ik vraag me dus soms af of we wel met de juiste dingen bezig zijn.

In dit proefschrift richt ik mij op de vraag: wanneer levert architectuur resultaat op? Hiervoor heb ik een aantal onderzoeksvragen opgesteld, waarop ik een antwoord geef.
Deze vragen zijn: Hoe wordt EA in de praktijk ervaren en toegepast? Hoe ziet een architectuurfunctie, de organisatorische functie die zich bezig houdt met het ontwikkelen en implementeren van een architectuur, eruit? Hoe bepaal ik of een architectuurfunctie efficiënt opereert? Hoe ervaren belanghebbenden, die zelf geen architect zijn, de dienstverlening van architecten? Hoe bepaal ik de mate waarin een architectuurfunctie bijdraagt aan het behalen van organisatorische doelen? Wat is de relatie tussen het behalen van organisatorische doelen door middel van architectuur en de tevredenheid van de belanghebbenden? Is er een relatie tussen de prestaties van de architectuurfunctie en het behalen van organisatorische doelen?

Om in kaart te brengen hoe architectuur in de praktijk wordt ervaren en toegepast hebben we 41 mensen, werkzaam bij 27 Nederlandse bedrijven en instellingen, geïnterviewd. Op basis van de interviewverslagen beschrijven we in Hoofdstuk 2 van dit proefschrift het integrale beeld dat we hebben kunnen opbouwen. Architectuur wordt vooral gezien als hulpmiddel om complexiteit abstract weer te geven, ontwerpkeuzes te communiceren en organisatorische veranderingen te besturen. Om architectuur succesvol toe te passen, blijkt in de praktijk dat het nodig is dat: de organisatorische veranderingen die een architectuur voorschrijft geaccepteerd worden, er efficiënte architectuurmiddelen beschikbaar zijn voor de architecten, en dat de architectuur op een juiste manier wordt gebruikt en toegepast. We hebben drie groepen van organisaties kunnen identificeren die zich van elkaar onderscheiden als het gaat om hun niveaus van architectuurvolwassenheid en de afstemming tussen bedrijfsarchitectuur en IT-architectuur: (1) organisaties waar architectuurbewustheid is ontstaan bij het hoger management, (2) organisaties met een architectuuroorsprong binnen de IT-afdeling, en (3) adviesbureaus. Op basis van een analyse van de interviews blijkt dat deze drie groepen een verschillende nadruk leggen op de aspecten en kritieke succesfactoren van architectuur. De resultaten uit Hoofdstuk 2 bieden een startpunt voor het beoordelen van de architectuurvolwassenheid en de afstemming tussen bedrijfs- en IT-architecturen binnen organisaties. Dit kan organisaties helpen de verschillende stromingen op elkaar af te stemmen. Onze resultaten laten zien dat het niet voldoende is alleen aandacht te hebben voor architectuur als middel om complexiteit abstract weer te geven en het ontwikkelen van efficiënte methoden en technieken; andere aspecten en kritieke succesfactoren spelen ook een essentiële rol.

Als we echt effectief willen zijn met architectuur, moeten we ons richten op alle elementen waar de organisatorische functie die verantwoordelijk is voor het ontwikkelen en realiseren van een architectuur (de architectuurfunctie) uit bestaat. In Hoofdstuk 3 van dit proefschrift definiëren wij daarom de architectuurfunctie als: “de organisatorische functie die bestaat uit alle rollen en overlegstructuren die verantwoordelijk zijn voor het ontwikkelen, onderhouden, bekrachtigen, handhaven en monitoren van architectuurbesluitvorming – vastgelegd in architecturen en beleid – die samenwerken via formele (besturing) en informele (samenwerking) processen op concern, domein, project en operatiornale niveaus.” We beschrijven een referentiemodel voor de architectuurfunctie, inclusief de doelen, producten, structuur, activiteiten, het procesmodel, de uitkomsten en de rollen. De architectuurfunctie bestaat uit drie subfuncties: (1) het hoger management dat verantwoordelijk is voor het maken en communiceren van architectuurbesluiten, (2)
Het volwassen worden van enterprise architectuur
Het verhogen van de prestaties van een opkomende discipline

de projecten en de operatie die verantwoordelijk zijn voor het implementeren van organisa-
tieveranderingen die aansluiten op de architectuurbesluiten, en (3) de architecten die
verantwoordelijk zijn voor het ondersteunen van het hoger management, de projecten en
de operatie in het nemen van de juiste besluiten en het juist implementeren van organisa-
tieveranderingen. De architectuurprocessen van het hoger management, de architecten,
de projecten en de operatie vormen gezamenlijk de architectuurleercyclus van advisering,
besluitvorming, detaillering, ondersteuning, naleving, monitoring, feedback en verbete-
ring. We illustreren de werking van ons referentiemodel door middel van een gevalsanalyse
waaruit we een aantal lessen trekken over de besturings- en procesaspecten van de archi-
tectuurfunctie. Deze lessen zijn: formele besturing en informele samenwerkingsprocessen
gaan hand in hand, de architectuurcyclus moet intact zijn, architectuurbesluiten en de
beoordeling van architectuurconformiteit moeten transparant en consistent zijn, en het
besluitvormingsorgaan moet een brede vertegenwoordiging van alle belanghebbenden bij
architectuur hebben.

Om te kunnen bepalen of een architectuurfunctie effectief opereren, hebben we een be-
oordelingsmodel nodig. In Hoofdstuk 4 presenteren we een gevalsanalyse die we hebben
uitgevoerd om een eerste versie van ons beoordelingsmodel te testen en verbeteren. Uit
deze gevalsanalyse hebben wij gevonden dat: het essentieel is om een verschil te maken
tussen architectuurbewustzijn (niveau van denken) en architectuurvolwassenheid (niveau
van doen), constructief inzicht kan worden verkregen in de efficiëntie van de architectuur-
functie door de beoordelingsresultaten te visualiseren in modellen, er verschil is tussen
de architectuurafdeling (de architecten) en de belanghebbenden (de niet-architecten) in
het beoordelen van hun efficiëntie, de tevredenheid van de belanghebbenden met de re-
sultaten van architectuur essentieel is om effectief te kunnen zijn met architectuur, en
het afstemmen van bedrijfs- en IT-architecturen niet altijd een doel hoeft te zijn. Op
basis van deze bevindingen hebben we een definitief beoordelingsmodel gemaakt, dat
bestaat uit twee delen. Het deel dat zich richt op de gehele architectuurfunctie kijkt
naar drie essentiële randvoorwaarden: (1) een duidelijke en geaccepteerde definitie van
de architectuurfunctie, (2) een transparante en consistent opererende besturing van de
architectuurfunctie, en (3) proactieve samenwerking en communicatie tussen alle rollen
en organen die betrokken zijn bij de architectuurfunctie. De architectuurafdeling (de
architecten) worden beoordeeld op vijf punten: (1) management en organisatie, (2) com-
municatie en PR, (3) werkprocessen, (4) personeelsbeleid en beschikbare hulpmiddelen,
en (5) de producten die zij opleveren. Om de werking van dit definitieve beoordelings-
model te illustreren, eindigen we Hoofdstuk 4 met een tweede gevalsanalyse die laat zien
dat het model goed toepasbaar is in een specifieke situatie en dat het concrete inzichten
biedt voor verbeterpunten.

Effectief zijn met architectuur is niet eenvoudig. Één van de bevindingen is dat actieve
betrokkenheid van de belanghebbenden een zeer kritieke succesfactor is. De bereidheid
van deze belanghebbenden om mee te werken hangt voor een groot deel af van de mate
waarin zij vinden dat architectuur hen helpt hun persoonlijke doelen te bereiken. In
Sectie 5.2 van dit proefschrift presenteren we ons werk waarin we laten zien hoe be-
langhebbenden verwachten dat de architectuurfunctie bijdraagt aan het behalen van hun

133
SAMENVATTING

persoonlijke doelen. Dit hebben we op basis van 16 interviews voor vier verschillende soorten functionarissen in kaart gebracht. Hieruit blijkt dat belanghebbenden niet tevrede zijn met de architectuurfunctie als deze niet direct of indirect bijdraagt aan de organisatorische doelen: het realiseren van strategische doelen, het op elkaar afstemmen van verschillende bedrijfsonderdelen en hun IT, het monitoren van organisatieveranderingen, en het garanderen van de operationele continuïteit van de organisatie.

Daarnaast is het van belang dat de architectuurfunctie ook bijdraagt aan het behalen van de strategische doelen van de organisatie. In Sectie 5.3 presenteren we een beoordelingsmodel om de effectiviteit van een architectuurfunctie in kaart te brengen. Dit model beschrijft hoe de directe uitkomsten van de architectuurfunctie (hoge kwaliteit besluitvorming en de realisatie van die besluitvorming) via het bereiken van subdoelen kunnen bijdragen aan de twee hoogste organisatorische doelen (interne cohesie en het mee kunnen veranderen met externe ontwikkelingen). Door middel van een gevalsanalyse laten we zien dat dit model goed toepasbaar is om, in een specifieke situatie, de doelstellingen van de architectuurfunctie scherper te krijgen en prestatie-indicatoren te definiëren.

In Secties 5.2 en 5.3 kijken we gescheiden naar respectievelijk de tevredenheid van de belanghebbenden en het behalen van organisatorische doelen. Daardoor weten we niet of de persoonlijke doelen die belanghebbenden verwachten te behalen met architectuur en de collectieve doelen die de organisatie verwacht te bereiken met architectuur hetzelfde zijn. Uit een vergelijking die wij doen in Sectie 5.4 blijkt dat de individuele doelen van belanghebbenden en de collectieve doelen van de organisatie goed op elkaar aansluiten. Op basis van de gegevens van twee gevalsanalyses blijkt dat de organisatie voornamelijk geïnteresseerd is in de eindresultaten van architectuur (het behalen van strategische doelen), terwijl de belanghebbenden het ook belangrijk vinden hoe de architecten zich opstellen. Blijkbaar kan een effectieve architectuurfunctie, die goed bijdraagt aan het behalen van organisatorische doelen, toch een ontevreden gevoel bij de belanghebbenden opwekken door de manier waarop architecten opereren (bijvoorbeeld, reactief in plaats van proactief, of louter toetsend en niet ondersteunend).

Aan de hand van een aantal gevalsanalyses hebben we laten zien dat er organisaties zijn waarbij elementen uit de architectuurcyclus ontbreken, waardoor deze niet optimaal functioneert. Deze organisaties willen weten of het onderhouden van een gedeeltelijk functionerende architectuurfunctie zinvol is en tot resultaten leidt. In Hoofdstuk [1] van dit proefschrift onderzoeken wij of dit zinvol is door 29 onafhankelijke en professionele beoordelaars, gespecialiseerd in het doorlichten van organisatorische processen, de vraag te stellen: Vindt u dat architectuur bijdraagt aan het behalen van organisatorische doelen? We hebben deze beoordelaars gevraagd twee situaties te beoordelen waar de architectuurcyclus niet volledig intact was. We hebben geen statistisch verband gevonden tussen hun oordeel van de prestaties van de architectuurfunctie en hun mening over de mate waarin de architectuurfunctie bijdroeg aan het behalen van organisatorische doelen. Op basis van het werk in Hoofdstuk 6 vermoeden we dat beoordelaars vinden dat in het algemeen (en wanneer correct ingericht) de architectuurfunctie bijdraagt aan het behalen van organisatorische doelen, maar als de architectuurcyclus niet intact is, de architectuur-
functie niet bijdraagt. Dit moet echter worden gevalideerd in toekomstig onderzoek. Wel hebben we aangetoond dat, in hun oordeel over de prestaties van de architectuurfunctie, beoordelaars het maken van slechte architectuurbeslissingen zwaarder beoordelen dan een foutieve implementatie van goede architectuurbeslissingen.

Met dit proefschrift hoop ik een bijdrage te leveren aan het volwassenheidsproces van architectuur. De inzichten die dit proefschrift biedt, geven organisaties concrete handvaten voor beoordeling en verbetering van hun architectuurfunctie. Op basis van de lessen die ik heb getrokken uit dit onderzoek, wil ik een aantal adviezen meegeven: zorg ervoor dat architecten mede verantwoordelijk zijn voor de implementatie van de architectuur, laat architecten zich pro-actief en ondersteunend opstellen richting de belanghebbenden, zorg ervoor dat alle belanghebbenden bewust zijn van hun verantwoordelijkheden met betrekking tot architectuur, laat het hoger management het eigenaarschap van de architectuur op zich nemen, en richt een volledige architectuurcyclus in.

Hoewel dit proefschrift bijdraagt aan het volwassenwordingproces van EA, zijn we er nog lang niet. Er is nog veel werk te verrichten. Dit proefschrift biedt een startpunt voor het volgende vervolgonderzoek. Ten eerste, het empirisch valideren van het beoordelingsmodel voor architectuurefficiëntie uit Hoofdstuk 4. Daarnaast is het ontwikkelen van een standaard tevredenheidsvragenlijst voor belanghebbenden en het empirisch valideren van het exploratieve model uit Sectie 5.2 potentieel vervolgonderzoek, evenals het kwalitatief en empirisch valideren van het beoordelingsmodel voor effectiviteit van de architectuurfunctie uit Sectie 5.3. Tenslotte, kan het valideren van de hypothese uit Hoofdstuk 6 – wanneer de architectuurcyclus volledig is ingericht draagt de architectuurfunctie bij aan het behalen van organisatorische doelen, maar wanneer de cyclus onvolledig is – leiden tot inzichten die essentieel zijn voor het tot volwassenheid brengen van het vakgebied Enterprise Architectuur.
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<td>Johan van den Akker (CWI)</td>
<td>DEGAS - An Active, Temporal Database of Autonomous Objects</td>
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<td>Floris Wiesman (UM)</td>
<td>Information Retrieval by Graphically Browsing Meta-Information</td>
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<td>A Contribution to the Linguistic Analysis of Business Conversations within the Language/Action Perspective</td>
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<td>Dennis Breuker (UM)</td>
<td>Memory versus Search in Games</td>
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<tr>
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</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Year</th>
<th>Author</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010-17</td>
<td>Spyros Kotoulas (VU)</td>
<td>Scalable Discovery of Networked Resources: Algorithms, Infrastructure, Applications</td>
</tr>
<tr>
<td>2010-18</td>
<td>Charlotte Gerritsen (VU)</td>
<td>Caught in the Act: Investigating Crime by Agent-Based Simulation</td>
</tr>
<tr>
<td>2010-19</td>
<td>Henriette Cramer (UvA)</td>
<td>People’s Responses to Autonomous and Adaptive Systems</td>
</tr>
<tr>
<td>2010-20</td>
<td>Ivo Swartjes (UT)</td>
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</tr>
<tr>
<td>2010-21</td>
<td>Harold van Heerde (UT)</td>
<td>Privacy-aware data management by means of data degradation</td>
</tr>
<tr>
<td>2010-22</td>
<td>Michiel Hildebrand (CWI)</td>
<td>End-user Support for Access to Heterogeneous Linked Data</td>
</tr>
<tr>
<td>2010-23</td>
<td>Bas Steunbrink (UU)</td>
<td>The Logical Structure of Emotions</td>
</tr>
<tr>
<td>2010-24</td>
<td>Dmytro Tykhonov</td>
<td>Designing Generic and Efficient Negotiation Strategies</td>
</tr>
<tr>
<td>2010-25</td>
<td>Zulfiqar Ali Memon (VU)</td>
<td>Modelling Human-Awareness for Ambient Agents: A Human Mindreading Perspective</td>
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