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Measuring Enterprise Architecture Effectiveness:

A Focus on Key Performance Indicators

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MASTER'S THESIS

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Abstract

Any organizational practice should be able to show its "value", including enterprise architecture (EA). Measuring the extent to which EA leads to certain desired results is essential when determining its value for an organization. However, measuring this EA effectiveness is often deemed difficult by both practitioners and researchers. Reasons for this are, for example, causality issues, a longer-term focus, and the difficulty of selecting performance indicators. As one should be aware of what to focus on when measuring EA effectiveness, a specified set of Key Performance Indicators (KPIs) is needed. Therefore, the aim of this research is to arrive at a clear overview of KPIs that can be used to measure EA effectiveness.

To arrive at a clear overview of KPIs for EA effectiveness, a design science research approach was adopted. For data collection prior to the design, qualitative methods were adopted; a semi-structured literature review was done and interviews were held with 18 experts in the field of EA. Prior to each interview, experts were asked to fill out an input survey. The outputs of these methods formed the input for the design phase. Initial versions of the proposed solution have been evaluated through intermediate assessments, an interactive evaluation session and an evaluation survey, and have been modified accordingly.

In this document, the resulting Focus Framework for Enterprise Architecture Measurements (FFEAM) is presented, which can be used to measure EA effectiveness by focusing on four areas: the decision-making process, the decision-making results, program implementation, and the actual program results. This framework can be implemented through a set of 22 KPIs for EA effectiveness. It is believed that this framework will help organizations measure the effectiveness of their EA by shifting the focus of EA measurements to the actual desired results.

Contents

Chapter 1

Introduction

Enterprise architecture is a young, diverse discipline that grew from being part of the information planning discipline to one that brings together several aspects [1]. Architecture in general can be regarded as an instrument to gain insight and oversight into complex matters [2]. *Enterprise* architecture emerged from the realization that different aspects within the enterprise, including business and IT, need to be aligned [2].

To be able to grasp the essence of enterprise architecture, one should first learn about its meaning. This chapter includes an overview of existing definitions of enterprise architecture. Based on a brief discussion of these definitions and their shortcomings, a new definition of enterprise architecture is introduced. Moreover, ways in which one can evaluate enterprise architecture are touched upon. This then includes a brief overview of other strands in this field of research, as well as descriptions of what characterizes enterprise architecture effectiveness. Finally, the chosen research approach and thesis outline are described.

1.1 Defining Enterprise Architecture

Continuing in the tradition of other researchers in the field (e.g., [2]), let us first look at a subset of existing definitions of enterprise architecture (EA), retrieved from both academic and grey literature:

TOGAF [3]: TOGAF uses ISO/IEC 42010:2007's definition of architecture: *"The fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution"*, and extends it with *"A formal description of a system, or a detailed plan of the system at a component level to guide its implementation"* and *"The structure of components, their inter-relationships, and the principles and guidelines governing their design and evolution over time "*.

TOGAF extends the ISO/IEC 42010:2007 definition of architecture in general. The TOGAF definition appears to be focused on descriptions, principles and guidelines used for system implementation. It is argued in the TOGAF Pocket Guide [3] that four types of architecture make up an overall EA: business, data, application, and technology.

Gartner (2013) [4]: *"Enterprise architecture (EA) is a discipline for proactively and holistically leading enterprise responses to disruptive forces by identifying and analyzing the execution of change toward desired business vision and outcomes. EA delivers value by presenting business and IT leaders with signature-ready recommendations for adjusting policies and projects to achieve target business outcomes that capitalize on relevant business disruptions. EA is used to steer decision making toward the evolution of the future state architecture"*.

This Gartner definition, retrieved from their IT Glossary [4], appears to focus on EA's role in decision making and how it should steer the enterprise during change. It puts more emphasis on the enterprise and on steering it towards a certain future state.

Ross, Weill and Robertson [5]: *"The organizing logic for business processes and IT infrastructure reflecting the integration and standardization requirements of the company's operating model".*

Ross, Weill and Robertson [5] specifically mention the linkage of IT infrastructure to business processes and focus on two dimensions: integration and standardization. In their book, they encourage you to first determine your company's operating model, which should be based on these two dimensions.

Jonkers et al. [6]: *"Coherent whole of principles, methods and models that are used in the design and realisation of the enterprise's organisational structure, business processes, information systems, and infrastructure".*

This definition by Jonkers et al. [6] appears to be focused on the use of EA artifacts, principles and methods, not only for design, but also for realization purposes.

Op 't Land et al. [2]: *"A coherent set of descriptions, covering a regulations-oriented, design-oriented, and patterns-oriented perspective on an enterprise, which provides indicators and controls that enable the informed governance of the enterprises evolution and success".*

Op 't Land et al. [2] identified three perspectives regarding the role of enterprise architecture (EA): a "regulation-oriented perspective", which is more prescriptive in nature, a "design-oriented perspective", which focuses on the use of models, and a "patterns-oriented perspective", which focuses on the use of design patterns.

Although it looks like the definitions by TOGAF and Jonkers et al. comply with both the design-oriented and regulation-oriented perspectives that Op 't Land et al. identified, as they include both models and principles, this is not clearly the case for the definitions by Gartner and Ross, Weill and Robertson. The one by Gartner does mention how EA is used for steering, but on a rather high level. Note that the patterns-oriented perspective, although important, is in general not often referred to [2]. The design- and regulation-oriented perspectives, as argued by Op 't Land et al. [2], are considered complementary to each other as the first perspective is about gaining "insight into an enterprise's design while also providing guidance to designers of enterprise systems", whereas the second perspective deals with actually directing the enterprise. It can be argued that a solid definition of EA should focus on at least both describing or designing the enterprise through artifacts and actually directing it.

The definitions by TOGAF and Jonkers et al. both include descriptions, models or designs, and principles (note that the TOGAF definition is actually focused on architecture in general, not necessarily on *enterprise* architecture). The same aspects are implicitly included in the definition by Op 't Land et al. [2], through their three perspectives. Although the definition by Jonkers et al. includes methods as well, the Gartner definition seems to be the only one that is focused on EA as a more active entity. It can be argued that a solid definition of EA should not only be focused on artifacts or principles, but on the actual roles and (formal) processes that make up the EA function [7] as well. Although Op 't Land et al. [2], for example, do describe roles and processes in their book, none of the above-mentioned definitions explicitly includes these aspects.

Initially, Gartner held on to a definition that differs from the one that is mentioned in their IT Glossary:

Gartner (2008) [8]: *"Enterprise architecture is the process of translating business vision and strategy into effective enterprise change by creating, communicating and improving the key requirements, principles and models that describe the enterprise's future state and enable its evolution. The scope of the enterprise architecture includes the people, processes, information and technology of the enterprise, and their relationships to one another and to the external environment. Enterprise architects compose holistic solutions that address the business challenges of the enterprise and support the governance needed to implement them".*

Although this definition is focused on EA as a process [8], includes both the design-oriented and regulation-oriented perspectives, and also puts emphasis on the role of enterprise architects, it can be argued that it is not concise and that its dimensions are described in a rather disconnected way.

The above discussion led to the use of the following definition of EA, which is used in this research:

Enterprise architecture (EA): A set of artifacts representing the design of an enterprise's business and IT, that alongside a set of principles, roles and processes, direct that enterprise towards a desired future state.

This definition:

- Focuses on both the actual artifacts representing an enterprise's (current or future) design as well as the principles and processes used to direct the enterprise.
- Focuses on EA as opposed to architecture in general.
- Does not only focus on artifacts or methods, but also explicitly mentions the roles associated with EA and the EA processes needed.
- Implies that EA is eventually about directing the enterprise towards a desired future state.
- Is concise, yet covers all relevant aspects that make up EA.

In the following subsections, the aspects that make up this definition are elaborated on. These elaborations are mainly based on Van der Raadt and Van Vliet's description of the EA function [7].

1.1.1 Enterprise Architecture Artifacts

EA artifacts are typically tangible EA documents. These artifacts should provide insight and oversight into the design of an enterprise's business and IT. In this regard, design could mean both the current design of the enterprise, as well as its envisioned design. Moreover, both business and IT are to be taken into consideration. Frameworks guiding the design of artifacts often cover business, information, application, and infrastructure technology architectures [9]. Thus, in the context of EA artifacts, IT relates to the actual physical infrastructure, applications, and IT functionalities.

EA artifacts often include an as-is architecture (also called the current state or baseline architecture) and a to-be architecture (also called a target state architecture) [7, 10, 11]. A roadmap (also called a sequencing plan) can be created that describes the path from the as-is to the to-be state [7, 11]. Bricknall et al. [10] argue that EA documents should be comprehensive to those who have to use them and actually have interest in them. Moreover, they recommend using graphical representations as opposed to merely textual ones.

1.1.2 Enterprise Architecture Principles

As described in the TOGAF Pocket Guide [3], principles may exist at enterprise level (enterprise principles), IT level (IT principles), and architecture level (architecture principles). Architecture principles then can be further divided into: "principles that govern the architecture process, affecting the development, maintenance, and use of enterprise architecture" and "principles that govern the implementation of the architecture" [3]. Van der Raadt and van Vliet [7] actually mention the "EA policy" as an EA product and define this as: "EA policy prescribes how projects should implement organizational changes through unified principles and practices". They argue that there are three forms then: "standards", "rules", or "guidelines" [7]. Finally, in line with their definition of EA, Op 't Land et al. [2] argue that principles can be interpreted as both "imposed laws" or guidelines.

It seems that principles can be both *input* of EA and part of the *output* of EA at the same time. Therefore, principles can guide both the development of the architecture and the practice itself, as well as the actual change processes. Either way, Bricknall et al. [10] argue that (IT) principles should be comprehensive and not too detailed.

1.1.3 Enterprise Architecture Roles

Van der Raadt and Van Vliet [7] identify four levels with regard to the EA process: enterprise, domain, project, and operational. They mention that a central EA team or department may exist at enterprise level, consisting of, for example, an EA manager, a chief enterprise architect and a number of enterprise architects. They argue that the chief enterprise architect should act in the interest of "enterprise-wide structures, processes, systems and procedures to achieve the corporate strategy" [7]. Moreover, several

"EA governance bodies" (e.g., architecture councils) may exist at enterprise and domain levels [7]. Roles at lower levels, i.e., project and operational levels, are then more concerned with conforming to EA [7].

1.1.4   Enterprise Architecture Processes

"Architecture is a process as well as a product" [6]. EA processes are concerned with the development of documents and their maintenance, as well with actual decision making and implementation [2, 7]. Op 't Land et al. [2] identify four aspects that are core to the EA process: "create", "apply", "maintain", and "organize". Raadt and Van Vliet [7] argue that the EA function has three main responsibilities: "EA decision making", "EA delivery" and "EA conformance". It is then not only about making, approving and changing EA products, but also about guiding decision making, providing support, implementing changes, ensuring compliance, and providing feedback. They argue that EA decision making (for "approving new EA products or changes in existing EA products" and "handling escalations regarding EA conformance") and EA delivery ("responsible for providing advice to guide EA decision making at strategic and tactical level") are mainly done at enterprise level, and partly at domain level [7].

In essence, EA processes are not just concerned with setting up EA and delivering artifacts, but also with actually directing the enterprise towards a desired future state.

1.2   Evaluating Enterprise Architecture

The previous section gave an overview of our view on EA. But what makes a "valuable" EA? The following subsections deal with the several ways in which one can evaluate EA.

1.2.1   Ways to Evaluate Enterprise Architecture

Claims have been made about what makes EA "valuable", both by researchers and practitioners. Strands in this field of include, for example, research on assessing EA maturity and EA quality. EA maturity can be defined as "the degree of development of the architectural practice, i.e. the whole of activities, responsibilities and actors involved in the development and application of EA within the organization" [1], whereas EA quality may be more concerned with the actual quality of EA products and services [12].

Raadt, Slot, and Van Vliet [13] describe the "Normalized Architecture Organization Maturity Index" approach (NAOMI) which, according to them, assesses architecture effectiveness using three perspectives: "architecture awareness", "architecture alignment", and "architecture maturity".

Boster, Simon and Thomas [14] argue that there are three value dimensions to what they call the "EA effort": the architect, the process, and the final products. Within these dimensions, they distinguish between the technical and the business perspective.

In their paper, Niemi and Pekkola [12] attempt to identify the quality attributes of EA products and services, where they consider EA quality attributes to be "the non-functional characteristics of EA products, services and processes that comprise the overall quality of EA". They found six attributes that they related to product quality: "clarity and conciseness", "granularity", "uniformity and cohesion", "availability", "correctness", and "usefulness" [12]. They also found several attributes related to service quality: "availability and timing", "awareness", "activeness", and again "usefulness" [12].

In a whitepaper by IT-eye [15][1], it is argued that two dimensions make up an architecture's value: its usability, and the extent to which the architecture coincides with goals. They identified several aspects that make up these two dimensions.

Although quality aspects and the existence of formal processes and awareness are considered important, this research focuses on how you can measure what this *leads to*.

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[1]It is believed that, although white papers are not peer-reviewed, by including them, an attempt is made to overcome the gap that often exists between research and practice. This is also in line with the adopted design science research approach. Moreover, EA itself is deemed inherently practical.

1.2.2   Enterprise Architecture Effectiveness

The online Business Dictionary [16] provides a clear description of effectiveness by comparing it to efficiency, where efficiency means "doing the thing right" and effectiveness means "doing the right thing". In this research, the definition by the online Oxford Dictionary [17], i.e., "The degree to which something is successful in producing a desired result" is adjusted to the field of EA:

> EA effectiveness: The degree to which enterprise architecture "is successful in producing a desired result" [17].

Many claims have been made by both researchers and practitioners regarding the possible effects of enterprise architecture. Lange and Mendling [18] claim that three areas of "EA benefit assessments" are apparent in literature: "EA scenario assessment", "EA process assessment", and overall "EA benefit assessment".

To give an indication of the benefits mentioned in literature, examples drawn from two books [2, 5], a paper [11], an expert's opinion [19], and a whitepaper by Microsoft [20] can be found in Table 1.1.

Table 1.1: Global set of EA benefits retrieved from a small set of literature [2, 5, 11, 18–20]

Reduced (IT) costs.	[2, 5, 11, 19]
Increased (IT) responsiveness, agility, or reduced delivery time.	[2, 5, 11, 19]
Improved Risk management.	[5]
Increased Satisfaction with IT.	[5]
Strategic business outcomes (e.g., operational excellence).	[5]
Improved and underpinned decision making.	[2, 11]
Improved communication and collaboradtion.	[11]
Business-IT alignment and partnership.	[2, 11, 20]
Documentation and overview of enterprise, baseline.	[2, 18, 19]
Unify and integrate business processes.	[19]
Unify and integrate data.	[19]
Link with external partners.	[19]
Increased agility and responsiveness.	[2, 19, 20]
Reduce and manage complexity.	[18–20]
Common vision.	[2, 19]
"Compass" for management.	[2]
Reduced duplication.	[2]
Assessing impact.	[2]
Identify opportunities.	[2]
Ensuring (business and IT) compliance and governance.	[2]
Translating strategy to execution.	[2]
Effective IT planning.	[2]
"Security by design".	[2]
Better solutions.	[2]
Alignment of information to business.	[2]
Effective change planning.	[2]
Improved IT usage.	[20]
Improved morale.	[20]
Focus on organizational goals.	[20]
Reduced IT system failure.	[20]
Drive transformation.	[18]
Support innovation.	[18]

Attempts at providing complete overviews of EA benefits have already been made. Niemi [21], for example, categorizes EA benefits according to an "Information Systems (IS) benefit classification model" [22],

shown in Appendix A, Figure A.1. Boucharas et al. [23] present the "Enterprise Architecture Benefits Map" shown in Figure A.2. Note that the extent to which an organization can benefit from EA differs per organization and may be dependent on many contextual factors [11, 21].

As with any discipline, the extent to which benefits are actually achieved needs to be measured. This can be done using Key Performance Indicators (KPIs) for EA effectiveness.

1.2.3 KPIs for Enterprise Architecture Effectiveness

In the introduction of his book, Parmenter [24] distinguishes between three types of performance measures: "Key Result Indicators" (KRIs), "Performance Indicators" (PIs), and "Key Performance Indicators" (KPIs). He uses an onion analogy, shown in Figure 1.1, to explain the difference between these types.
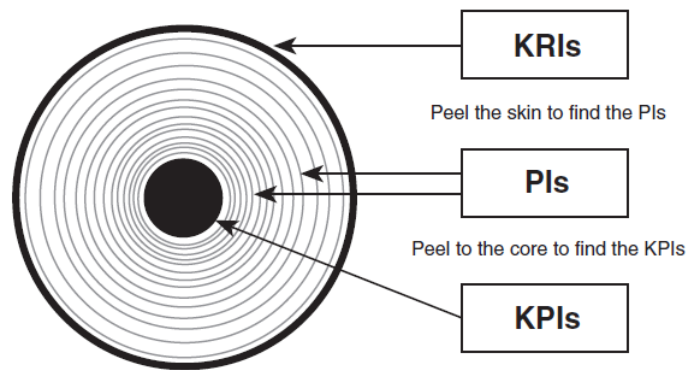

Figure 1.1: Types of performance measures [24].

As described by Parmenter [24], KRIs are "the result of many actions" [24]. He argues that they show whether the organization is going in the intended direction, but that they do not show what is needed in order to improve. Moreover, he argues that KRIs can be of interest to the board, but that management might actually be more interested in PIs or KPIs. He defines KPIs as follows: "KPIs represent a set of measures focusing on those aspects of organizational performance that are the most critical for the current and future success of the organization" [24].

It can be argued that KPIs differ from general metrics [25]. The term *Key Performance Indicator* is in this research used in the context of EA effectiveness. Therefore, the definition by Parmenter [24] is simplified while keeping its essence, and applied to the field of EA while truly focusing on its effectiveness:

> KPIs for EA effectiveness: A set of metrics focusing on those effects of enterprise architecture that are the most critical for determining its success.

Note that this definition does not say anything about the level of granularity. A KPI could consist of one or several metrics, as long as it is key to showing EA effectiveness.

1.3 Research Design and Thesis Outline

For this research, a design science research approach is adopted. Hevner et al. [26] apply design science research in the IS discipline and compare it against behavioral science, arguing that it focuses on "creating and evaluating innovative IT artifacts that enable organizations to address important information-related tasks". Design science research has previously been used within the field of EA and EA evaluation [27–29].

Hevner et al. [26] argue that each of their seven guidelines needs to be addressed:

1. "Design as an Artifact",

2. "Problem Relevance",
3. "Design Evaluation",
4. "Research Contributions",
5. "Research Rigor",
6. "Design as a Search Process", and
7. "Communication of Research".

In order to meet such guidelines, Peffers et al. [30] propose a "Design Science Research Process" (DSRP) for doing design science research, as shown in Figure 1.2. This process is embedded in the structure of this thesis document.

In Figure 1.2, chapters are linked to the several steps of the design science process. Note that an actual demonstration of the design in a case setting is beyond the scope of this research for now.
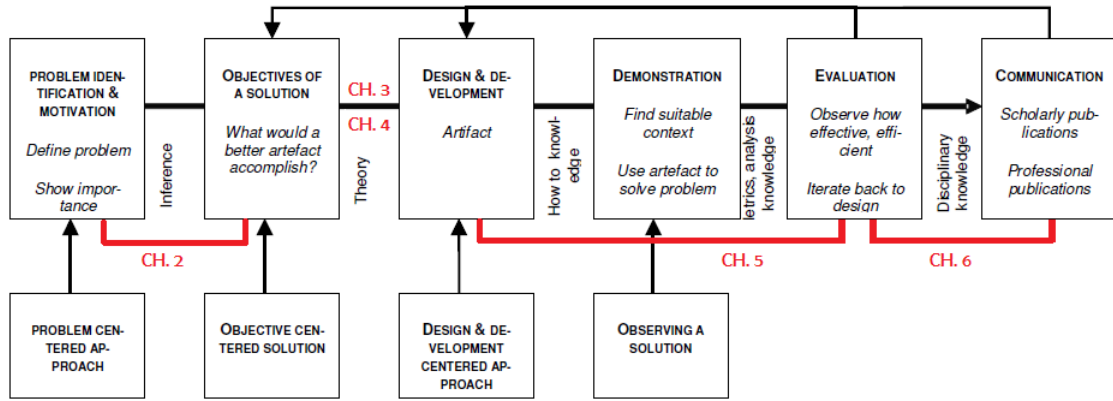

Figure 1.2: "Design Science Research Process" [30] applied to this research.

In Chapter 2, *Study Objectives*, the problem that formed the motivation of this thesis is described. This relates to "Problem Identification & Motivation". Thus, in this research, a problem-centric approach is adopted. Moreover, in Chapter 2, the design requirements and research questions are described, relating to "Objectives of a Solution".

In Chapter 3, *Methods*, a complete overview of all research methods applied in this research is given. This includes data collection and data analysis methods, as well as evaluation approaches.

In Chapter 4, *Results*, the results of the data collection methods forming the initial input for "Design & Development", are outlined.

Chapter 5, *Design and Development*, consists of three main sections:

- *Initial Design Assumptions:* The results of Chapter 4 are discussed and translated into design assumptions.
- *The Focus Framework for Enterprise Architecture Measurements (FFEAM):* The journey towards the FFEAM as well as its most recent version are discussed.
- *Key Performance Indicators for Enterprise Architecture Effectiveness:* The journey towards the proposed KPIs for EA effectiveness and their most recent versions are discussed.

Therefore, Chapter 5 describes the iterative process and results related to "Design & Development" and "Evaluation".

In Chapter 6, the extent to which the proposed solution meets its requirements is assessed. Moreover, inspired by researchers in the field who adopted design science research [1, 28], this research and its

resulting designs are assessed against the seven guidelines by Hevner et al. [26]. This includes a discussion on how this research will be communicated. Therefore, to a certain extent, Chapter 6 is related to the "Evaluation" and "Communication" phases.

In Chapter 7, *Conclusion*, our main research contributions are outlined and possibilities for future research are given.

Chapter 2

Study Objectives

In this chapter, the problem that formed the motivation of this research is described. Moreover, the design requirements and research questions are outlined.

2.1 Problem Identification

Describing and measuring the outcomes of EA, be it quantitatively or qualitatively, can be challenging [31]. This difficulty is recognized by both practitioners and researchers. During a course that was part of the Master's ICT in Business program at Leiden University, for example, students were sent out to interview architects in the field about the "value of enterprise architecture". Although some metrics were mentioned[1], interviewees generally acknowledged the difficulty of assessing the impact of EA. Moreover, Lange and Mendling [18] found that: "All interviewed experts, both experts from enterprises as well as consultants, reported that they neither measure enterprise architecture benefits objectively, nor do they use any structured approach to assess or track such". They did, however, see the need and demand for such measures and approaches.

As acknowledged by Bricknall et al. [10], EA can be considered a long-term investment, making it hard to show any short-term benefits. Moreover, as acknowledged by Steenbergen and Brinkkemper [27], EA's effect on business goals set by senior management is indirect and the EA practice is only "one of the factors contributing to these goals". Finally, Gils and Van Dijk from Bizzdesign (a Dutch consultancy company) [32], argue that it can be difficult to determine clear goals and performance indicators for EA practices due to its "(perceived) abstract nature". However, they argue that "proof is much stronger when it can be based on numbers" [32].

Described below are a number of assumptions that together make up the problem statement for this research:

- Any organizational practice should be able to show its "value", including enterprise architecture (EA). Practices that are not valuable to organizations may be redundant.
- Measuring the extent to which EA leads to certain desired results, i.e., EA effectiveness, is essential when determining the value EA delivers to an organization.
- Both researchers and practitioners deem measuring EA effectiveness to be a difficult task. Reasons for this are, for example, causality issues, a longer-term focus, and the difficulty of selecting performance indicators.
- As one should be aware of what to focus on and what to measure, a specified set of KPIs is needed for measuring EA effectiveness.
- It is not clear which metrics can be considered to be true KPIs. Also, to the author's knowledge, no clear overview is available that relates these KPIs and that can be used by practitioners to measure EA effectiveness.

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[1] For validity, these metrics are not used in this research

2.2 Design Requirements

Our main objective is to find a way to measure EA effectiveness by focusing on KPIs. Thus, the aim of this research is to arrive at a clear overview of KPIs for EA effectiveness. The design of such an overview should meet the following requirements:

Requirement 1: It should be clear what areas practitioners should focus on when measuring EA effectiveness.

Requirement 2: It should present KPIs for EA effectiveness.

Requirement 3: Practitioners should be able to choose which KPIs are applicable for measuring the effectiveness of their EA.

Requirement 4: The design in general should be clear enough for use in practice.

2.3 Research Questions

In order to arrive at a clear overview of KPIs than can be used to measure EA effectiveness, the following research questions need answering:

RQ1: What methods can be used to measure enterprise architecture effectiveness?

RQ2: What metrics can be used to measure enterprise architecture effectiveness?

RQ3: What are key performance indicators for enterprise architecture effectiveness?

RQ4: How are key performance indicators for enterprise architecture effectiveness linked?

Note that RQ3 is not about finding a definition for the term "KPIs for EA effectiveness", as that has already been given in Section 1.2.3. Instead, RQ3 is about finding KPIs that can be used to measure EA effectiveness.

Chapter 3

Methods

This chapter provides an overview of the methods used to answer our research questions. First, a general overview is given, the main reasons for adopting certain methods are outlined, and methods are linked to research questions. Then, each method is elaborated on in more depth.

3.1   Research Approach

A qualitative approach is adopted for answering the research questions. In Figure 3.1, a concise representation of the general research approach is shown.
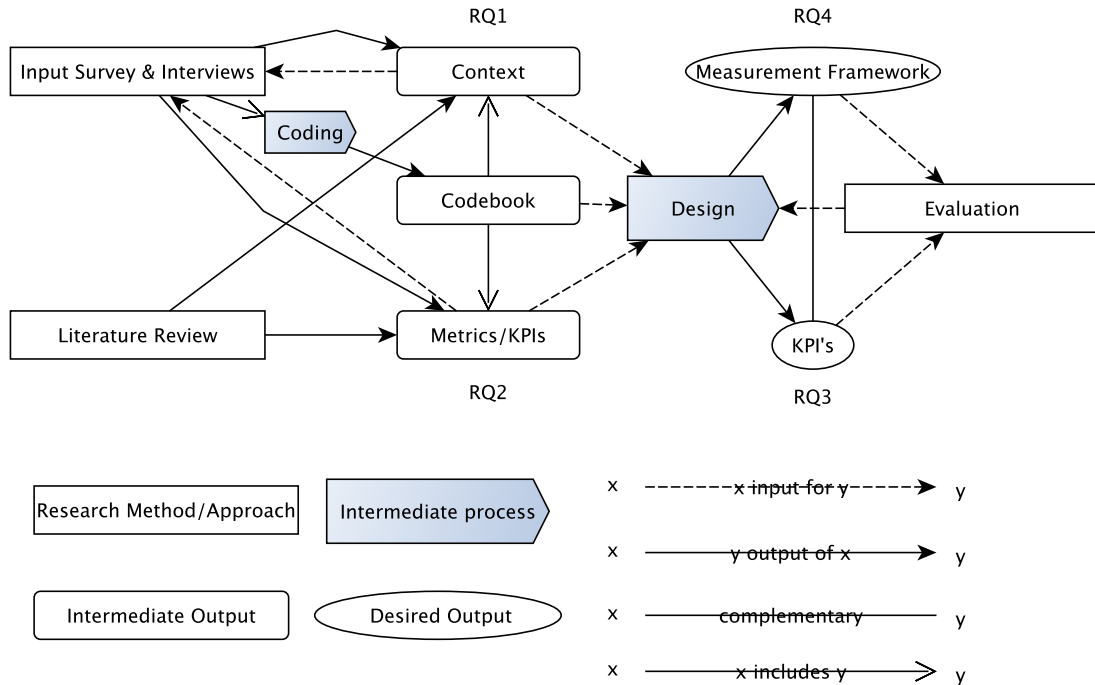

Figure 3.1: General research approach

Note that *evaluation* is an approach consisting of multiple steps and methods: intermediate evaluations, an evaluation session, and an evaluation survey. This is elaborated on later. Also, because a design science

research approach is adopted, the intermediate results of the evaluation methods continuously provide feedback for the design. Therefore, this *design cycle* is run through multiple times.

The prime purposes of a literature review are to "*frame* the problem under scrutiny", to "*identify* relevant concepts, methods/techniques and facts", and to "*position* the study" [33]. With regard to this, the literature review is mainly done for the following reasons:

- To get more familiar with the topic by analyzing relevant context, including already existing methods that can be used to measure EA effectiveness, in order to better position this research.
- To find metrics that can be used to measure EA effectiveness.

The context and metrics found before the interviews are used as input for the survey and interview questions. Before an interview, each participant is sent a link to an online survey. This is mainly done for the following reasons:

- To provide context in the sense of background information of interviewees, their organizations, and their view on EA.
- To give interviewees the opportunity to think about the subject and write down metrics and KPIs that can be used to measure EA effectiveness beforehand.

The results of each survey are used as input for the interviews. Interviews allow for getting more in-depth information. In this research, interviews are mainly done for the following reasons:

- To find out in-depth what the interviewees' views on EA are.
- To get more in-depth information on how one can measure EA effectiveness and what aspects should be accounted for when doing so.
- To find out why interviewees chose certain metrics or KPIs.

The context, codes and metrics collected through the literature review, survey and interviews, are used as input for the design.

Evaluation is necessary to: "Observe and measure how well the artifact supports a solution to the problem" [30]. Therefore, an evaluation of the design is mainly done for the following reasons:

- To determine the extent to which certain practitioners agree with the design and feel that it could actually help them measure the effectiveness of their EA.
- To find out whether the KPIs found are accepted.
- To find out whether something is still missing.

In Table 3.1, each subquestion for answering the main research question is linked to a research method.

Table 3.1: Link between research questions and research methods

Research Question	Method
RQ1: What methods can be used to measure enterprise architecture effectiveness?	Literature Review
RQ2: What metrics can be used to measure enterprise architecture effectiveness?	Literature Review, Input Survey & Interviews
RQ3: What are key performance indicators for enterprise architecture effectiveness?	Literature Review, Input Survey & Interviews, Evaluation (Intermediate Evaluations, Evaluation Session, Evaluation Survey)
RQ4: How are key performance indicators for enterprise architecture effectiveness linked?	Literature Review, Input Survey& Interviews, Evaluation (Intermediate Evaluations, Evaluation Session, Evaluation Survey)

In the sections below, each method is discussed in more detail.

3.2 Literature Review

Relevant context, existing EA effectiveness measurement approaches, metrics, and key performance indicators are identified through a semi-structured literature review. An attempt is made to gain results from both academic, and "grey literature". It is believed that, although grey literature is not always peer-reviewed, by including both, an attempt is made to overcome the gap that often exists between research and practice. This is also in line with the adopted design science research approach. Moreover, EA itself is deemed inherently practical.

A more structured approach is adopted while searching for academic literature using the ACM Digital Library [34] and the IEEE Xplore Digital Library [35], two well-known computer science-related digital libraries that allow for entering detailed search queries. Although they require subscription to actually access the articles, free full text versions of titles can often be found through other channels. The search query used in these databases can be found in Appendix B, Section B.1.

The following steps are taken:

1. Search in ACM using the defined keywords.
2. Save the resulting list of titles in a spreadsheet.
3. Judge each paper on its title and abstract: Is it possibly about EA value?
4. Can a free full text be found using Google, Google Scholar, Leiden Library Catalogue, or a VPN connection to Leiden University?
5. Judge papers on their introduction, conclusion, and a quick scan. Leave out those papers that are focused on EA maturity, EA quality, EA scenario analysis etc..
6. Read remaining papers in more detail. Judge them on their content: Is it about measuring the effectiveness of EA?
7. Are measurement approaches/methods, metrics or KPIs given?
8. Search in IEEE using the same search query.
9. Save the resulting list of titles in a new spreadsheet.
10. Identify duplicates.
11. Judge remaining papers in the same way as done for papers from ACM.

Papers focusing on EA maturity, EA quality, service oriented (enterprise) architecture, and EA scenario planning are excluded as the focus of this research chiefly lies with EA effectiveness.

Rather unstructured searches are done using Google Scholar and the regular Google search engine. This is unstructured due to the fact that search queries in these engines can result in hundreds or thousands of results, which requires thorough filtering [36]. However, as argued by Giustini and Boulos [36], despite Google Scholar's "changing content, unknown updating practices and poor reliability", it should not be excluded from use during literature reviews. It may complement them [37]. Therefore, in this research, both Google Scholar and the regular Google search engine are used. The regular Google search engine serves as a good source for grey literature as well. In these search engines, similar keywords are used in different combinations, in addition to keywords such as and not limited to "effectiveness".

As a final source, literature is received from other researchers, fellow students, and interviewees.

3.3 Input Survey and Interviews

The input survey and interviews are closely related. As will become clear from the following subsections, not only does the input survey provide input for the design phase, but for the interviews as well. Moreover, interviews are analyzed next to their corresponding input surveys.

3.3.1 Online Input Survey

A link and ID to an online survey are sent to each interviewee some time (typically one week) before the interview date, accompanied by an overview of the interview questions. This way, they function both as

a reminder to the appointment and a short introduction to the subject. The survey is built and spread using *"Instant.ly"* [38]. An overview of the questions asked in this survey is shown in Appendix C, Section C.1.1[1].

3.3.2 Interviews

Interviews are held with experts in the field of EA. An expert in this regard can be a practitioner, a consultant, or a researcher involved with EA (or both). This way, multiple viewpoints are accounted for. Researchers are often up to date about new research in the field and new context regarding their topic. Practitioners on the other hand are experienced with the way EA actually works in practice. Finally, consultants often gained experience from multiple organizations.

Attempts are made to answer all of the questions shown in Appendix C, Section C.1.2. Beforehand, each interviewee is asked for permission to record the interview. Recordings facilitate the construction of accurate and complete transcriptions of interviews.

3.3.3 Data Analysis

Each interview is recorded, transcribed, and, next to the corresponding surveys, coded using a generic form of open-coding, derived from our understanding of grounded theory [39]. For this, a tool called *"QDA Miner Lite"* [40] is used. More specifically, interview data is dealt with in the following way:

1. Recordings are transcribed as literally as possible.
2. Each recording is listened to one more time and is compared to what is transcribed.
3. Transcriptions are imported into *QDA Miner Lite*.
4. Each transcript is coded using a generic form of open-coding. For clarity purposes, codes are directly categorized into themes corresponding to the interview topics.
5. Each coded transcription is analyzed once more and first attempts are made to relate codes to each other on paper. Moreover, answers given by participants to questions in the input survey are also taken into account at this stage. While reanalyzing further, links between codes are visualized using a tool called *"Yed"*, which is useful in the sense that it can automatically adjust the layout of the resulting graph [41].
6. Codes having a frequency of occurrence higher than 50% are analyzed in more depth as these are considered recurring themes.
7. If deemed necessary at step 5 or 6, codes are restructured or new codes are added.

3.4 Evaluation

The evaluation phase consists of multiple steps: intermediate evaluations, an official evaluation session, and an evaluation survey.

3.4.1 Intermediate Evaluations

Before the interactive evaluation session, two experts in the field of EA are asked about their opinion on earlier versions of the design. One of those experts, whom is approached several times, is a member of SIG. The other expert, an enterprise IT architect, is approached once. Moreover, an informal presentation is held at SIG for consultants and researchers, in order to get timely feedback.

3.4.2 Interactive Evaluation Session

The *CIO Platform*, a Dutch, independent organization for CIO's and IT managers [42], is approached for an interactive evaluation session. This session is held on the 22nd of May 2014, during their CIO Interest Group meeting on architecture.

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[1]The questions were slightly modified after feedback from the first respondent. How his version differed is mentioned in Appendix C, Section C.2.1

Before the evaluation session, each participant is asked to fill in a short survey regarding their view on EA and its effectiveness. This survey is not included in this thesis document as it provides no academic value. It functions as an introduction to the interactive evaluation session.

During the evaluation session, parts of the design are presented. Participants are invited to be active and critical, ask questions, and give constructive feedback.

3.4.3 Evaluation Survey

A survey is sent to each participant that was present at the interactive evaluation session. This survey contains a set of draft KPIs and some questions related to each KPI, and is structured as shown in Table 3.2.

Two questions are central to evaluating the draft KPIs:

1. Is KPI x clear enough for use in practice?
2. Is KPI x useful for measuring EA effectiveness?

Question 1 is important due to the fact that a design science research approach is adopted in this research, which made one of the objectives of the resulting design that it should clear enough for use in practice, as mentioned in Section 2.2. Question 2 is important due to the fact that KPIs should be focused on measuring EA effectiveness. Both questions are operationalized through a statement that respondents can agree or disagree with. For this, 5-scale "Likert response options" [43] are used.

Participants are given room to comment on each KPI, and are, at the end of the survey, asked whether they feel KPIs are missing, or whether they have any general comments. This is important as it provides respondents with the possibility to elaborate on their choices. Therefore, their reasons may become more transparent and the researcher can use this to modify KPIs based on more constructive types of feedback.

Table 3.2: Structure of the evaluation survey

KPI 1: Description KPI 1
Questions with regard to KPI 1
Room for comments on KPI 1

KPI 2: Description KPI 2
Questions with regard to KPI 2
Room for comments on KPI 2

KPI 3: Description KPI 3
...

Chapter 4

Results

In the following sections, the results of the literature review, input survey, and interviews are described. Note that at the end of each section, a number of general observations are given.

4.1 Literature on Measuring Enterprise Architecture Effectiveness

This section deals with the measurement methods or approaches, and metrics for measuring EA effectiveness, that were found during the literature review.

4.1.1 Search Results

Entering the search query in the ACM digital library (on October 15, 2013) resulted in 207 possible titles. For 66 of those, the title and abstract seemed relevant enough for further scanning. After having excluded books, for 54 of these, free full texts corresponding to the titles could be found. After scanning, 23 of these were considered for detailed reading. Finally, 6 papers actually mentioned approaches for measuring EA effectiveness [28, 44–48].

Using the same query in the IEEEXplore digital library (on November 21 and 22 2013) resulted in 136 possible titles. However, 70 of those were duplicates with regard to the previous search using ACM. Having judged them on title and abstract, 19 of the remaining 66 papers were considered for scanning. Only for 5 of these could a free full text version be found. All of these were judged on their introduction, conclusion, and a global scan. However, after detailed reading of 4 papers, none of them proved to be useful for answering our research questions.

A less structured search was done using roughly the same keywords in different combinations in the regular Google Search engine and Google Scholar. Also, some literature was received from fellow students and teachers. Some papers were explicitly searched for, based on suggestions by interviewees [49–52].

4.1.2 Existing Measurement Methods and Approaches

Below, existing measurement methods and approaches found during the literature review are discussed. First, journal and conference papers are discussed. Then, books, Phd dissertations, university papers and master thesis's are elaborated on. Finally, company (white) papers are outlined.

Schelp and Stutz [53] acknowledge that evaluating EA benefits can be difficult. They therefore propose a framework based on Kaplan and Norton's Balanced Scorecard [54]. They renamed the four BSC perspectives to: "services", "processes", "assets", and "finance" [53]. Also, they added a second dimension in order to limit the scope. The framework is accompanied by a method that can be used to identify indicators, which is based on the so-called "Goal Question Metric" (GQM) approach. This GQM approach is suggested by multiple other sources as well (e.g., [27, 55, 56]). Examples of metrics that can be used

to measure EA effectiveness, given by Schelp and Stutz [53], are linked to the dimensions of agility and standardization by Ross, Weill and Robertson [5].
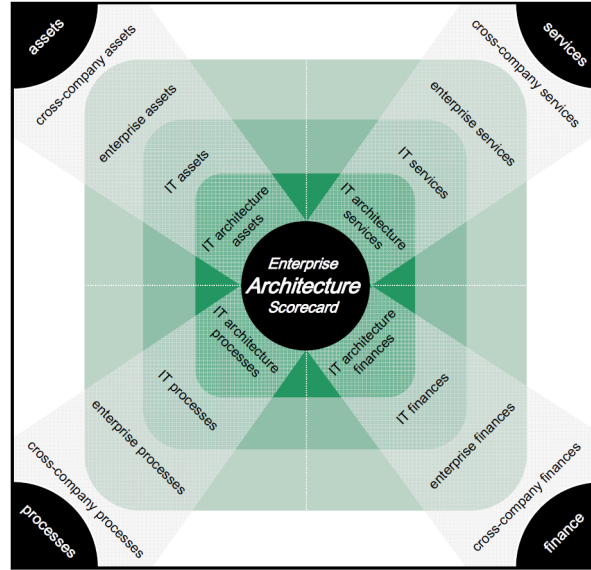

Figure 4.1: Schelp and Stutz's "Enterprise Architecture Scorecard Framework" [53]

Rodrigues and Amaral [57] argue that one should not only look at the balance between gains and losses, but also at the balance between financial and operational measures. In their view, "a value assessment requires the implementation of a performance measurement system that gathers the complex information about the use and impact of EA" [57]. Therefore, the authors suggest using a so-called "EA value tree" [57], of which an example is shown in Figure 4.2.
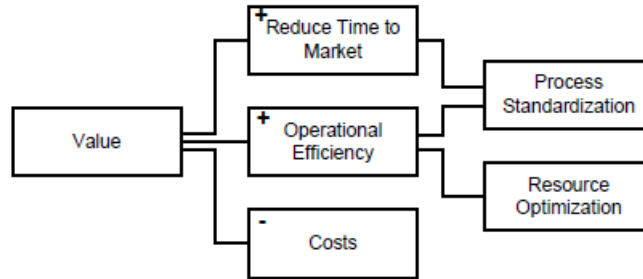

Figure 4.2: Rodrigues and Amaral's "Value Tree Example" [57].

Rather similar to this is the research by Steenbergen and Brinkkemper [27], who introduce the "Architecture Effectiveness Model" on which the choice of KPIs for EA effectiveness can be based. They use a graphical representation including effects and cause-effect relations. Effects then are divided into three types, moving from left to right: "architectural results", "organizational performance effects" and "business goal effects" [27]. Their approach is shown in Figure 4.3.

Hämäläinen and Kärkkäinen [56] found that one should be well aware of: the IT and business goals of the company, its reasons and goals for the EA program, the information needs related to this, and the context and possibilities that are apparent within the company. Their suggested approach for defining metrics is shown in Figure 4.4. Moreover, they propose the following metric categories: "activity-oriented metrics", "acceptance-oriented metrics", "quality-oriented metrics", and "value-oriented metrics" [56]. The value-oriented metrics aim at business and IT value and at proving benefits achievement [56], and are therefore the most interesting ones for this research. Their approach is shown in Figure 4.4.
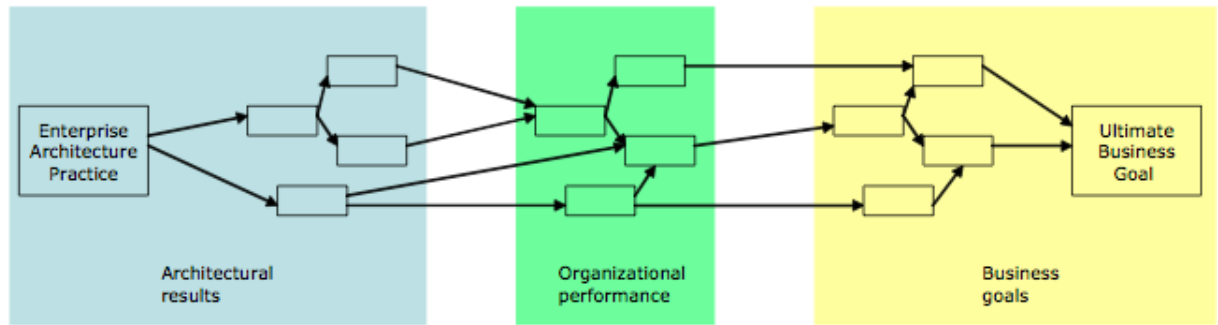
Figure 4.3: Steenbergen and Brinkkemper's "general structure of an architecture effectiveness model" [27].
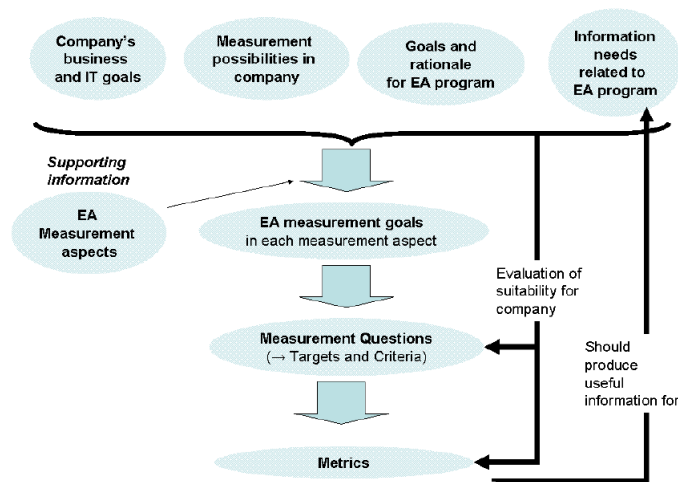

Figure 4.4: Hämäläinen and Kärkkäinen's "goal-oriented definition approach of metrics for EA program" [56]

Morganwalp and Sage [44] argue that EA is a so-called "System of Systems (SOS)" and modified the Zachman framework by adding a third dimension consisting of "SOS levels". This led to their so-called "3D EAF" [44]. When dealing with measuring the effectiveness of their architecture, the authors actually quote Buchanan while suggesting to measure EA quality against "financial efficiency", "business effectiveness", and the "architecture process" [44]. Moreover, the authors quote Sproles [58] while suggesting that one should determine so-called "Measures of Effectiveness", defined as "a standard for establishing how well something achieves its intended purpose" [44, 58]. This is similar to the definition of KPIs for EA effectiveness used throughout this research. They suggest doing multi-attribute evaluations and do provide some high-level objectives for their EAF, which they feel can be scored negatively, neutral or positively. However, it can be argued that these objectives are too high-level to be considered true indicators. The more detailed attributes are not given in their paper.

Gøtze et al., who focus on national EAs and interoperability beyond national boundaries, stress the importance for governments to start using both qualitative and quantitative KPIs for measuring performance [45]. The authors mention a couple of "business drivers" that can be transformed into measurable goals and can be evaluated in terms of "efficacy", "efficiency", effectiveness", "ethicality", and "elegance" [45].

Niemi [47] shortly describes an "evaluation plan" that could include information on where evaluations are done (i.e., which governance area), wat should be evaluated (i.e., which targets), what criteria and metrics one could use to do so, when evaluations are done (i.e., in which situation), by whom this is done,

and why they are done (i.e., purpose and audience).

Pruijt et al. [29, 59] developed the "Enterprise Architecture Realization Scorecard (EARS)", which is not only focused on measuring the effectiveness of EA, but also on improving it. Therefore, the EARS also focuses on the way certain outcomes are achieved [29]. In this regard, the authors identified five EA activities: "define vision", "develop sub architectures", "plan migration", "supervise implementation projects", and "exploit the architecture in operation" [29]. Moreover, they argue that the results of these activities should be scored on three aspects: "product", "acceptance", and "scope" [29]. Results of the earlier EA activities then include, for example, designs and plans, whereas implementation and operation actually lead to project and operational results.

Plessius, Slot and Pruijt [50] identified four phases in which one should measure EA: "development", "realization", "use", and "re-use". Together with the balanced scorecard categories by Kaplan and Norton, these two dimensions are combined in a matrix-like structure in their "Enterprise Architecture Value Framework (EAVF)" [50]. The authors argue that EA benefits can be mapped onto this EAVF, which is accompanied by a so-called "measurability maturity scale" and a set of indicators [50].

Potts [60] argues that an enterprise architect should be concerned with the performance of the enterprise's structure and that this may be more important than operational results. He therefore suggests using "EA guiding ratios" [60]. It is argued that "architecture must be designed for the kinds of shows that take place, but is not accountable for the artistic or financial success of the shows themselves" [60].

Based on a survey, Cameron and McMillan [61] designed a "Conceptual Metrics Reference Model for EA Value Measurement", shown in Figure 4.5. As shown in the model, they argue that certain management levels (i.e., enterprise, tactical, program, and operational) are concerned with distinct metric categories. The model is accompanied by quite an extensive number of metrics, divided into several categories: "business metrics", "innovation", "regulatory metrics", "financial", "EA internal metrics", "IT", and "customer metrics" [61]. Of particular interest are those metrics that are actually focused on the results of practicing EA. Note that the authors argue that "the success of this model depends on associating the right metrics with their goals" [61].

Figure 4.5: Cameron and McMillan's "Conceptual Metrics Reference Model for EA Value Measurement" [61].

Meyer et al. [28] aim at providing a solution where both maturity assessment and EA performance assessment complement each other. They propose their solution in the form of four artifacts: an "enterprise architecture business value framework (EABVFW)," an "EA Measurement Process (EAMP)", an "EA Balanced Scorecard (EABSC)" and an "enterprise architecture business value model (EABVM)" [28]. Note that in their paper, the authors focus more on the design process and do not provide actual details with regarding their designed artifacts.

Alaeddini and Salekfard [46] base their measurements on Luftman's model for business-IT alignment [62] and try to measure whether organizations' business-IT alignment levels are affected by EA programs.

Note that respondents are asked about their measures on a before- and after EA basis.

In their literature review, Cane and McCarthy [63] actually refer to a paper by Morganwalp and Sage, who argue that there are three approaches to evaluating EA effectiveness. The first is based on measuring the performance of the actual system built. The second approach is based on "determining the expected performance" beforehand. Finally, they suggest looking for expert help. Metrics mentioned originate from this same paper (Morganwalp and Sage in [63]).

Bradley et al. [48] look at several relationships between EA maturity, IT alignment with business, "operational IT effectiveness", and "enterprise agility" in healthcare organizations. They look at both direct and indirect effects of EA maturity. They derived a set of indicators for each of the previously mentioned categories. Most of these are measured on a scale from 1 to 7.

Lagerström et al. [64] aim at finding a relation between IT success and EA management. Interesting in terms of effectiveness then is IT success, which they assess using three aspects: "Successful execution of IT projects" in terms of budget and delays, "duration of procurement projects" compared to other organizations, and "operational departments satisfied with IT", which is also compared to other organizations [64].

Foorthuis et al. [65] attempt to find out what the benefits of EA are, both for individual projects and the organization as a whole. They therefore use a survey and try to see how well EA scores on several, maybe more subjective aspects. They measure respondents' perception, but argue that this is not a problem as objective measures "will not yield more valid results in a non-laboratory setting" [65].

Rico [66] argues that one could measure the impact of EA using more financially focused metrics and defines benefits as "the monetization of increased operational efficiency, reduced operational costs and personnel numbers, increased customer satisfaction, and consolidated legacy computer systems" [66].

Next to the "EA Value Model", which shows focus areas for EA benefits, Schekkerman [67] proposes the "Enterprise Architecture Measurement Framework", arguing that one should focus on why, what, how, with what, and when to measure. Moreover, he argues that one could measure to "comply", "check" or "challenge" and argues that measurements should be done for encouragement [67]. Finally, he discusses multiple, mostly financial, appraisal methods.

In his dissertation, Slot [68] proposes a "Real Options Analysis" approach, which appears to be focused on valuing and choosing a scenario. He acknowledges that solution architecture is an integral part of enterprise architecture and, therefore, attempts to find a relation between architecture-related project variables and actual success variables.

In his Master's thesis, Bonnet [69] defines EA effectiveness as "the degree to which the objectives of EA are being attained *by means* of EA". He acknowledges that EA cannot be cost-justified and proposes the "EA effectiveness measurement model", which is focused on agility and alignment [69]. The model's agility and alignment concepts are operationalized using several dimensions and indicators, which are partly based on indicators by Luftman [62] and partly on another model (Sherehiy et al. in [69]). In his dissertation, Van der Raadt [70] presents the "EA effectiveness measurement model" as well. He argues that effectiveness can be measured both objectively, through performance, and subjectively, by looking at EA stakeholder perceptions. Their "EA effectiveness measurement model" is shown in Figure 4.6.

In his Master's thesis, Kobussen [52] provides an overview of claimed EA benefits. He focuses on measuring the direct impact of EA and therefore held interviews on the extent to which EA helps with regard to several aspects. The items he uses are scored on a scale of [0-20] and he attempts to find a correlation between EA maturity and impacts.

In his Master's thesis, Roest [49] attempts to find a relationship between enterprise architecture, and business complexity and performance. He found that EA maturity is linked to business performance. Thus, those indicators used to define business performance may, for this research, be considered metrics for EA effectiveness.

Matthes et al. [71] developed the so-called "EAM KPI Catalog" and argue that KPIs can be selected in two ways: using a "Goal-KPI Matrix", where columns represent identified EA management goals, and by focusing on EA layers. Moreover, they use a standard template where each KPI is accompanied by a
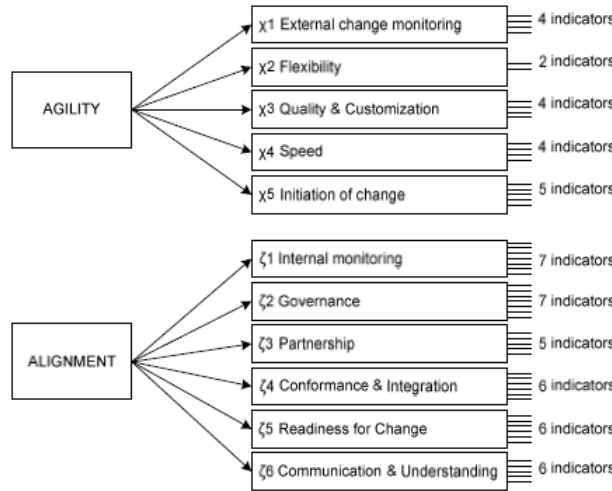
Figure 4.6: Bonnet [69] and Van der Raadt's [70] "EA effectiveness measurement model

description, calculation description, sources, and "information model' [71]'. Finally, they identified several "Architecture-KPI-Categories", such as Business-IT alignment, that will help navigate through the KPI catalog [71]. Their approach for choosing KPIs is shown in Figure 4.7. Note that in Version 1.0 of their document, all 52 KPIs seem to be referencing Cobit 4.0. The authors acknowledge that it is work in progress and aim at evaluating their ideas with industry partners.

"The Office of Management and Budget (OMB) Enterprise Architecture Assessment Framework Version 3.1", presented in a governmental paper [72], "features the use of key performance indicators (KPIs) to measure the effectiveness of EA". Therefore, three areas are considered: "completion", "use", and "results". It could be argued that the actual results are the most relevant for this research.
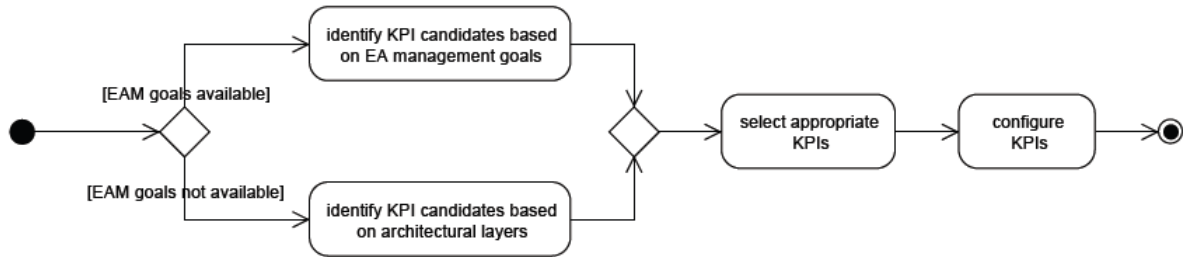
Figure 4.7: "Sequence of activities" when using the "EAM KPI Catalog", by Matthes et al. [71].

In a Gartner paper, Weiss and Rosser [73] argue:"If an EA team is to develop metrics that align to the business strategy, it must know how the business operates strategically: Is the team focused on a run, grow or transform process?". Therefore, they identify four investment categories: "frontier", "enhancement", "utility", and "infrastructure" [73]. Metrics can then be plotted against each of these categories, as shown in Figure 4.8. Moreover, they provide a set of sample metrics and argue that one should look at these on a before EA and after EA basis.

In another Gartner paper by Rosser [74], a set of recommendations is made for measuring the value of EA. He suggests having an "EA Measurement Program" consisting of the following steps: "plan", "assess the EA and IT organization", "design and identify effective measures", "build the measurement process", "implement and measure the program", "review, change and improve performance", and "communicate results to apporpriate stakeholders" [74]. Moreover, he argues that metrics related to IT, as well as metrics related to business, should be measured on a before EA and after EA basis.
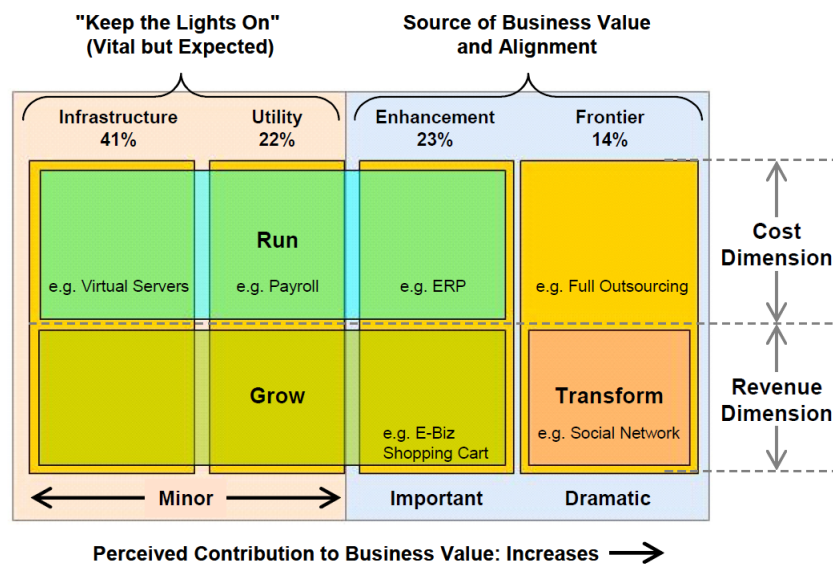
Figure 4.8: Relationships between Weiss and Rosser's four investment categories [73].

In a Cisco paper from 2008 [75], it is claimed that at Cisco, architectural effectiveness is measured using metrics on "production data fixes", "time to capability", and "innovation".

Burns et al. [76], in a Booz and Company global study, attempt to find a link between EA maturity and value and focus on four areas to do so: decreased costs, reduced complexity, reduced risk, and increased agility. Moreover, they argue that EA can help in three longer-term areas : "Efficiency and lean operations", "agility and innovation", and "customer-focused services" [76].

In an OMG whitepaper, Buchanan and Soley [77] argue that the value of EA should be defined both in financial terms, and in terms of "business effectiveness" (e.g., increased market share). Thus, they argue that measures should be developed that relate to both of these concepts.

In an InfoSys whitepaper, Aziz et al. [78] argue: "Metrics are crucial to both managing the development of Enterprise Architecture and to justifying its existence". Therefore, they identify measurements as one of their seven dimensions of architecture governance and outline several best practices. Moreover, they identify three classes of metrics: "activity oriented", "acceptance oriented", and "value oriented metrics" [78]. As value oriented metrics are about measuring the actual EA benefits [78], these are the most interesting for this research.

In his Forrester paper, in line with the Balanced Score Card approach, Scott [79] argues: "Every EA team should measure five metrics: strategy momentum, financial impact, customer satisfaction, skills and capability growth, and process improvement". Generally, the metrics seem to be described through suggestions and guidelines, as opposed to concrete metrics.

In the exposure draft version of the COBIT 5 Process Reference Guide [80], several metrics are related to and grouped by IT-related goals and Process goals. As argued: "The process supports the achievement of a set of IT-related goals, which support the achievement of a set of enterprise goals" [80]. The list of metrics provided is quite extensive.

4.1.3   Existing Metrics

Not all of the previously discussed papers actually provide metrics for EA effectiveness. Nevertheless, quite some metrics could be derived from the literature set. In the first column of each of the tables shown in Appendix B, Section B.2, metrics found during the literature review are outlined. Some of the metrics included may still be more about compliance, maturity or governance as opposed to effectiveness. This seems to be the case for, for example, most of the EA Internal Program and Compliance/Regulatory

metrics by Cameron et al. [61]. Although in some cases such metrics could be left out beforehand, others are accounted for at a later stage. Also, in some cases, metrics could are combined as they could be considered comparable.

4.1.4 Observations

Although some authors present clear frameworks, others merely mention broader aspect areas and some general metrics. Moreover, throughout literature, different meanings are given to the term EA effectiveness. For example, Bonnet [69] focuses on the achievement of "objectives of EA", whereas Raadt's [70] definition is focused on "organizational objectives", and Van Steenbergen and Brinkkemper [27] focus on the "contribution of enterprise architecture practice to the achievement of business goals".

Many papers mention general EA benefits. These were only considered metrics or KPIs if they are clearly mentioned as such, or if they are actually used for measurements (e.g., through surveys [65]). Metrics or KPIs for measuring EA effectiveness can be both objective and subjective [81]. Some authors have a more financial focus and argue that EA benefits should be monetized (e.g., [66, 67]), whereas others believe that EA cannot be cost-justified (e.g., [69]). Note that often no clear distinction is made between metrics and KPIs.

4.2 Expert Views

4.2.1 Input from Online Survey

A summary of the results of the survey as provided by "*Instant.ly*" can be found in Appendix C, Section C.2.1. Note that these summarized results should not be seen as a form of statistical information that could be representative for organizations and should not be treated as such. Remember that this was not the intention as individual responses on the survey were primarily used for providing context and input for the interviews [1].

Most of the respondents indicated that EA is either *valuable* (39%) or *very valuable* (56%) for organizations. However, one respondent (6%), who did seem to acknowledge the value of EA, argued that it may be overrated.

Most respondents acknowledged the importance of measuring EA effectiveness as 50% answered that it is *important*, and 44% even answered that it is *really important*. Reasons for measuring EA effectiveness as can be derived from the summary are: to control, focus, manage, guide, steer, monitor, and especially improve the EA function, and explain and show its value. Experts did however acknowledge the difficulty of measuring EA effectiveness and, in some cases, questioned the focus on measurements.

Interesting is also what respondents consider to be the major stakeholders of EA. More than half of the respondents explicitly mentioned business owners, senior management or CxO's. Note that the distinction between business and IT was not always made.

Most of the respondents tried to come up with metrics or KPIs. However, some respondents did not immediately make the distinction between the two while filling in the survey. This can be concluded from the fact that either the KPIs are exactly the same as the metrics, or no KPIs are given.

When asked what factors influence the choice of EA effectiveness KPIs, most respondents (89%) answered *business goals*. A large part also answered *organization's strategy* (67%) and *stakeholder interests* (67%).

4.2.2 Interviews and Codes

Eventually, interviews were held with 18 experts, divided over 17 seperate interview appointments [2]. Interviews were held both in person and through the use of Skype (once without video). All interviews

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[1]Due to rounding, percentages can add up to slightly more or less than 100%.
[2]Note that, due to circumstances, not all questions could be asked in all cases.

were recorded and the transcripts are shown in Appendix E. Note that in this document, for confidentiality reasons, experts remain anonymous [3]

As described in section 3.3.3, each transcript was coded. Also, the survey answers corresponding to each interview were included during recoding. In order to be able to make some sense of the relations between codes, while rereading and recoding the transcripts, codes were visualized in a graph using *Yed*. This graph is shown in Appendix C, Section C.2.3. For this graph, the focus was on those codes deemed relevant for answering the research questions on measuring EA effectiveness. Also, special attention was given to categorizing and relating the metrics.

A final list of codes is shown in Appendix C, Section C.2.2. Note that the relevant frequency for these codes, as shown in the appendix, is that of the number of cases in which a code was found. This then means that it was mentioned at least once during an interview or in the corresponding survey answers. Although some codes are very similar, some are more generic than others, and some respondents may have elaborated more on certain codes than others, codes that appeared in 9 or more cases (thus having a frequency $> 50\%$) are considered recurring themes.

Note that quite some codes were related to the constant friction between business and IT. Although this is a very relevant topic, it is considered out of the scope of this research. Therefore, codes having a frequency of of occurrence higher than 50%, but related to this discussion [4], are not included in the following overview. For each remaining code having a frequency of occurrence higher than 50%, per expert, summaries were made of what was found in the interview transcripts that was linked to this code. Resulting tables consisting of these summaries can be found in Appendix C, Section C.2.4. Below, for each code, descriptions based on these summaries are given. Therefore, the descriptions below reference to the author's interpretations of what was found in the interview transcripts. Note that, per code, cases are referenced not more than once as only main insights are referenced.

What is EA

During the interviews, experts were asked about what they thought EA actually entails. Codes related to this category are discussed below.

Enterprise level: During the interviews, experts were often asked about their view on where EA resides (i.e., on which organizational levels). This code relates to the "enterprise level" [7], as opposed to domain or even project levels. Based on what was found in the interview transcripts related to this code, it can be argued that EA is about the entire enterprise and about arriving at a complete picture, encompassing all domains. It can be argued that EA is about exceeding the boundaries of individual domains or business units (3, 5, 16), covering the entire organization (8, 12, 18) from operations and IT to business (10). Moreover, it can be argued that it is about collective interests (7) and that it fulfills the need for a kind of top-down structuring (4). Finally, a bottom-up approach for implementing EA was suggested, where one eventually ends up at enterprise level (14).

As-is vs to-be: As mentioned in the introduction, EA artifacts can include both as-is and to-be architectures. Based on what was found in the interview transcripts related to this code, it can be concluded that different perspectives exist on the importance of both, as well as on the order in which they should be created. It can be argued, for example, that EA should focus on the future (12), and that the as-is matters less as EA is about setting a direction (8). On the other hand, it can be argued that in order to get to that future, it is important to be aware of the current situation (15) . Nevertheless, the importance of both is generally acknowledged (3, 4, 10, 11, 13, 14, 16, 18).

Framing: EA seems to be linked to the act of setting "frames" or boundaries. Note that this concept may be closely related to that of "principles for guidance", which apparently did not always clearly emerge. Based on what was found in the interview transcripts related to the code "framing", it can be argued that frames in this sense are about both guiding and controlling implementations. It can be argued that

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[3]Names can be asked for, but are only given after having consulted the concerned experts.

[4]Architecture - IT enables business, Business vs IT goals, Business vs IT, IT-Business. The latter was mainly about whether IT metrics can be generalized as opposed to business metrics. Although interesting, this too was considered beyond the scope of this research.

boundaries should be set within which plans and strategies can be executed and (lower-level) solutions fall (3, 8, 9, 12, 16, 18) . Related to EA's framing role in terms of guidance, one expert emphasized the importance of finding an enterprise's "pivot points" (4). Another function of EA in its framing perspective, is that it can be used as an assessment framework. EA can be used to assess the extent to which lower level (operational) initiatives or decisions actually fit with plans made (5, 6). One expert specifically mentioned "EA controls" in this regard (17).

Dynamic vs abstraction: This code is closely related to the discussion on whether EA is long-term or short-term focused. Note that the terms "dynamic" and "abstraction" can mean different things in different contexts. Whereas some experts appear to use the terms slightly differently (3, 4), for this code, the first term is interpreted as the speed at which environments change nowadays, whereas the second is interpreted as the level of detail of models. Based on what was found in the interview transcripts related to this code, it can be argued that EA should be abstract enough to be durable or stable, but should at the same time facilitate short-term changes. It can be argued that you should be aware of changes in the environment (5, 14) and that making long-term plans may not work anymore (18). If you do architecture right however, you should be able to make changes when needed (1). It can be argued that a more abstract architecture is more stable over time (12) and that the longer-term the focus, the more it should be about giving directions (8). In this regard, it may be argued that architecture at higher levels is more "vague" or global (7, 16), and that it is more about setting a course or horizon (10, 15). Finally, one expert argued that highly dynamic start-up companies may not want to practice architecture yet as there is not enough stability yet (6).

Strategic-long term: EA is often linked to strategy, which gives it a longer-term, strategic focus. Based on what was found in the interview transcripts related to this code, it can be argued that one should not focus mainly on solutions that seem to be the most relevant for now, or in the short-term future. Thus, "in principle", EA is related to the (strategic) future and plans (2, 3, 6, 13, 15, 18), and should limit erroneous shorter-term decisions (10). One may consider time spans of, for example, 5 years (5, 7, 12, 16). In other words, EA urges you to keep the longer term future in mind (1) and can thus be used during strategy formation (8).

Short-term aspects: As mentioned before, experts acknowledged that the world we live in is a dynamic one. Based on what was found in the interview transcripts related to this code, it can be argued that EA should be involved with short-term changes and priorities as well. It can be argued that new technologies, for example, may call for a revision of the architecture (2). Moreover, EA can be involved in shorter-term decision making (3), possibly more operational (6, 16), and can partly be involved with tactics (7). Also, it can be argued that you should sometimes accept short-term priorities and changes (5, 14), need to show short-term value (18), and should not focus mainly on established roadmaps as these may not be stable (12). Note, however, that shorter-term aspects still need to be in line with the longer-term horizon (15).

EA goals and effects

Quite some goals and effects of EA were mentioned during the interviews. Examples are agility, increased flexibility, insight in and lower costs, and synergy, to name but a few. One code, however, had the highest frequency of occurrence in this category: help during decision making.

Help during decision making: This code is about *helping* and being *supportive* during decision making. Based on what was found in the interview transcripts related to this code, it can be argued that generally, EA should lead to informed decision making. EA can be used during discussions (2) and should support or influence decision making (4, 6, 13). Note, however, that enterprise architects do not necessarily make such decisions themselves (10, 11, 14), which could still lead to fragmented decision making (17). Nevertheless, EA can function as an information source (3, 15) and can provide advice (5), which should lead to better decisions. Finally, EA can get involved in the so-called "strategic dialogue" by translating strategy into impact, which may lead to informed decisions making (16).

EA stakeholders

EA stakeholders can be both stakeholders officially practicing EA (fulfilling EA roles), and stakeholders that are essentially customers of EA. Codes related to this category are discussed below.

Enterprise Architect: In general, this code is about the actual enterprise architects. Although enterprise architects are not always explicitly mentioned as such, the difference from other kinds of architects is often clear from the context. Based on what was found in the interview transcripts related to this code, it can be argued that, to be effective as a person, architects in general may need certain competences, e.g., a good set skills (14), experience (10), several personal traits, and the ability to link business and IT (11). Enterprise architects need to be able to explain how IT can enable business (3). Moreover, they can be situated close to the CIO (4, 7, 18), can be argued to have a governing role (8), and should eventually serve strategic goals (12). One expert argued that, although the role of the enterprise architect may exist formally, the distinction with, for example, domain architects is not always clear in reality (16).

CxO/senior management/board: This code relates to higher management, i.e., executives, senior management, or even the board. In the survey, they were already mentioned as some of the major stakeholders of EA and those that may ultimately be responsible for EA. This is in line with the fact that EA is often considered to be strategic, residing on enterprise level. This is also in line with Van der Raadt's [70] view on "non-architect stakeholders of the EA function" at enterprise-level. Based on what was found in the interview transcripts related to this code, it can be argued that one of the most often mentioned executives by experts is the CIO. The CIO may be concerned with operations (3, 18). Moreover, as mentioned before, architects can be situated close to him or her (4, 5, 7). The C-level or senior management in general may be considered EA's most important stakeholder as EA is about supporting business transformations (6) and thus about big transformations concerning the entire enterprise (13, 17). Moreover, they are involved with actually setting targets and goals (1). In that regard, the CIO may provide input for EA in terms of what should happen (10). Finally, it can be argued that C-level stakeholders are concerned about risks and impacts (15).

Solution architects: This code relates to the more detail-focused solution architects. Based on what was found in the interview transcripts related to this code, it can be argued that solution architects are regarded as architects that have to work with enterprise architects and their deliverables. Solution architecture is more concrete, has a greater level of detail, focuses on certain solutions or projects instead of on the enterprise as a whole (2, 6, 10, 13), and is steered or framed by EA (7, 18). Solution architects may be expected to have knowledge of both business and IT as well (5), and should focus on realizing or implementing plans made at higher levels (8, 15). Therefore, EA and solution architecture reside at a different level (12). Note, however, that solution architecture is "still designing something that needs to work" (9).

EA Value

"Value" may mean different things to different people and, in this case, may be closely linked to EA goals and effects. One code that had a high frequency of occurrence is that of insight and oversight, which is discussed below.

Insight and oversight: Providing insight and oversight is typically seen by experts as one of the value-adding aspects of EA. Note that the difference between insight and oversight is not always clear, although the first is arguably about depth, whereas the second is about a broad picture. Gaining insight was also mentioned at times as one of the reasons for adopting and implementing EA in the input survey. Based on what was found in the interview transcripts related to this code, it can be argued that insight relates to insight into certain risks or impacts (5, 16), in the way the current landscape is built up (6), in the way IT and business are linked (11), in what the "pivot points" of the organization are (4), and into complex situations in general (10). Moreover, it can be argued that insight and oversight are needed for judging certain requests (15). One expert related oversight to increased speed when providing advise or helping projects (13). Finally, the importance of insight over having beautiful models can be emphasized (17).

KPI relations

This category is mostly related to aspects that can be taken into account when choosing KPIs. Already in the input survey, interviewees were asked what they would base their choice of EA effectiveness KPIs on. As the mode for this question equaled "on business goals", and more than half of the respondents answered "on stakeholder interests" and "on the organization's strategy", these are also the codes that are discussed below. Moreover, the organization's operating model was also discussed more often during the interviews. Finally, a distinction could be made between subjective KPIs or actual objective ones.

On business goals: As already became evident from the input survey, business goals are often considered leading when choosing KPIs for EA effectiveness. Based on what was found in the interview transcripts related to this code, it can be argued that business goals are on top of a tree-like structure when it comes to goal setting (8). This then means that business goals are set first, and EA and IT goals follow from those (2, 15). Therefore, the business may be leading (5, 18) and EA should support the achievement of business goals (12). One expert argued that you should in general focus on aspects that are externally visible (16). Another expert argued that goals should always be expressed in business terminology (1). It can also be argued that goals may provide a better foundation than the organization's strategy (14). Finally, one expert warned that the business itself could still be fragmented (7).

On strategy: During the interviews, the way KPIs are linked to strategy was not often specifically discussed. Based on what was found in the interview transcripts related to this code, it can be argued that strategy is closely related to business goals and also resides on top of the tree like structure when it comes to goal setting (8). Example strategies given are cost-reducing or power-focused strategies (1). One expert acknowledged that he should have chosen this option while filling in the input survey, as goals cannot exist without strategy (12). Finally, it can be argued that the organization's strategy may be more steady than its business goals (13).

On stakeholder interests: This code is closely related to the question of who should measure EA effectiveness. It is also closely related to stakeholder satisfaction metrics. Finally, it can be argued that interests of top-level stakeholders are closely related to business goals. Based on what was found in the interview transcripts related to this code, it can be argued that you often have to justify EA to stakeholders, e.g., EA customers and employers. It can be argued that those you are doing EA for should be able to understand the KPIs used (12). Moreover, different stakeholders, having different functions and different responsibilities, have different interests (11). Therefore, it can be argued that you should look at who you are doing things for (2, 13), what their concerns are (5, 14), and what they want to know or care about when choosing KPIs (9, 17). As an architect, you should be able to explain what you are doing to your stakeholders (10). Stakeholders could be considered partners in this sense (15) and could include a broad set of people affected (18).

On Operating Model: At first instance, when this option was included in the input survey, the kind of operating model by Ross, Weill and Robertson [5] was meant. As derived from what was found in the interview transcripts related to this code, next to Ross, Weill and Robertson's operating model (12), the term can be related to the way the enterprise works (14) and is steered (16). Moreover, it can be linked to the adopted business model (6) and the organization's strategy (13). One respondent, who did not choose this option while filling in the input survey, argued that although the operating model is interesting, it may be difficult to use it for choosing KPIs (8).

Subjective vs objective: KPIs can be more subjective in nature (such as EA customer satisfaction), or they can actually be focused on facts (such as financials or measurable quality), and thus be objective. Note that this code was also sometimes linked to the distinction between qualitative or quantitative KPIs. Based on what was found in the interview transcripts related to this code, it can be argued that objectively determining EA effectiveness, or linking it to hard numbers, may be difficult. It was questioned whether you should actually want to make it explicit (12, 16). Moreover, it can be argued that you need to be mature to do so (2, 7), that EA's impact on decision making is something subjective (4), that subjectivity is inevitable (8), that attributing revenue to a CEO is also very difficult (10), and that you cannot realize numbers without subjective aspects (13). On the other hand, it can be argued that there is a certain risk associated with keeping things subjective as you may be too late when things go wrong (3), that it should matter less whether people like you or not (15), and that contributions should indeed be made

explicit (17). Generally something can be said for the importance of objective, subjective, qualitative, as well as quantitative KPIs (6, 9, 11, 14, 18).

Measurement challenges

Codes in this category have to do with the difficulties, discussions, and dilemmas that arise when trying to measure EA effectiveness.

Causality/traceability: The issue of causality was already recognized in literature (e.g., [27]) and experts were explicitly asked how they would deal with it. As can be derived from what was linked to this code, however, this issue was still often recognized. Part of the issue is, for example, that it may be difficult to conclude that things went "better", or that "better" decisions were made thanks to EA (10) as there is nothing to compare it with (1, 16). It may even be difficult to determine what something has cost (5). You cannot do the same thing twice, i.e., once with and once without EA (7). Moreover, once ideas actually get implemented, they have gained many fathers (2, 18) and thus are subject to multiple influences (8, 13). Finally, the "cause and effect chain" of EA is rather large (14, 17) and effects of EA can be really indirect (11). This could make it difficult to link EA to, for example, external customer satisfaction (12). Experts therefore suggest looking at "interim metrics" (9) or at what makes a "good" architecture (6).

Project vs strategic level: This code is closely related to the "enterprise level" code, where it was argued that EA is typically about the entire enterprise. Within organizations, a distinction can be made between the higher strategic levels and lower project levels [1, 7]. Based on what was found in the interview transcripts related to this code, it can be argued that some discussion exists on the extent to which EA should be involved with lower levels. Therefore, it can also be questioned whether EA effectiveness should be measured at higher or lower levels. From one perspective, it can be argued that EA should not be concerned with, for example, implementation choices (8, 12), function points (11), or too many other technical project details (14), and that it may no longer be about EA when you go deeper as it is less involved then (10, 16). A distinction can be made between actual EA at managerial level and lower level architectures (3, 13), where EA is about the entire organization (6) and about providing guidance (9). On the other hand, EA can still be evaluated at project level on, for example, quality aspects and contribution (4). Moreover, it can be argued that enterprise architects have to step down every now and then (7). One respondent even argued that measurement programs should be implemented bottom-up (15). It can be argued that, depending on the level at which decisions were made, EA can still be held responsible for actual performance aspects (18). Finally, EA is used differently at different levels (5). EA controls, for example, may reside at a portfolio planning level (17).

Metrics and KPIs

Quite some metrics and KPIs were suggested by experts and these are accounted for at a later stage of this research. The metric that occurred the most frequently is that of internal customer satisfaction. Note that this code actually includes several other codes, i.e., "CxO satisfaction", "managers satisfaction", and "project leader satisfaction". During the analysis, it turned out that these could all be combined into "Internal customer satisfaction". General "customer satisfaction" and "stakeholder satisfaction" also proved to be very closely related to internal customers and were also partly included.

Internal customer satisfaction: As mentioned, an internal customer could be a CxO, a manager, a project leader, or other internal stakeholders. Based on what was found in the interview transcripts related to this code, it can be argued that it is then not only about satisfaction levels of stakeholders (or EA customers) at higher levels within the organization, such as the CIO (4, 16), or business stakeholders (managers) (8, 11), but also, to a certain extent, of those who have to work with or below EA (12). Moreover, it can be argued that EA cannot be useful if the EA customer or principals do not think it is (10). On the other hand, if EA customers generally feel EA is valuable, this may actually be the case (13, 14, 18). Satisfaction levels could be determined through, for example, interviews (6, 17).

When to measure

Experts were often asked about when EA effectiveness should be measured. This then relates to questions such as how many times, and at what (maturity) stages it should be measured.

Early stages of maturity: As can be derived from what was linked to this code, even when EA is not yet mature, one could try to measure its effectiveness. It is believed that EA can be effective even if it is not mature yet (6) and that initiatives taken at early stages can already be measured (11). The architect could play a large role in this (8) and may have to take responsibility for it himself (12). Moreover, it may be rather informal at that point (13). One expert generally did not think maturity and effectiveness are linked (5). Another argued that you can measure effectiveness from the start, but that you then may not be able to obtain hard data yet (2). However, it can be argued that you can gain the most efficiency at the start (1). Finally, measuring from the start gives you insight into *progress* (16).

Who should measure

During the interviews, experts were asked about who they thought should measure EA effectiveness. For example, should the CIO do such measurements, should measurements be performed by project owners, or maybe by external parties?

Architects/individuals themselves: Based on what was found in the interview transcripts related to this code, it can be argued that architects themselves may have to measure EA effectiveness. Architects may have to report to business (1) and may have to get their own grade (16). Moreover, although some form of professionalism could be expected when measuring effectiveness (7), a kind of check may be needed (2), and results may need to be compared with stakeholder views (9). Architects should be able to promote themselves (10), to show that they do well (13), and to show added value (12). One expert argues that, even though architects need to measure the extent to which they fulfill their role, it can be argued that measurements need to be done throughout the organization. He therefore suggests using a balanced scorecard (5).

4.2.3 Observations

In speech, and therefore also in this thesis document, people often simply mention architecture as opposed to *enterprise* architecture. The context however, is often clear enough to make the difference.

The distinction between metrics and KPIs was not always recognized by experts. Moreover, the way business goals and strategy are linked, and which one provides a better foundation, was not always clear.

Chapter 5

Design and Development

In this chapter, first, a number of initial design assumptions are outlined. Then, the Focus Framework for Enterprise Architecture Measurements (FFEAM) and its accompanying set of KPIs for EA effectiveness are discussed.

5.1 Design Assumptions

Based on our collected data and analyses, we were able to arrive at a measurement framework and accompanying set of KPIs for EA effectiveness. These were initially based on a set of design assumptions, which are outlined below.

Decision-making level: As derived from the interviews, EA should generally be effective at decision-making level. This becomes evident from the fact that help during decision making was found to be one of the main goals of EA. Of course, this insight in itself is nothing new [7,11,53]. However, while constructing the visualization graph shown in Appendix C, Section C.2.3, it appeared that metrics mentioned by experts on effectiveness at this level could globally be divided into two *focus areas*: decision-making process and decision-making results. Decision-making process is then concerned with the way decisions are made. Decision-making results is concerned with the actual delivery of the decision-making process, i.e., the kinds of choices and decisions made.

Causality: As was expected, during the interviews, traceability of EA effectiveness proved to be an important issue. It could be argued that, the lower one moves in terms of management levels, the harder it gets to determine the influence of EA as effects become subject to multiple influences. Therefore, the further one gets from the actual decision-making process, the harder it may be to measure EA effectiveness.

Program level: The discussion on whether EA should reside at a strategic level or is involved at all management levels is not new either [1,7]. From both the interviews and literature, it could be concluded that enterprise architects should take some form of responsibility at lower levels. In this regard, it could be argued that EA is about enterprise-wide programs as opposed to domain-specific programs or projects, where programs typically reside at a level higher than projects [2]. This focus on enterprise-wide programs is in line with Van der Raadt and Van Vliet's ' [7] view on the chief architect, who according to them is responsible for "the quality and effectiveness of the overall EA" and should thus "act in the interest of enterprise-wide structures, processes, systems and procedures to achieve corporate strategy". Therefore, enterprise-wide programs can be defined as:

> Enterprise-wide program: Program "in the interest of the enterprise-wide structures, processes, systems and procedures" [7].

It can be argued that a program is in the enterprise's interest once it is in the interest of more than one domain.

While constructing the graph shown in Appendix C, Section C.2.3, it turned out that metrics mentioned by experts on effectiveness at this level could globally be divided into two *focus areas*: program implementation and program results. Program implementation is then mainly concerned with the way changes are implemented through programs. Program results is concerned with the actual delivery of programs and the subsequent effects in operation, i.e., what programs lead to.

EA involvement and EA use and compliance:　With regard to the definition of effectiveness used in this research as given in Section 1.2.2, EA involvement, EA use and compliance, should not be seen as desired results of the EA practice. Rather, they should be seen as *requirements*. In order for EA to influence decision-making, its involvement is required. Moreover, for EA to be effective at program level, EA use and compliance or conformance are required [7, 65].

Architecture, Maturity and Governance:　Although EA quality could be important, it should not be EA's desired result to build an architecture that adheres to all kinds of quality-guidelines. It is a means to an end. EA maturity and governance should not be seen as desired results of the EA practice either. Rather, it can be argued that actual architectural aspects (quality, content, design), maturity, and governance are increasingly required for EA to be effective. For example, EA governance may not need to be defined yet if EA is only involved in decision making. Once EA gets involved in the actual programs, however, aspects such as principles, more mature processes, and governance are required in order to direct changes and be accountable for certain results.

Business Goals, Strategy, and Stakeholder Interests:　From the survey, it became clear that it should be possible to map KPIs for EA effectiveness to the business goals and strategy of the organization, as well as to stakeholder interests. This is in line with Rosser [74], who argues that one should "map measures to strategies and stakeholders".

Initial choice of Key Performance Indicators:　Van Steenbergen and Brinkkemper [27] focus on EA's contribution to the achievement of business goals. However, due to causality and traceability issues, linking metrics such as revenue and customer satisfaction to EA can be hard. As Slot [68] rightfully points out, EA is mainly supportive. Therefore, it could be argued that, when measuring EA effectiveness, one should focus on effects that can reasonably be linked to EA, i.e., things EA can directly influence or that can be attributed to EA. Although the context differs, this is in line with Parmenter's onion model for KPIs as shown in Figure 1.1, Section 1.2.3. It is also in line with Niemi's [21] division between benefits that are strongly attributable to EA and those that are weakly attributable to EA. Therefore, metrics found during the literature review were initially filtered in the following way:

1. Metrics were filtered on being about EA effectiveness as opposed to EA maturity, EA governance, compliance or conformance, or EA quality.
2. Metrics that were not considered too high-level or unclear were divided among the main focus areas: decision-making process, decision-making results, program implementation, or program results.
3. Metrics were given a rank of 0, 1 or 2:
   - A metric was ranked 2 if it was considered an effect that can reasonably be linked to EA (e.g., because it spans over multiple organizational domains; it is something EA can directly influence; it can be considered EA's responsibility; it is often initiated by EA on enterprise level; or EA plays a very big role or has a big stake in it).
   - A metric was ranked 1 if it did not meet any of the requirements for it is hard to link to EA (e.g., because the metric misses context; it could be linked to EA, but the metric itself rather unclear; it is subject to multiple influences; it is too specific or too low level for EA [closer to domain or project level]; EA only has a small stake in it; it could be hard to prove whether EA had something to do with it; or it is generally unclear how it can be attributed to EA). Note that this mainly has to do with the issue of causality.
   - A metric was ranked 0 if no link with or relevance for measuring EA effectiveness could be thought of.
4. For each metric, the reasons for giving it a certain ranking were written down, either globally or, if deemed necessary, more detailed.
5. Each metric was assigned a category (e.g., B-IT alignment).

The same procedure was used for those codes retrieved from the interviews or the survey that had been categorized under "Metrics and KPIs". Note that in some cases, metrics that were not deemed to be about effectiveness or were considered too high-level may already have been left out during coding (e.g., number of standards delivered, execution).

Eventually, metrics that received a ranking of 2 were combined and mixed into an initial set of KPIs for EA effectiveness.

Categories: The focus on effects that EA can reasonably influence has an important implication, namely that it should be possible to map these KPIs for EA effectiveness to corresponding business goals, strategies and stakeholder interests. The assignment of categories to KPIs makes this easier. Note, however, that these categories are not necessarily mutually exclusive.

5.2   The Focus Framework for Enterprise Architecture Measurements (FFEAM)

In this section, first, relevant evaluation feedback on initial versions of the FFEAM is discussed. Then, the resulting version of the FFEAM is presented and elaborated on. Those interested only in the resulting framework are advised to read Section 5.2.3.

5.2.1   Intermediate Evaluation Feedback on Initial FFEAM

In order to get timely feedback before the official evaluation session, an initial version of the framework was presented at SIG. This led to the following feedback:

- The framework gave the impression that it was "Waterfall"-style. It was argued that the focus areas should be regarded in a more dynamic way where one is not bound to a successive order.
- It was argued that the actual effects of EA are related to the program results focus area.

Initially, the framework was meant to be static, showing focus areas as opposed to active steps. As for the second point, although this may be true for the organization as a whole, it can be argued that EA is still expected to affect the other focus areas as well.

5.2.2   Evaluation Session Feedback on Initial FFEAM

The official evaluation session was attended by 2 university supervisors, 11 members and 2 representatives of the CIO Platform. During the evaluation, a presentation was given and participants were invited to actively engage, ask questions, and give feedback. The framework and example KPIs shown during the evaluation session are shown in Appendix D, Section D.1.

During the evaluation session, respondents questioned, for example, the definition of EA used in this research and reasons for measuring EA effectiveness. Nevertheless, the following feedback was given on the FFEAM:

- No extra focus areas were mentioned. Some discussion did arise with regard to EA's role during decision making. One participant argued, for example, that decision makers are doing EA themselves, and that everyone makes decisions in the best interest of the organization. Decision makers do not necessarily need EA for that and actually provide input for EA. Architects may then have to ask about more specific issues, which again calls for decisions to be made. Added value then, according to participants, stems from showing implications, framing solutions, and delivery (being a police agent).
- No comments were given on the distinction made between requirements (e.g., compliance and maturity) and effects. There seemed to be agreement on this.
- It was argued that the link to business could be more clear.
- The framework was again considered to be too much waterfall.

The fact that EA should help during decision making, but does not make decisions, was acknowledged by experts that provided input for the framework as well. However, as EA should still *help* during decision making, it needs to be effective on that level.

As for the second item, the framework shows that KPIs should be based on the business goals and strategy, and stakeholder interests. Moreover, KPIs can be focused on IT in terms of the infrastructure or stakeholders, but also on business in terms of functions, processes and people.

Finally, it was acknowledged that making the framework "circular" would be value adding. Thus, the use of feedback loops was considered.

5.2.3 Resulting Design of the FFEAM

In this subsection, the current version of the FFEAM, shown in Figure 5.1 is discussed.
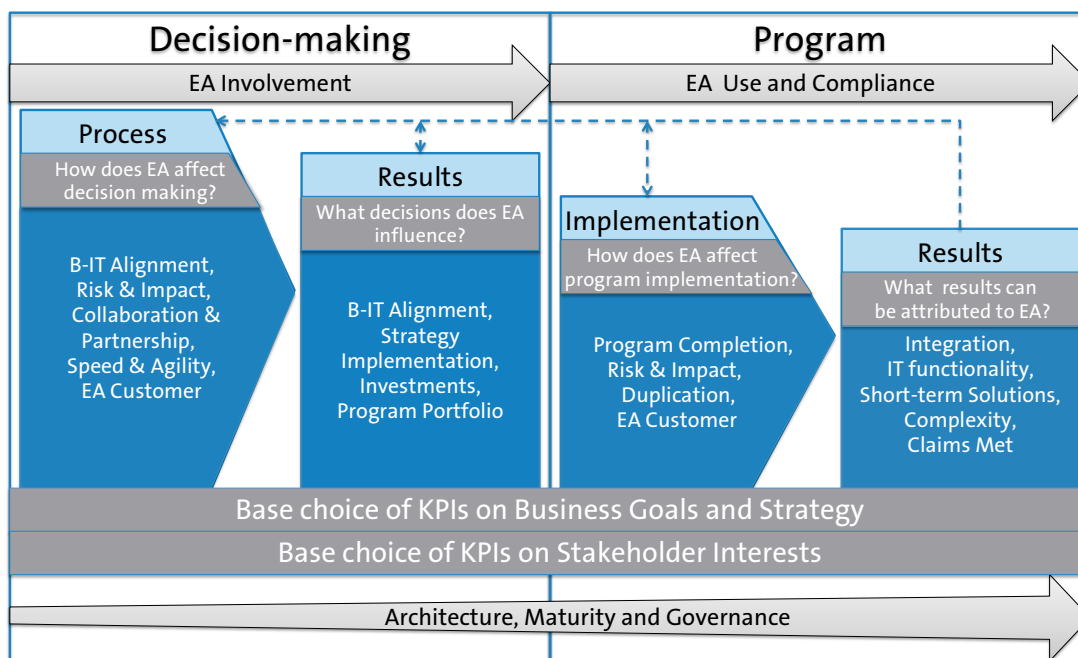
Figure 5.1: The Focus Framework for Enterprise Architecture Measurements (FFEAM)

The FFEAM focuses on measuring EA effectiveness, i.e., the degree to which EA "is successful in producing a desired result". Aspects such as EA involvement, EA use and compliance, and Architecture, Maturity and Governance, should be seen as *requirements*. Being compliant or having an architecture that adheres to all "quality aspects" are not desired results. They are means to get to desired results. This does not mean that the importance of these aspects is not acknowledged, they are kept in mind while focusing on the actual effectiveness of EA.

As shown in Figure 5.1, the FFEAM suggests looking at two main "levels" at which EA should be effective: decision-making level and program level. These are further divided into so-called *focus areas*: decision-making process, decision-making results, program implementation, program results. EA should be effective in each of these focus areas. The decision-making process is about decision making at the enterprise level and includes building a vision and strategy, formulating and evaluating scenarios, and selecting alternatives and scenarios [7, 68, 82]. Decision-making results then include the actual decisions made, i.e., the goals, strategies, and program plans resulting from the decision-making process. Program implementation is about carrying out enterprise-wide program plans and implementing changes through such programs. Finally, program implementation leads to certain program results. Thus, this last focus

area is concerned with the actual delivery of programs and subsequent effects in operation. The division of the four focus areas appears to be in line with the distinction made by Tamm et al. [11], between direct EA benefits and benefits resulting from implementation.

The further one gets from the decision-making process, the harder it may be to show EA's influence. This is visualized by the staircase-like structure. Therefore, when using the FFEAM, one should focus on those effects of EA that can reasonably be linked back to it. To be able to do so, each focus area is assigned one *key question* that needs answering if one is to measure the effects of EA in that area.

Naturally, the focus areas are passed through in a successive order, i.e., decision-making process → decision-making results → program implementation → program results, and based on that, decision making again. However, if something goes wrong or additional information is needed, one should be able to go back to previous steps as well. Moreover, as argued during the evaluations, we currently live in a much more dynamic world. Therefore, frameworks and models may also need to be more agile. In the current version of the FFEAM, these dynamics are visualized through feedback arrows to earlier stages.

The FFEAM can be implemented through a set of 22 KPIs, divided over the four focus areas. Each KPI is assigned to a more high-level category (e.g., Integration). Note that not all KPIs are interesting for all organizations, nor are they in the interest of all stakeholders. Therefore, the choice of KPIs should be based on the business goals and strategy, and stakeholder interests.

5.3   Key Performance Indicators for Enterprise Architecture Effectiveness

In this section, first, general feedback on KPIs retrieved from the intermediate evaluations and the evaluation session is discussed. Then, the types of KPIs present in the current set of KPIs for EA effectiveness are outlined. Finally, each KPI is, in relation to the evaluation survey results, elaborated on while keeping in mind some of the aspects from the metric catalog by Bouwers, Visser, and Van Deursen [83]. Those interested only in the resulting set of KPIs are advised to read Sections 5.3.4 and 5.3.5.

5.3.1   Intermediate Evaluation Feedback on Initial KPIs

Prior to the presentation at SIG, earlier versions of the framework and some of the initial KPIs were discussed with an expert in EA from SIG, as well as with one external enterprise IT architect (separately). Feedback included the following points:

- It can be hard to link objective measures such as "time needed for decision making" to EA, although it is an important KPI for measuring the way EA affects the decision-making process.
- The responsibility of actual program implementations (i.e., whether they are completed within budget and time) may be that of program managers, not enterprise architects.

With regard to the first point, it was acknowledged that such KPIs need to be operationalized through surveys. Not only is it difficult to measure, for example, the actual time needed for decision making, but it is even harder to prove that EA influenced this.

The second point seemed to be in line with Slot's [68] argument on the relation of architecture to program execution: "Project management is responsible for keeping projects within budgets, within the agreed timelines and the allocation of resources. Architects are responsible for designing an optimal solution. Program management and architecture need to work together one from the process point of view; the other from the content point of view". This view is shared by Op 't Land et al. [2]. Therefore, instead of just looking at program completion in terms of time, budget, and failure, the decision had been made to look at programs suffering due to EA-related issues.

5.3.2 Evaluation Session Feedback on Initial KPIs

As shown in Appendix D, Section D.1, some KPIs were shown during the evaluation session. This led to the following feedback:

- KPIs and accompanying definitions should be about the business as well, instead of just focused on IT.
- Business and IT goals should not be different. Also, what is B-IT alignment? This actually creates a gap between business and IT, where they should be seen as one.
- Business stakeholders do not think about IT, they think in terms of information and therefore information provision.
- EA may be more about KBIs (Key "Belevings" [i.e., Perception] Indicators): Trying to measure everything is not reality. If you are not useful, you should leave, where being useful may be a matter of perception.
- Some KPIs may reflect means instead of goals and may therefore not be real KPIs.

KPIs in general should not focus too much on IT. EA is about both business and IT and, therefore, KPIs should be related to both. However, although IT is an integral part of the business, it can still be seen as a separate entity. Therefore, although business and IT goals should not be different, it may in practice happen that they are and EA plays a crucial role here. Finally, information provision is located between business and IT [84]. Thus, to a certain extent, EA should be concerned with all of these areas.

With regard to the Key "Belevings" Indicators, it can be argued that one should not leave everything to perception or a "gut feeling".

As for the last point, as acknowledged before, the actual results may be the program results. However, influencing "means" during decision making and program implementation is still a desired result of EA. Some KPIs may not be a desired result of the enterprise as a whole, but they can be considered desired results of EA. This is an important distinction to keep in mind.

After the official evaluation session, one respondent sent several suggestions for KPIs. Due to confidentiality reasons, these cannot be outlined here. However, it suffices to say that similar KPIs are accounted for in the lists of metrics as shown in Appendix B and C, and that this did not lead to new insights.

The initial set of KPIs did not include a KPI specifically focusing on impact and risk. It was implicitly embedded in other KPIs. However, as participants of the evaluation session put emphasis on the importance of showing risks and impacts, such a KPI was added.

5.3.3 Evaluation Survey Feedback on Draft KPIs

After the intermediate evaluations and the evaluation session, metrics were filtered again using newly gained insights and, again, mapped to a set of KPIs. These KPIs, from now on referred to as *draft KPIs*, were eventually evaluated through an evaluation survey. This survey, including the draft KPIs as well as the questions asked, is shown in Appendix D, Section D.3.1. In Appendix B, Section B.2, and Appendix C, Section C.2.5, the final categorizations of metrics from literature and experts are shown. A final mapping between the metrics that were ranked 2 and the set of draft KPIs that was evaluated, is shown in Appendix D, Section D.2.

Eventually, 6 people who participated in the evaluation session also answered all of the survey questions. A summary report of their responses retrieved from *Instant.ly* [38] is shown in Appendix D.3.2.

A draft KPI is per definition rejected if no respondent considered it useful for measuring EA effectiveness, i.e., not one respondent answered *agree* or *strongly agree* for the corresponding statement. Remaining draft KPIs could be modified based on comments and feedback. For the right reasons, such a modification could still include the draft KPI being taken out.

The following draft KPIs are not included in the final set:

- **Draft KPI 10**: "Erroneous decisions where EA was a key originator".

Most respondents thought draft KPI 10 was not clear enough for use in practice as the mode for this statement equaled 2 (67% answered *disagree*) and two respondents (33%) answered *neutral*. Moreover, most respondents thought draft KPI 10 was not useful for measuring EA effectiveness as the mode for this statement equaled 2 (50% answered *disagree*), one respondent (17%) even answered *strongly disagree*, and no respondent answered anything higher than *neutral*. Therefore, this draft KPI was considered rejected.

- **Draft KPI 14**: "Business stakeholder satisfaction with IT's responsiveness to new requirements". Although the mode for this statement equaled 4 (50% answered *agree*) not all respondents were convinced that draft KPI 14 was clear enough for use in practice. Two respondents (33%) answered *neutral* and one respondent (17%) answered *disagree*. However, although the mode for this statement equaled 3 (50% answered *neutral*), there were more respondents who thought draft KPI 14 was useful (33% answered *agree*) than respondents who thought draft KPI 14 was not useful (17% answered *disagree*) for measuring EA effectiveness. Nevertheless, three respondents wrote down comments expressing concerns about whether this draft KPI is for EA only, or that it is subject to multiple influences. It could indeed be argued that IT responsiveness cannot be attributed to EA. The rationale behind this draft KPI was that it is about stakeholders' satisfaction with IT's responsiveness, which EA could have great influence on, as opposed to IT's actual responsiveness. However, as this is still subject to many influences, it was acknowledged that this draft KPI was not in line with the definition of KPIs for EA effectiveness that is used in this research.

- **Draft KPI 19**: "Critical to business processing incidents caused by EA-related errors".
  Most respondents thought draft KPI 19 was not clear enough for use in practice as the mode for this statement equaled 3 (50% answered *neutral*) and no respondent answered anything higher than *neutral*. Two respondents (33%) even answered *strongly disagree*. Moreover, the mode and variances in frequency for the statement suggesting that draft KPI 19 was useful for measuring EA effectiveness were exactly the same. Therefore, this draft KPI was considered rejected.

- **Draft KPI 24**: "Diversity among critical systems".
  Most respondents were indifferent about whether draft KPI 24 was clear enough for use in practice as the mode for this statement equaled 3 (67% answered *neutral*), one respondent (17%) answered *agree* and one respondent (17%) answered *disagree*. Moreover, there was quite some disagreement among respondents on whether draft KPI 24 was useful for measuring EA effectiveness as there were three modes for this statement: 2 (33%) answered *disagree*, 3 (33%) answered *neutral*, and 4 (33%) answered *agree*. Initially, this draft KPI was not rejected. However, one of the respondents argued that "IT management and ITIL are not EA". Another respondent questioned whether the number of vendors is actually an EA issue and argued that the number of versions may be more of an Application Life cycle Management issue. During the input interviews as well, experts argued that EA may not need to be concerned with actual implementation forms or version numbers. Respondents of the evaluation survey therefore rightfully argued that this draft KPI may not have been in the area of EA anymore.

At the end of the survey, one respondent mentioned two KPIs he felt were missing: "contribution to company strategy" and "external customer satisfaction". As argued throughout this research, such KPIs are not considered effects that can reasonably be linked to EA. Another respondent felt most KPIs had a negative feel to them. It could be argued that this depends on the kind of KPI. Finally, one respondent argued that the number of KPIs "should be brought down to a maximum of 10". However, this is very difficult and would limit practitioners in their choice when basing KPIs on business goals, strategy, and stakeholder interests, which can differ greatly per organization.

Remaining draft KPIs are, either (largely) modified or unchanged, included in the final set of KPIs for EA effectiveness. An overview of the modifications made can be found in Appendix D, Section D.3.3.

5.3.4   Types of KPIs

Four types of KPIs are included in the final set of KPIs for EA effectiveness:

Subjective KPIs: KPIs of this type could be interpreted to be subjective and are operationalized through scaled surveys. Three essential elements are included in their description: the topics asked, the

stakeholders whom questions on these topics are asked, and the way the KPI is operationalized in more detail. The topics asked and the stakeholders whom are asked about these topics may differ per KPI. However, all KPIs of this type are operationalized by determining the percentage of stakeholders giving negative ratings for each of the topics. This makes the range for such KPIs equal to $[0\%, 100\%]$. For EA to be considered effective then, the percentage of stakeholders giving negative ratings, per topic, should be as low as possible, e.g., $< 20\%$.

Mapping-based KPIs: KPIs of this type involve a mapping between two separate items. Therefore, three essential elements are included in their description: a description of the first item, a description of the second item, and the way the KPI is operationalized. The two items can differ, but all KPIs of this type are operationalized by determining the percentages of (1) instances of item 1 not mapped to instances of item 2, and (2) instances of item 2 not adequately supported by instances of item 1. Note that it may be difficult to determine whether instances of item 2 are adequately supported by instances of item 1. As suggested during the intermediate evaluations, one could use the Pareto principle for this. As it is about percentages, KPIs of this type have a range of $[0\%, 100\%]$ and, for EA to be considered effective, percentages should be as low as possible, e.g., $< 20\%$.

Case-based KPIs: KPIs of this type are case-based, meaning that they are operationalized on a per-case basis, i.e., by looking at the impact and occurrence of certain events. Therefore, two essential elements are included in their description: a description of the kind of cases one should look out for, and the way the KPI is operationalized in more detail. KPIs of this type are operationalized by looking at the number of existing cases in a certain time period, as well as their impact. Theoretically, the range for the number of cases equals $[0, \infty]$. Of course, in practice this number is finite. The impact of such cases may have to be expressed in monetary values or time. Therefore, although this number is in practice finite as well, the theoretical range for the impact also equals $[0, \infty]$. Note that the number of cases could say different things about EA effectiveness for different KPIs.

Percentage-based KPIs: KPIs of this type are operationalized by determining the number of occurrences of an unfavorable phenomenon as a percentage of a whole. Determining such percentages allows for easier comparison of improvement over time. Two essential elements are included in their description: what phenomenon to look out for, and as a percentage of what whole it should be operationalized. As it is about percentages, the range for this type of KPIs equals $[0\%, 100\%]$. Moreover, as it is about the occurrence of unfavorable phenomenons, this percentage should be as low as possible, e.g., $< 20\%$.

5.3.5 Resulting Set of KPIs for EA Effectiveness Related to Decision-Making Process

Table 5.1 links KPIs to the categories shown in the FFEAM for the decision-making process focus area.

Table 5.1: KPIs linked to categories for the decision-making process focus area

Category	KPI
B-IT Alignment	KPI 1, 2, 3
Risk & Impact	KPI 4
Collaboration & Partnership	KPI 5, 6
Speed & Agility	KPI 7
EA Customer	KPI 8

As shown in the FFEAM, EA involvement is required if EA is to be effective during the decision-making process. EA cannot influence any decision-making process if it is not in some form involved, be it through roles, artifacts, principles, or EA processes.

All KPIs related to this focus area are of the subjective type. This may be because the process of decision

making can be very subjective in itself, and actually measuring something about the way it is done is difficult.

B-IT Alignment

Business-IT alignment during the decision-making process refers to the subjective alignment of those business and IT stakeholders that are involved in this process at enterprise level. KPIs linked to this category are largely based on two of Luftman's [62] indicators for business-IT alignment (i.e., "understanding of business by IT" and "understanding of IT by business").

KPI 1: EA's influence on IT stakeholders' understanding of the business direction.

The current version of KPI 1, a subjective KPI, is shown in Table 5.2.

Table 5.2: Current version of KPI 1: EA's influence on IT stakeholders' understanding of the business direction.

KPI 1: EA's influence on IT stakeholders' understanding of the business direction
Question: Does EA [Not at all 1 2 3 4 5 Very much] lead to an increased understanding of the business goals and strategy? Ask of: Key IT stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key IT stakeholders giving negative ratings.

If IT stakeholders feel EA does not increase their understanding of the business direction, this is considered a crucial flaw as it can lead to ineffective decision making on their part. To reduce the percentage of key IT stakeholders giving negative ratings, EA should focus on describing more effectively the business direction of the organization, in terms of its business goals and strategy. Moreover, EA may need to focus on actively explaining this direction.

KPI 1 originates from draft KPI 1, which was essentially the same, apart from that it included another topic related to business-IT alignment: IT linkage to business. The evaluation survey resulted in the following feedback on draft KPI 1:

- Although the mode for this statement equaled 4 (33% answered *agree*), there was quite some disagreement among respondents on whether draft KPI 1 was clear enough for use in practice. Apart from *agree*, every other option was selected exactly once (i.e., frequency of 17% for each). One respondent, who answered *neutral*, argued that it could be hard to quantify this draft KPI. Also, two respondents, of whom one answered *disagree* and one answered *strongly disagree*, indicated that there were actually two topics embedded in this draft KPI. Thus, one respondent suggested splitting it. Another respondent, who answered *agree*, foresaw potential confusion as to whether this draft KPI was about the EA process or EA products.
- Most respondents thought draft KPI 1 was useful for measuring EA effectiveness as the mode for this statement equaled 4 (67% answered *agree*) and no respondent answered anything lower than *neutral*. One respondent (17%) even answered *strongly agree* and acknowledged that EA guides changes and that "EA principles describe the road to the corporate vision and strategy".

Note that the definition of EA used in this research automatically relates the KPIs to both the EA processes and EA products. Besides that, respondents criticized the fact that draft KPI 1 was actually about two separate topics. Therefore, for clarity, draft KPI 1 was split into two seperate KPIs, of which one is the current version of KPI 1, shown in Table 5.2.

KPI 2: EA's influence on business stakeholders' understanding of the IT landscape.

The current version of KPI 2, a subjective KPI, is shown in Table 5.3.

Table 5.3: Current version of KPI 2: EA's influence on business stakeholders' understanding of the IT landscape.

KPI 2: EA's influence on business stakeholders' understanding of the IT landscape
Question: Does EA [Not at all 1 2 3 4 5 Very much] lead to an increased understanding of (1) the IT landscape, (2) IT financial information, and (3) IT innovation possibilities?
Ask of: Key business stakeholders involved in decision making at enterprise level.
KPI operationalization: The percentage of key business stakeholders giving negative ratings.

Just like IT stakeholders should feel EA increases their understanding of the business direction, business stakeholders should feel EA increases their understanding of the IT landscape. If EA fails to do so, this too could lead to ineffective decision making. Therefore, to reduce the percentage of key business stakeholders giving negative ratings, EA should focus on describing more effectively the IT landscape, in terms of the IT landscape itself, accompanying IT financial information, and IT innovation possibilities. Again, EA may need to focus on actively explaining these aspects.

KPI 2 originates from draft KPI 2, which was very similar, apart from the fact that it also included the linkage between business and IT, and did not include the general IT landscape as a subtopic. The evaluation survey resulted in the following feedback on draft KPI 2:

- Although the mode for this statement equaled 4 (50% anwered *agree*), there were as many respondents who thought draft KPI 2 was clear enough (i.e., *agree* or *strongly agree*), as there were respondents who thought draft KPI 2 was not clear enough for use in practice (i.e., *disagree* or *strongly disagree*). One respondent (17%) answered *strongly disagree*, whereas no respondent answered *strongly agree*. Two respondents (33%) answered *disagree*, of whom one argued that an increased understanding of IT financial information and innovation may not be effects of EA, although an increased understanding of the IT landscape is. The other argued that two topics were included in this draft KPI: IT financials and innovation.
- All respondents thought draft KPI 2 was useful for measuring EA effectiveness as the mode for this statement equaled 4 (83% answered *agree*) and no respondent answered anything lower than that. The same respondent that strongly disagreed with draft KPI 2 being clear enough for use in practice, now answered *strongly agree*.

As was the case for draft KPI 1, the understanding of the IT linkage to business was separated from the general understanding of IT by business. Moreover, it was acknowledged that business stakeholders' understanding of the actual IT landscape itself is very important as well. IT financials and innovation, however, were not split from this draft KPI as these may be closely linked to the IT landscape and an understanding of these may help greatly during the decision-making process. The changes led to the current version of KPI 2, shown in Table 5.3.

KPI 3: EA's influence on stakeholders' understanding of the linkage between IT and business.

The current version of KPI 3, a subjective KPI, is shown in Table 5.4.

Table 5.4: Current version of KPI 3: EA's influence on stakeholders' understanding of the linkage between IT and business.

KPI 3: EA's influence on stakeholders' understanding of the linkage between IT and business
Question: Does EA [Not at all 1 2 3 4 5 Very much] lead to an increased understanding of the way IT is, and can be, linked to business?
Ask of: Key stakeholders involved in decision making at enterprise level.
KPI operationalization: The percentage of key stakeholders giving negative ratings.

As for KPI 3, the difference between business and IT stakeholders is no longer explicitly made as it is about the views of all key stakeholders involved in decision making at enterprise level. To reduce the percentage of key business stakeholders giving negative ratings, EA should focus on linking business and IT using a layered view. It is not just about technology infrastructure or business processes. Instead, it is about business, information, applications and IT infrastructure [9], or any similar order of layers. Moreover, it is not only about gaining insight into the current situation, but also about how business and IT can be linked in the future.

Initially, KPI 3 was embedded within KPI 1 and 2. However, it was acknowledged that the linkage between IT and businesss could be a measurement topic in itself. Therefore, KPI 3, shown in Table 5.4, was added to account for this linkage.

Risk & Impact

Risk and impact, in terms of the decision-making process, is concerned with the extent to which decision makers gain insight into the consequences of their decisions.

KPI 4: EA's influence on stakeholders' understanding of risks and impacts.

The current version of KPI 4, a subjective KPI, is shown in Table 5.5.

Table 5.5: Current version of KPI 4: EA's influence on stakeholders' understanding of risks and impacts.

KPI 4: EA's influence on stakeholders' understanding of risks and impacts
Question: Does EA [Not at all 1 2 3 4 5 Very much] lead to an increased understanding of the (1) risks, and (2) impacts of certain scenarios and decisions? Ask of: Key stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key stakeholders giving negative ratings.

EA should help during the decision-making process by providing insight into the risks and impacts that decisions may lead to. If EA is not able to do so, it can hardly be considered effective. To reduce the number of key stakeholders giving negative ratings for this KPI, EA should focus on actively explaining the consequences of one's decisions. This then goes beyond the boundaries of just one area of expertise (e.g., IT or business). It is about the risks and impacts for the entire enterprise.

KPI 4 originates from draft KPI 3, which was added after participants of the official evaluation session argued that EA is about providing insight into the impacts of certain decisions. The evaluation survey resulted in the following feedback on draft KPI 3:

- Most respondents thought draft KPI 3 was clear enough for use in practice as the mode for this statement equaled 4 (50% answered *agree*) and no respondent answered anything lower than *neutral*. Moreover, two respondents (33%) even answered *strongly agree*.
- Although most respondents agreed that draft KPI 3 was useful for measuring EA effectiveness as the mode for this statement equaled 4 (67% answered *agree*) and one respondent (17%) even answered *strongly agree*, one respondent (17%) answered disagree. However, the reason for doing so was not mentioned. The respondent who answered *strongly agree*, acknowledged that EA helps mitigate risk.

It was concluded that respondents generally thought draft KPI 3 was clear enough for use in practice. Moreover, only one respondent disagreed with draft KPI 3 being useful for measuring EA effectiveness and no modifications were suggested. Therefore, besides a renumbering, no modifications were made to draft KPI 3, which led to the current version of KPI 4, shown in Table 5.5.

Collaboration & Partnership

Collaboration and partnership during the decision-making process is about the subjective feeling of collaboration, both between internal business and IT stakeholders, and between internal and external stakeholders.

KPI 5: EA's influence on the ability of business and IT stakeholders to cooperate.

The current version of KPI 5, a subjective KPI, is shown in Table 5.6.

Table 5.6: Current version of KPI 5: EA's influence on the ability of business and IT stakeholders to cooperate.

KPI 5: EA's influence on the ability of business and IT stakeholders to cooperate
Question: Does EA [Not at all 1 2 3 4 5 Very much] (1) facilitate the strategic dialogue between business and IT, (2) promote IT as a driver or as "co-adaptive", and (3) promote IT as a partner in creating value? Ask of: Key business and IT stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key business and IT stakeholders giving negative ratings.

Note that, for EA to improve collaborations and partnerships between business and IT at enterprise level, IT should already have a certain place within the organization. To reduce the percentage of key stakeholders giving negative ratings, EA should focus on actively explaining the value IT could bring to business and the fact that nowadays IT is such an integral part of business.

KPI 5 originates from draft KPI 4. The evaluation survey resulted in the following feedback on draft KPI 4:

- Most respondents thought draft KPI 4 was clear enough for use in practice as the mode for this statement equaled 4 (67% answered *agree*) and no respondent answered anything lower than *neutral*. One respondent (17%) even answered *strongly agree*.
- The modes and variance in frequency for the statement suggesting draft KPI 4 was useful for measuring EA effectiveness were exactly the same as for the statement suggesting it was clear enough for use in practice. One respondent commented "I hope this KPI always is green!".

It was concluded that respondents generally thought draft KPI 4 was clear enough for use in practice and useful for measuring EA effectiveness. Therefore, apart from a renumbering, no modifications were made to draft KPI 4, which led to the current version of KPI 5, shown in Table 5.6.

KPI 6: EA's influence on stakeholders' ability to cooperate with external business partners.

The current version of KPI 6, a subjective KPI, is shown in Table 5.7.

Table 5.7: Current version of KPI 6: EA's influence on stakeholders' ability to cooperate with external business partners.

KPI 6: EA's influence on stakeholders' ability to cooperate with external business partners
Question: Does EA [Not at all 1 2 3 4 5 Very much] (1) lead to an increased understanding of the way external business partners are, and can be, linked to the enterprise, and (2) facilitate communication with external business partners? Ask of: Key stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key stakeholders giving negative ratings.

If the percentage of key stakeholders giving negative ratings is rather high, one could miss out on the opportunity to benefit from, for example, shared capabilities. To reduce the percentage of

key stakeholders giving negative ratings, EA should not only be concerned with describing the enterprise itself, but also look for possibilities beyond the enterprise's boundaries. Moreover, EA should actively get involved in discussions with external business partners.

KPI 6 originates from draft KPI 5, which focused on the extent to which EA influences stakeholders' understanding of the way external business partners are related to the enterprise, as well as on the extent to which EA facilitates cooperation with external business partners. The evaluation survey resulted in the following feedback on draft KPI 5:

- Although the mode for this statement equaled 4 (50% answered *agree*), not everyone was convinced that draft KPI 5 was clear enough for use in practice. One respondent (17%) answered *disagree* and two respondents (33%) answered *neutral*. The respondent who answered *disagree* argued that the way EA supports partnership needed to be elaborated on.
- Most respondents were indifferent about whether draft KPI 5 was useful for measuring EA effectiveness as the mode for this statement equaled 3 (50% answered *neutral*). However, there were still more respondents who thought draft KPI 5 was useful (33% answered *agree*) than respondents who thought draft KPI 5 was not useful for measuring EA effectiveness (17% answered *disagree*). The respondent who disagreed mentioned that, although EA principles may be about sourcing and EA views show how processes work in relation to external business partners, he did not think draft KPI 5 would help measure EA effectiveness.

It was concluded that draft KPI 5 needed clarification with regard to the way EA improves collaborations with external business partners. Respondents questioned for example, whether this kind of collaboration has to do with governance, standards or interfaces. However, measuring that kind of collaboration and, especially, EA's influence on that kind of collaboration, is difficult. It was argued that a KPI focused on collaboration and partnership with external business partners during the decision-making process should focus on the extent to which EA provides insight and facilitates communication. It is then not just about the way external business partners are linked to the enterprise, but also about the way they *can* be linked in the future. This led to the current version of KPI 6, shown in Table 5.7.

Speed & Agility

Speed and agility with regard to the decision-making process relates to the time needed to reach actual decisions. As one expert noted during the intermediate evaluations, objectively measuring this and linking it to EA's influence may be very difficult. However, as stakeholders often recognize whether EA is a bottleneck or speeds up the decision-making process, this can be measured subjectively.

KPI 7: EA's influence on the speed of decision making.

The current version of KPI 7, a subjective KPI, is shown in Table 5.8.

Table 5.8: Current version of KPI 7: EA's influence on the speed of decision making.

KPI 7: EA's influence on the speed of decision making
Question: Does EA affect [Slows down 1 2 3 4 5 Speeds up] the speed of the decision-making process?
Ask of: Key stakeholders involved in decision making at enterprise level.
KPI operationalization: The percentage of key stakeholders giving negative ratings.

In some cases, slowing down the decision-making process may be necessary if this leads to better decisions. However, unless slowing down the decision-making process is justified, this typically reduces the extent to which EA is considered effective. To reduce the percentage of key stakeholders giving negative ratings, EA should explain why it is sometimes necessary to slow down the decision-making process as it may lead to better decisions. Moreover, EA may have to avoid acting as a "police agent" rather than a mediator.

KPI 7 originates from draft KPI 6. The evaluation survey resulted in the following feedback on draft KPI 6:

- Most respondents were indifferent about whether draft KPI 6 was clear enough for use in practice as the mode for this statement equaled 3 (50% answered *neutral*). However, no respondent answered anything lower than neutral. Two respondents (33%) answered *agree* and one respondent (17%) even answered *strongly agree*.
- Not every respondent was convinced that draft KPI 6 was useful for measuring EA effectiveness. There were actually two modes for this statement: 3 (33% answered *neutral*) and 4 (33% answered *agree*). Moreover, one respondent (17%) answered *strongly disagree*, whereas another respondent (17%) answered *strongly agree*. This last respondent argued that EA compliance to EA principles and the "EA deviation process" should speed up decision making.

It was concluded that respondents thought draft KPI 6 was, to a certain extent, clear enough for use in practice and useful for measuring EA effectiveness. Although not every respondent was convinced of draft KPI 6's usefulness, no real changes were suggested. Moreover, it was argued that, as often EA is considered a bottleneck, a KPI like draft KPI 6 is needed to measure this negative effect. Therefore, apart from a renumbering, no modifications were made to draft KPI 6, which led to the current version of KPI 7, shown in Table 5.8.

EA Customer

In general, EA should help the EA customer during the decision-making process. Note that at enterprise level, EA stakeholders (and therefore also customers) are typically the CxO's [70].

KPI 8: EA's contribution during decision making.

The current version of KPI 8, a subjective KPI, is shown in Table 5.9.

Table 5.9: Current version of KPI 8: EEA's contribution during decision making.

KPI 8: EA's contribution during decision making
Question: Does EA [Not at all 1 2 3 4 5 Very much] help the EA customer during the decision-making process by (1) facilitating communication, (2) providing insight and oversight, and (3) providing input and advice?   Ask of: Key stakeholders involved in decision making at enterprise level.   KPI operationalization: The percentage of key stakeholders giving negative ratings.

As mentioned by experts during the input interviews, whenever EA is not considered helpful by those who have to benefit from it, it is not effective. To reduce the percentage of key stakeholders giving negative ratings, EA could try to be more proactive during the decision-making process. It is then not just about creating images or models, but about helping EA customers understand such models, as well as providing input based on them.

KPI 8 originates from draft KPI 7. The evaluation survey resulted in the following feedback on draft KPI 7:

- Although the mode for this statement equaled 4 (50% answered *agree*) and two respondents (33%) even answered *strongly agree*, one respondent (17%) strongly disagreed with the statement suggesting that draft KPI 7 was clear enough for use in practice. However, no comments were given as to why.
- All respondents thought draft KPI 7 was useful for measuring EA effectiveness as the mode for this statement equaled 4 (67% answered *agree*) and two respondents (33%) even answered *strongly agree*. Also, again, one respondent commented: "I hope this KPI always is green!".

It was concluded that respondents thought draft KPI 7 was, to a certain extent, clear enough for use in practice. No feedback was given on how to improve its clarity. Moreover, all respondents thought draft

KPI 7 was useful for measuring EA effectiveness. Therefore, apart from a renumbering, no modifications were made to draft KPI 7, which led to the current version of KPI 8, shown in Table 5.9.

5.3.6 Resulting Set of KPIs for EA Effectiveness Related to Decision-Making Results

Table 5.10 links KPIs to the categories shown in the FFEAM for the decision-making results focus area.

Table 5.10: KPIs linked to categories for the decision-making results focus area

Category	KPI
B-IT Alignment	KPI 9
Strategy Implementation	KPI 10
Investments	KPI 11
Program Portfolio	KPI 12

For this focus area as well, EA involvement is needed if EA is to be effective and for certain decision-making results to be attributed to EA. Note that the definition of enterprise-wide programs, which is used for some of the KPIs of this focus area, was given in Section 5.1 and can be found in the glossary.

B-IT Alignment

Business-IT alignment (B-IT alignment) can be an important category for the decision-making results focus area as well. In this regard, it is mostly about whether decisions made that are related to IT are aligned with those decisions made related to business.

KPI 9: Mapping between IT strategic goals and business strategic goals.

The current version of KPI 9, a mapping-based KPI, is shown in Table 5.11.

Table 5.11: Current version of KPI 9: Mapping between IT strategic goals and business strategic goals.

KPI 9: Mapping between IT strategic goals and business strategic goals
Mapping between: (1) IT strategic goals, and (2) business strategic goals. KPI operationalization: The percentages of (1) IT strategic goals not mapped to or competing with business strategic goals, and (2) business strategic goals not adequately supported by IT strategic goals.

In practice, in order to be able to map them to each other, business and IT strategic goals may need to be normalized [1] or translated to objectives that are typically one level lower. As KPI 9 is a mapping-based KPI, the Pareto principle could be used to determine the extent to which strategic business goals are adequately supported by strategic IT goals. Whenever business and IT strategic goals are not aligned, this could have serious effects in the future as business strategic goals may not be achieved. This problem needs to be handled during the decision-making process. EA should immediately react and re-engage in a strategic dialogue with business and IT.

KPI 9 originates from draft KPI 8, which was largely based on a metric by Cobit [80] (i.e., "Percentage enterprise strategic goals and requirements supported by IT strategic goals"). The evaluation survey resulted in the following feedback on draft KPI 8:

- Most respondents thought draft KPI 8 was clear enough for use in practice as the mode for

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[1] W. Heijstek

this statement equaled 4 (50% answered *agree*) and no respondent answered anything lower than *neutral*. One respondent (17%) even answered *strongly agree*.
- Most respondents thought draft KPI 8 was useful for measuring EA effectiveness as the mode for this statement equaled 4 (67% answered *agree*) and no respondent answered anything lower than *neutral*. Also, again, one respondent (17%) answered *strongly agree* and argued that this was a great draft KPI.

It was concluded that respondents generally thought draft KPI 8 was clear enough for use in practice and useful for measuring EA effectiveness. Therefore, apart from a renumbering, no modifications were made, which led to the current version of KPI 9, shown in Table 5.11.

Strategy Implementation

"Typically [..] strategy is executed through programs." [2]. In other words, strategy needs to be implemented and EA plays a crucial role here [2].

KPI 10: Mapping between enterprise-wide programs and business strategic goals.

The current version of KPI 10, a mapping-based KPI, is shown in Table 5.12.

Table 5.12: Current version of KPI 10: Mapping between enterprise-wide programs and business strategic goals.

KPI 10: Mapping between enterprise-wide programs and business strategic goals
Mapping between: (1) Enterprise-wide programs, both adopted (i.e., budgeted and planned for) and ongoing, and (2) business strategic goals.   KPI operationalization: The percentages of (1) enterprise-wide programs not mapped to or competing with business strategic goals, and (2) business strategic goals not adequately supported by enterprise-wide programs.

Again, the Pareto principle could be used to determine whether business strategic goals are adequately supported by enterprise-wide programs. If any of the percentages is rather high, this means that strategies set are not adequately implemented. EA should then immediately react and re-design its roadmap and portfolio. Programs may need to be terminated, changed or created. Therefore, EA should re-engage in the decision-making process.

KPI 10 originates from draft KPI 9. The evaluation survey resulted in the following feedback on draft KPI 9:

- Most respondents thought draft KPI 9 was clear enough for use in practice as the mode for this statement equaled 4 (67% answered *agree*) and no respondent answered anything lower than *neutral*. One respondent (17%) even answered *strongly agree*.
- All respondents thought draft KPI 9 was useful for measuring EA effectiveness as the mode for this statement equaled 4 (67% answered *agree*) and two respondents (33%) even answered *strongly agree*. One of them acknowledged that "every program should somehow support strategic goals".

It was concluded that respondents generally thought draft KPI 9 was clear enough for use in practice. Moreover, it was concluded that respondents thought draft KPI 9 was useful for measuring EA effectiveness. Therefore, apart from a renumbering, no modifications were made, which led to the current version of KPI 10, shown in Table 5.12.

Investments

Whether EA actually leads to better investments can be hard to measure. However, in some cases, EA's contribution by preventing erroneous decisions may be clear.

KPI 11: Erroneous decisions prevented thanks to EA.

The current version of KPI 11, a case-based KPI, is shown in Table 5.13.

Table 5.13: Current version of KPI 11: Erroneous decisions prevented thanks to EA.

KPI 11: Erroneous decisions prevented thanks to EA
Cases: (1) Inefficient or (2) ineffective decisions clearly prevented by EA (e.g., by suggesting better alternatives).   KPI operationalization: (1) The number of cases, and (2) their theoretical impact.

If the number of cases is low, it may just be because decision makers do not make inefficient or ineffective decisions. However, if these values are high, it shows that EA truly led to better decisions.

This KPI originates from draft KPI 11, which was essentially the same except for that it was about the actual impact of erroneous decisions. The evaluation survey resulted in the following feedback on draft KPI 11:

- There was quite some disagreement among respondents on whether draft KPI 11 was clear enough for use in practice. There were two modes for this statement: 2 (33% answered *disagree*) and 4 (33% answered *agree*). However, there were more respondents who thought draft KPI 11 was not clear enough than respondents who thought draft KPI 11 was clear enough for use in practice as one of the remaining respondents (17%) answered *strongly disagree* and the other (17%) answered *neutral*.
- The modes and variance in frequency for the statement suggesting draft KPI 11 was useful for measuring EA effectiveness were exactly the same as for the statement suggesting it was clear enough for use in practice. One respondent, who answered *strongly disagree* for both statements, argued that draft KPI 11 was "not measurable and not wise to measure". One of the two respondents who answered *disagree* for both statements argued that draft KPI 11 was just the inverse of draft KPI 10 (which was considered rejected). The other questioned the traceability of this KPI.

Although there was quite some disagreement on the clarity and usefulness of draft KPI 11, no improvements to this draft KPI were suggested. Nevertheless, a new version of draft KPI 11 was considered, addressing the *theoretical* impact of better alternatives as decisions may not have been implemented yet. This led to the current version of KPI 11, shown in Table 5.13.

Program Portfolio

Whereas program managers are responsible for the implementation of programs in terms of budget and time, EA is responsible for their content [68]. Therefore, EA has responsibility with regard to whether the established program portfolio sufficiently covers stakeholder goals. Both enterprise and domain stakeholder interests are important here.

KPI 12: Stakeholder satisfaction with the scope of the enterprise-wide program portfolio.

The current version of KPI 12, a subjective KPI, is shown in Table 5.14.

Table 5.14: Current version of KPI 12: Stakeholder satisfaction with the scope of the enterprise-wide program portfolio.

KPI 12: Stakeholder satisfaction with the scope of the enterprise-wide program portfolio
Question: Does the scope of the enterprise-wide program portfolio, including both adopted (i.e., budgeted and planned for) and ongoing enterprise-wide programs, sufficiently support [Not at all 1 2 3 4 5 Fully] stakeholder interests?   Ask of: Key stakeholders affected by enterprise-wide programs at enterprise and domain levels.   KPI operationalization: The percentage of key stakeholders giving negative ratings.

Negative ratings could imply, for example, that stakeholders' domain specific or area specific goals are not sufficiently supported by the enterprise-wide program portfolio. At some point, specific stakeholder interests may have to vail for enterprise-wider goals. However, stakeholders should be made aware of the reason why. Therefore, one would still expect the percentage of key stakeholders giving negative ratings to be low. If the percentage of key stakeholders giving negative ratings is rather high, EA should focus on the reason why. Is it, for example, because stakeholder interests are not in line with strategic goals, or because several domain-level stakeholders are not heard?

KPI 12 originates from draft KPI 12. The evaluation survey resulted in the following feedback on draft KPI 12:

- There was quite some disagreement among respondents on whether draft KPI 12 was clear enough for use in practice. There were two modes: 1 (33% answered *strongly disagree*) and 4 (33% answered *agree*). Moreover, one respondent (17%) answered *strongly agree* and another respondent (17%) answered *neutral*. Although one respondent who answered *strongly disagree* argued that the draft KPI needed clarification, he did not mention why or how.
- Most respondents thought draft KPI 12 was useful for measuring EA effectiveness as the mode for this statement equaled 4 (67% answered *agree*) and the remaining two respondents (33%) answered *neutral*.

It was concluded that, although draft KPI 12 was generally considered useful for measuring EA effectiveness, it still needed to be clarified for actual use in practice. Therefore, a new version of draft KPI 12 was considered, focused on the extent to which stakeholder interests are supported through the program portfolio, instead of on whether they are "covered". Moreover, a brief elaboration was needed on what the program portfolio entails. This led to the current version of KPI 12, shown in Table 5.14.

5.3.7 Resulting Set of KPIs for EA Effectiveness Related to Program Implementation

Table 5.15 links KPIs to the categories shown in the FFEAM for the program implementation focus area.

As shown in the FFEAM, EA use and compliance during program implementation is needed for EA to be effective here, or to be held responsible for certain results. The importance of compliance or conformance is also recognized by Foorthuis et al. [65] and Van der Raadt and Van Vliet [7]. Moreover, this calls for more elaborate architectures, certain governance processes, and greater maturity.

Table 5.15: KPIs linked to categories for the program implementation focus area

Category	KPI
Program Completion	KPI 13
Risk & Impact	KPI 14
Duplication	KPI 15
EA Customer	KPI 16

Program Completion

Although, as noted during the intermediate evaluations, EA may not be responsible for program completion in terms of budget and time, it could still play a big role here [68]. It may be difficult to prove EA's influence on budgets and time. One could focus on finding correlations between EA aspects and project success [68], or one could focus on stakeholders' views on whether EA helped complete enterprise-wide programs within budget and time. It can be argued that this last option is easier when certain data points are not available within an organization.

KPI 13: EA's contribution to program completion.

The current version of KPI 13, a subjective KPI, is shown in Table 5.16.

Table 5.16: Current version of KPI 13: EA's contribution to program completion.

KPI 13: EA's contribution to program completion
Question: Did EA [Not at all 1 2 3 4 5 Very much] help complete enterprise-wide programs, within (1) budget, and (2) time?
Ask of: Key stakeholders involved in enterprise-wide program implementation.
KPI operationalization: The percentage of key stakeholders giving negative ratings.

As it can be hard to objectively prove EA's contribution to program completion, the current version of KPI 13 is of the subjective type and focuses on stakeholder views. Although it may not be EA's responsibility to complete enterprise-wide programs within budget and time, it can be expected to help. If the percentage of key stakeholders giving negative ratings is rather high, it could mean that EA is considered a bottleneck or barrier during program implementation. EA should make sure that, whenever issues arise that call for extra time or budget, the reasons for doing so are explained clearly.

This KPI originates from draft KPI 13, which was about the extent to which enterprise-wide programs suffered due to EA-related issues. However, this draft KPI was modified quite drastically based on the following feedback from the evaluation survey:

- Although the mode for this statement equaled 3 (50% answered *neutral*), there were more respondents who thought draft KPI 13 was clear enough (33% answered *agree*) than respondents who thought draft KPI 13 was not clear enough (17% answered *disagree*) for use in practice. The respondent who answered *disagree* argued that "EA related issues is not concise enough". Another respondent seemed to refer to one of his previous comments about traceability.
- Although the mode for this statement equaled 3 (50% answered *neutral*), there were more respondents who thought draft KPI 13 was not useful (33% answered *strongly disagree*) than respondents who thought draft KPI 13 was useful (17% answered *agree*) for measuring EA effectiveness. One of the respondents who answered *strongly disagree* argued that EA should always help enterprise-wide programs and thus that delays or budget outruns because of an EA issue may still lead to a better result.

As rightfully noted by one of the respondents, "EA related issues" may lead to better results, even though they may result in a program running out of budget or time. A program may even need to be stopped if it is in the interest of the organization. As argued during the intermediate evaluations as well, EA may not be held responsible for program implementation in terms of budget or time. However, as one respondent mentioned in the evaluation survey: "EA is there to help Enterprise-wide programs". Therefore, it was argued that a KPI related to program completion should focus on the way EA helps complete enterprise-wide programs, as was also suggested during the input interviews. This is also more in line with Slot's research [68]. These insights led to the current version of KPI 13, shown in Table 5.16. Note that this may even be considered an entirely new KPI.

Risk & Impact

Risks can always occur during program implementation. As EA can be expected to foresee EA related risks and impacts it has some stake in the occurrence of such.

KPI 14: Occurrence of critical to business EA-related issues during enterprise-wide program implementation.

The current version of KPI 14, a case-based KPI, is shown in Table 5.17.

Table 5.17: KPI 14: Occurrence of critical to business EA-related
issues during enterprise-wide program implementation.

KPI 14: Occurrence of critical to business EA-related issues during enterprise-wide program implementation
Cases: EA-related issues (e.g., domain-integration problems) that limit ongoing business operations during enterprise-wide program implementation.   KPI operationalization: (1) The number of cases, and (2) their impact.

As shown, EA-related risks include, for example, domain-integration problems. If domain-specific IT systems need to be integrated, but this appears to be hardly doable mid-program, this may be something EA should have foreseen. Note that a low occurrence of such issues does not prove EA's effectiveness here. If these values are large, i.e., it happens a lot that EA-related issues limit business operations, it sais something about how ineffective EA is at identifying and mitigating risks. However, if these values are low, it is hard to prove that this is thanks to EA.

KPI 14 originates from draft KPI 15, which was about the occurrence of EA-related incidents that prevent the business from operating during enterprise-wide program implementation. The evaluation survey resulted in the following feedback on draft KPI 15:

- Although the mode for this statement equaled 3 (50% answered *neutral*), there were more respondents who thought draft KPI 15 was clear enough (33% answered *agree*) than respondents who thought draft KPI 15 was not clear enough (17% answered *strongly disagree*) for use in practice. However, although there was someone who answered *strongly disagree*, no respondent answered *strongly agree*. Note that even though he answered *agree*, one of the respondents argued that this draft KPI needed "to be more concise".
- There was quite some disagreement among respondents on whether draft KPI 15 was useful for measuring EA effectiveness. This is evident from the fact that there were three modes for this statement: 1 (33% answered *strongly disagree*), 3 (33% answered *neutral*), and 4 (33% answered *agree*). One of the respondents who answered *strongly disagree* seemed to argue that EA-related issues may not occur during program implementation.

A new version of draft KPI 15 was considered, focused on EA-related issues occurring during program implementation that limit business operations, as opposed to actually prevent them. Moreover, an example of such an issue was needed. This led to the current version of KPI 14, shown in Table 5.17.

Duplication

As EA is about crossing domain boundaries, it should have a good overview of duplication within the enterprise-wide program portfolio. This could lead to less unintentional duplication.

KPI 15: Unintentional duplication within the enterprise-wide program portfolio.

The current version of KPI 15, a percentage-based KPI, is shown in Table 5.18.

Table 5.18: Current version of KPI 15: Unintentional duplication
within the enterprise-wide program portfolio.

KPI 15: Unintentional duplication within the enterprise-wide program portfolio
Determine: Number of programs or projects within the enterprise-wide program portfolio unintentionally aiming for something very similar to other programs, projects, or already existing solutions.   KPI operationalization: As a percentage of the total number of programs or projects within the enterprise-wide program portfolio.

Unintentional duplication of programs or projects can be costly and is very inefficient. If duplication

within the enterprise-wide program portfolio is found, the programs or projects in question may need to be terminated or merged. In some situations, continuation may be considered, depending on the kind of projects or programs and the state they are in. Note that for this KPI to work, all programs and projects that could be in the interest of "enterprise-wide structures, processes, systems and procedures" [7] should be visible at enterprise-level.

KPI 15 originates from draft KPI 16, which was about duplication within the enterprise-wide program portfolio in general. The evaluation survey resulted in the following feedback on draft KPI 16:

- Although the mode for this statement equaled 4 (50% answered *agree*), not all respondents were convinced that draft KPI 16 was clear enough for use in practice. Two respondents (33%) answered *neutral* and one respondent (17%) answered *disagree*.
- Although the mode for this statement equaled 4 (50% answered *agree*), not all respondents were convinced that draft KPI 16 was useful for measuring EA effectiveness. One respondent (17%) answered *strongly disagree* and argued that, as duplication could be something that is intended, it is not wise to use this for measuring EA effectiveness. One respondent (17%) answered *disagree* and acknowledged the difficulty of this draft KPI. Moreover, this respondent argued that there may be overlap resulting from the "deviation process". Finally, one respondent (17%) answered *neutral* and argued that, as a precondition, the "portfolio process should be aligned with EA".

Respondents rightfully argued that duplication could be intended and that this was not accounted for in draft KPI 16's description. Therefore, the focus needed to shift to *unintentional* duplication. This insight led to the current version of KPI 15, shown in Table 5.18. Note that the alignment of the portfolio process with EA as a precondition is in line with the idea of compliance as a requirement, which is accounted for in the FFEAM.

EA Customer

In general, as was the case for the decision-making process, EA should help the EA customer during program implementation. EA stakeholders (and therefore EA customers) at this level include, for example, domain owners and domain architects [70].

KPI 16: EA's contribution during enterprise-wide program implementation.

The current version of KPI 16, a subjective KPI, is shown in Table 5.19.

Table 5.19: Current version of KPI 16: EA's contribution during enterprise-wide program implementation.

KPI 16: EA's contribution during enterprise-wide program implementation
Question: Does EA [Not at all 1 2 3 4 5 Very much] help the EA customer during enterprise-wide program implementation by (1) facilitating communication, (2) providing insight and oversight, (3) providing input and advice, and (4) providing directions?
Ask of: Key stakeholders involved in enterprise-wide program implementation.
KPI operationalization: The percentage of key stakeholders giving negative ratings.

Whenever EA is not considered helpful by those who have to benefit from it, it will not be considered effective. To reduce the percentage of key stakeholders giving negative ratings, EA should focus on being more proactive during program implementation. This means that EA may have to step down every now and then.

KPI 16 originates from draft KPI 17. The evaluation survey resulted in the following feedback on draft KPI 17:

- Most respondents thought draft KPI 17 was clear enough for use in practice as the mode for

this statement equaled 4 (50% answered *agree*) and no respondent answered anything lower than *neutral*. One respondent (17%) even answered *strongly agree*. Two respondents mentioned the similarity with draft KPI 7. One of the respondents who answered *neutral*, argued that this draft KPI was about four questions instead of one.

- All respondents thought draft KPI 17 was useful for measuring EA effectiveness as the mode for this statement equaled 4 (67% answered *agree*) and two respondents (33%) even answered *strongly agree*.

Four questions were embedded within draft KPI 17. However, they were all related to EA's overall contribution during program implementation. Moreover, the difference with draft KPI 7 was that draft KPI 17 was about EA's general contribution during program implementation whereas draft KPI 7 was about EA's general contribution during the decision-making process. Apart from a renumbering, no modifications were made to draft KPI 17, thus leading to the current version of KPI 16, shown in Table 5.19.

5.3.8   Resulting Set of KPIs for EA Effectiveness Related to Program Results

Table 5.20 links KPIs to the categories shown in the FFEAM for the program results focus area.

Table 5.20: KPIs linked to categories for the program implementation focus area

Category	KPI
Integration	KPI 17
IT Functionality	KPI 18
Short-term Solutions	KPI 19
Complexity	KPI 20, 21
Claims met	KPI 22

An important definition for the program results focus area is that of a critical system:

Critical system: Distinct combination of business, information, applications and infrastructure providing a certain critical service.

During the evaluation session, respondents put emphasis on the inclusion of business in this definition.

Again, as shown in the FFEAM, EA use and compliance and increased architecture, governance, and maturity are required for EA to be effective here, or to be held responsible for certain program results.

Integration

As argued by Ross, Weill, and Robertson [5], one of the key dimensions EA influences is that of integration, which "links the efforts of organizational units through shared data". As argued during the evaluation session, it should then be about integration in terms of both business and IT.

KPI 17: Integration of critical systems with other critical systems.

The current version of KPI 17, a percentage-based KPI, is shown in Table 5.21.

Table 5.21: Current version of KPI 17: Integration of critical systems with other critical systems.

KPI 17: Integration of critical systems with other critical systems
Determine: Number of critical systems insufficiently communicating with other critical systems.

KPI operationalization: As a percentage of the total number of critical systems.

Critical systems that are not sufficiently integrated may cause business inefficiency. Ways of sharing data that are optimal for the organization should be found. Several ways of integration exist. On a technical level, for example, one could use direct links or an ESB. Note that one could also choose to combine critical systems or replace them by one larger critical system (e.g., introduction of an ERP application).

KPI 17 originates from draft KPI 18 which was about the extent to which critical systems were insufficiently linked with other critical systems. The evaluation survey resulted in the following feedback on draft KPI 18:

- Although the mode for this statement equaled 4 (50% answered *agree*), and one respondent (17%) even answered *strongly agree*, not all respondents were convinced that draft KPI 18 was clear enough for use in practice. One respondent (17%) answered *disagree* and argued that it was due to the "lack of definition of critical systems". One respondent (17%) even answered *strongly disagree* and argued that it was not clear what was meant by "insufficiently linked".
- Although the mode for this statement equaled 4 (50% answered *agree*), there were as many respondents who thought draft KPI 18 was useful (i.e., *agree* or *strongly agree*) as there were respondents who thought draft KPI 18 was not useful (i.e., *disagree* or *strongly disagree*) for measuring EA effectiveness. Two respondents (33%) answered *disagree*. One of them argued that it was not clear how EA is involved in connecting critical systems. The other argued that this draft KPI may have been more risk related. Moreover, one respondent (17%) even answered *strongly disagree* and argued that more connections would oppose the concept of a service bus.

Although critical systems may be defined, respondents rightfully argued that it was not clear what kind of linkage between critical systems was meant in the description of draft KPI 18 and that this needed clarification. Linkage in this sense is actually about whether critical systems are able to adequately exchange information, i.e., to communicate. This could then mean communication through an ESB as well. This is accounted for in the current version of KPI 17, shown in Table 5.21.

IT Functionality

As EA needs to work with program managers and should focus on the content of programs [68], it has a stake in whether IT functionality resulting from enterprise-wide program implementations is eventually in line with what business stakeholders expected.

KPI 18: Business stakeholder satisfaction with IT functionality resulting from enterprise-wide program implementation.

The current version of KPI 18, a subjective KPI, is shown in Table 5.22.

Table 5.22: Current version of KPI 18: Business stakeholder satisfaction with IT functionality resulting from enterprise-wide program implementation.

KPI 18: Business stakeholder satisfaction with IT functionality resulting from enterprise-wide program implementation
Question: Level of satisfaction [Very dissatisfied 1 2 3 4 5 Very satisfied] with IT functionality resulting from enterprise-wide program implementation?   Ask of: Key business stakeholders at enterprise and domain levels.   KPI operationalization: The percentage of key business stakeholders giving negative ratings.

A low satisfaction level could mean that the program delivered what it should, but that it did not align with stakeholder interests. It could also mean that the program did not deliver what it should have. To reduce the percentage of key business stakeholders giving negative ratings, EA should focus on the cause of the dissatisfaction, e.g., did enterprise-wide programs deliver what was agreed? Also, EA should engage more with solution architects and lower level architects that operate within the frames set by EA.

KPI 18 originates from draft KPI 20, which was modified quite drastically based on the following feedback from the evaluation survey:

- Although the mode for this statement equaled 4 (67% answered *agree*), not every respondent was convinced that draft KPI 20 was clear enough for use in practice. One respondent (17%) answered *disagree* and one respondent (17%) even answered *strongly disagree*.
- Some disagreement existed among respondents on whether draft KPI 20 was useful for measuring EA effectiveness. The mode for this statement equaled 2 (50% answered *disagree*). Respondents who answered *disagree* argued that this may be an overall IT or IT service management draft KPI, and that EA does not always define the outcome. One respondent (17%) even answered *strongly disagree*. Note, however, that two respondents (33%) answered *agree*.

Respondents rightfully argued that draft KPI 20 was actually about IT in general. This may be hard to link to EA as it is subject to multiple influences. As argued by Slot [68], however, EA is still somehow responsible for the content that is delivered by programs. Thus, EA may still be held responsible for whether IT solutions resulting from enterprise-wide programs sufficiently support the business. These insights led to the current version of KPI 18 shown in Table 5.22. Note that this required the related category to change from "User satisfaction with IT" to "IT functionality".

Short-term Solutions

As became evident from the input interviews, EA is often considered long-term, but should also be concerned with shorter-term aspects.

KPI 19: Existence of short-term focused critical systems.

The current version of KPI 19, a percentage-based KPI, is shown in Table 5.23.

Table 5.23: Current version of KPI 19: Existence of short-term focused critical systems.

KPI 19: Existence of short-term focused critical systems
Determine: Number of short-term focused critical systems posing a serious threat to the achievement of longer-term strategic goals.   KPI operationalization: As a percentage of the total number of critical systems.

If the percentage of short-term focused critical systems posing a serious threat to the achievement of longer-term strategic goals is rather high, these goals may not be reached in time. Reorganizations, updates, or new critical systems may need to be considered. Of course, great care should be taken that proposed solutions are not short-term focused themselves.

KPI 19 originates from draft KPI 21, which was about the existence of short-term focused critical systems (i.e., not in line with longer-term strategic goal). The evaluation survey resulted in the following feedback on draft KPI 21:

- There seemed to be quite some disagreement among respondents on whether draft KPI 21 was clear enough for use in practice. There were two modes: 3 (33% answered *neutral*) and 4 (33% answered *agree*). However, one respondent (17%) answered *disagree* and one respondent (17%) even answered *strongly disagree*.
- Although one respondent (17%) answered *agree*, most respondents were not convinced that draft KPI 21 was useful for measuring EA effectiveness. The mode for this statement equaled

2 (50% answered *disagree*) and two respondents (33%) answered *neutral*. One respondent, who answered *disagree* for both statements, argued that it does not immediately mean that EA has failed and that you should look at how long EA has already existed. Another respondent argued that EA could actually recommend short-term solutions. Finally, one of the respondents argued that this can happen "due to the deviation process".

Respondents rightfully argued that sometimes, short-term solutions are preferred or prioritized. However, it was argued that, as EA is about framing and guiding the organization towards achieving longer-term strategic goals, such solutions should not oppose these goals. They should not pose a *serious threat* to achieving longer-term strategic goals. This led to the current version of KPI 19 shown in Table 5.23.

Complexity

Complexity may mean different things in different contexts. Forms of complexity EA may influence are duplication and reuse of critical systems, as EA is about crossing boundaries.

KPI 20: Critical systems unintentionally having similar or closely related functionalities.

The current version of KPI 20, a percentage-based KPI, is shown in Table 5.24.

Table 5.24: Current version of KPI 20: Critical systems unintentionally having similar or closely related functionalities.

KPI 20: Critical systems unintentionally having similar or closely related functionalities
Determine: Number of critical systems unintentionally providing services similar or closely related to one or more other critical systems.   KPI operationalization: As a percentage of the total number of critical systems.

Having a duplication of services or services delivered by distinct critical systems that could be jointly delivered by one bigger critical system could be costly and may result in unnecessary overhead. EA should look for ways in which critical systems providing similar or closely related services could be combined.

KPI 20 originates from draft KPI 22, which was about critical systems having similar or closely related functionalities in general. The evaluation survey resulted in the following feedback on draft KPI 22:

- Although the mode for this statement equaled 4 (50% answered *agree*), not every respondent was convinced that draft KPI 22 was clear enough for use in practice. One respondent (17%) answered *strongly disagree*, one respondent (17%) answered *disagree*, and one respondent (17%) answered *neutral*.
- The mode and variance in frequency for the statement suggesting draft KPI 22 was useful for measuring EA effectiveness were exactly the same as for the statement suggesting it was clear enough for use in practice. One respondent, who answered *strongly disagree* for both statements, argued that EA cannot be held accountable for complexity. Another respondent, who answered *disagree* for both statements, again pointed to the fact that, especially at the early stages of EA, it does not immediately mean EA has failed. Finally, one of the respondents, who answered *agree* for both statements, argued that this was a draft KPI for both EA and Application Life cycle Management.

Respondents rightfully argued that EA cannot directly be held responsible for complexity that already existed and that it may depend on how long EA has already existed. Note that this is in line with the idea that EA maturity and governance are increasingly required for EA to be held responsible for certain aspects. Therefore, this is to a certain extent accounted for in the FFEAM. Also, it was argued that one of the goals of EA may be to fight complexity and that therefore, this at some point does become a responsibility of EA. Finally, even though respondents did not

mention this, it was argued that a new version of draft KPI 20 was needed, focused on *unintentional* duplication and similarity. These led to the current version of KPI 20 shown in Table 5.24.

KPI 21: Reuse of critical systems.

The current version of KPI 21, a percentage-based KPI, is shown in Table 5.25.

Table 5.25: Current version of KPI 21: Reuse of critical systems.

KPI 21: Reuse of critical systems
Determine: Number of critical systems used by only one domain at most.
KPI operationalization: As a percentage of the total number of critical systems.

A lack of reuse may indirectly imply duplication. Moreover, it implies that critical systems operate in a really isolated manner. EA should continuously look for ways in which already existing critical systems can be reused.

KPI 21 originates from draft KPI 23: "Critical systems used by more than one domain". The evaluation survey resulted in the following feedback on draft KPI 23:

- There was quite some disagreement among respondents on whether draft KPI 23 was clear enough for use in practice. Although the mode for this statement equaled 3 (33% answered *neutral*), all other options were selected exactly once.
- Most of the respondents were not convinced that draft KPI 23 was useful for measuring EA effectiveness as the mode for this statement equaled 2 (50% answered *disagree*), two respondents (33%) answered *neutral* and only one respondent (17%) answered *agree*. As a matter of fact, every respondent who answered *disagree* seemed to think draft KPI 23 labeled reuse a bad thing, which they questioned. The respondent who answered *neutral* again argued that it depends on how long the EA program has existed.

Generally, reuse of critical systems is considered a good thing. This was also the intention of draft KPI 23. However, the structure of that draft KPI differed from the structure of other draft KPIs and seemed to reflect the reuse of critical systems as a bad thing. A new version of draft KPI 23 was considered, reflecting reuse as a good thing. Its name and operationalization were changed, which led to the current version of KPI 21 shown in Table 5.25.

Claims met

Eventually, if EA makes certain claims (e.g., cost reduction due to reuse of existing applications), these claims need to be met. In some cases, it can be very clear whether claims are met or not met.

KPI 22: Enterprise-wide programs meeting EA-related claimed benefits.

Table 5.26: Current version of KPI 22: Enterprise-wide programs meeting EA-related claimed benefits.

KPI 22: Enterprise-wide programs meeting EA-related claimed benefits
Cases: Enterprise-wide programs where EA-related claimed benefits (e.g., reduced (IT) costs thanks to reuse, targeted cost savings achieved) are (1) met, or (2) not met.
KPI operationalization: (1) The number of cases, and (2) their impact.

There are those few cases where EA's contribution is clear [74]. In other cases, EA's contribution may not be clear, but if EA initiated a program based on, for example, the promise of reduced costs, then EA could actually be held accountable for the extent to which these costs are reduced. Thus, it was be argued that KPI 22 should be operationalized on a per-case basis. Any case that shows how EA led to certain claimed benefits, as well as the (actual) impact of those benefits may

be related to the effectiveness of EA.

KPI 22 originates from draft KPI 25. The evaluation survey resulted in the following feedback on draft KPI 25:

- Although the mode for this statement equaled 4 (67% answered *agree*), not all respondents were convinced that draft KPI 25 was clear enough for use in practice. One respondent (17%) answered *disagree* and argued that it may be hard to operationalize this draft KPI. One respondent (17%) even answered *strongly disagree*.
- Most respondents thought draft KPI 25 was useful for measuring EA effectiveness as the mode for this statement equaled 4 (83% answered *agree*) and the remaining respondent (17%) answered *neutral*.

It was concluded that, although respondents generally thought draft KPI 25 was useful for measuring EA effectiveness, the draft KPI itself needed some clarification to make it easier to operationalize. Therefore, another example of an EA-related claimed benefit, i.e., general targeted cost savings achieved, was added. For example, EA may have advised to implement a certain solution as it would be cheaper. This claim then needs to be met. This led to the current version of KPI 22 shown in Table 5.26.

Chapter 6

Discussion

In this chapter, first, the proposed solution is evaluated against its design requirements. Then, both the research approach and the proposed solution are evaluated against the Design Science Guidelines by Hevner et al. [26].

6.1   Achievement of Design Requirements

Below, the proposed solution, i.e., the FFEAM in combination with the proposed set of KPIs for EA effectiveness, are assessed against the design requirements as stated in Section 2.2.

Requirement 1:   It should be clear what areas practitioners should focus on when measuring EA effectiveness.

The FFEAM shows that two levels can be distinguished at which EA should be effective: decision-making level, and program level. Moreover, metrics at these levels could be categorized into four focus areas on which practitioners should focus when measuring EA effectiveness: the decision-making process, decision-making results, program implementation, and program results.

Requirement 2:   It should present KPIs for EA effectiveness.

The FFEAM can be implemented through 22 KPIs for EA effectiveness that are considered key when measuring EA effectiveness. These KPIs are divided over the four focus areas and are of a subjective, mapping-based, case-based, or percentage-based type.

Requirement 3:   Practitioners should be able to choose which KPIs are applicable for measuring the effectiveness of their EA.

The FFEAM shows that the choice of KPIs should be based on the business goals and strategy, as well as on stakeholder interests. Moreover, each KPI is assigned a category, making it easier to relate it to these aspects.

Requirement 4:   The design in general should be clear enough for use in practice.

Evaluation results with regard to this point look promising. In the evaluation survey, KPIs have explicitly been evaluated on whether they were clear enough for use in practice and have been modified based on the results. Note, however, that the FFEAM has not yet been validated in a case study.

6.2   Assessment against Design Science Guidelines

As has been done by authors who use design science research in the field of EA evaluation [27, 28], this section deals with the assessment of this research against the seven guidelines set by Hevner et al. [26]. The same style that is used by Van Steenbergen [1] is adopted.

Guideline 1, Design as an Artifact: "Design-science research must produce a viable artifact in the form of a construct, a model, a method or an instantiation" [26].

Throughout this research, the goal was to arrive at a clear overview of KPIs that can be used to measure EA effectiveness. The solution consists of two complementary and inseperable designs: the FFEAM and a corresponding set of 22 KPIs, which together form a model for measuring EA effectiveness.

Guideline 2, Problem Relevance: "The objective of design-science research is to develop technology-based solutions to important and relevant business problems" [26].

The FFEAM and its accompanying set of KPIs allow for practitioners to measure EA effectiveness. As explained in Chapter 2, measuring EA effectiveness is often considered a difficult task. The FFEAM and its accompanying set of KPIs allow for architects and their customers to regain focus on what EA should actually lead to. Thus, it addresses the identified problem by focusing on actual EA relevance.

Guideline 3, Design Evaluation: "The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods" [26].

With regard to design evaluation, a descriptive approach was adopted as for now the design appears to be evaluated using "informed argument" [26], based on knowledge gained from literature and expert views. The biggest part of the evaluation included a survey on a set of draft KPIs, where every expert had to answer whether these KPIs were *clear enough for use in practice* and *useful for measuring EA effectiveness*. KPIs were then modified based on this evaluation feedback. A next step would be to further improve the FFEAM and its accompanying KPIs through observational case studies. However, due to resource constraints, this is left for future research.

Guideline 4, Research Contributions: "Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies" [26].

To the author's knowledge, no research has focused on establishing true KPIs for EA effectiveness and relating them in a clear way yet. The FFEAM and its accompanying set of KPIs shift the focus of EA measurements towards actual *EA effectiveness*. It can be argued that, as the framework and KPIs have not been tested in a real environmental setting, this research mainly adds to the current knowledge base [26]. A more elaborate overview of the main research contributions is given in the conclusion of this research, Chapter 7.

Guideline 5, Research Rigor: "Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact" [26].

This research is assessed against rigor by focusing on the limitations of the chosen research methods.

In its early phases, this research was mainly concerned with gaining knowledge through existing research and analysis methods (semi-structured literature review, input survey, interviews, transcription, coding, evaluation methods).

The FFEAM is largely based on the analysis of codes retrieved from expert interviews. A key step, although arguably subjective, was the construction of a visualization graph, which led to new insights and therefore the identification of four focus areas for KPIs for EA effectiveness. These KPIs are based on a set of metrics retrieved from both literature and expert opinions. The main goal of the literature review was to gain insight into existing methods and metrics, both from peer-reviewed articles and from practitioner papers. This goal is achieved by including a broad set of both academic and grey literature in this research. The use of Google and Google Scholar for the semi-structured literature review, however, may give rise to critic in terms of the extent to which you can make sure all relevant papers are covered and whether it can be repeated. Moreover, free full text versions for papers were retrieved solely through Google, Google Scholar, and Leiden University. This search process may not have been exhaustive, which may have led to relevant papers being left out, because no free full text version could be found at that

moment [1]. An overview of papers for which no full text could be found during the structured part of the literature review can be found in Appendix B. Nevertheless, it is believed that the overview of methods and metrics that can be used to measure EA effectiveness given in this thesis document, forming part of the input for the FFEAM, is quite extensive.

Interviews have been held with 18 experts. These may have, to a certain extent, been subject to interviewer bias, as knowledge gained from previous interviews and literature was brought in at times. This bias however is limited through the use of a pre-determined list of questions. Moreover, a coding technique was adopted to limit bias during the analyses.

During the evaluations, the focus was on relevance. Intermediate evaluation sessions, although resulting in relevant feedback, were rather informal. The evaluation session and especially the evaluation survey, however, were more formal and structured.

Experts approached for the interviews and evaluations include consultants, researchers, as well as actual practitioners. As pointed out during the evaluations, even though these experts may have focused on what is expected from EA, the actual customers of EA were missing.

Finally, the FFEAM and its accompanying set of KPIs have not been applied in practice yet. Evaluations are done on a theoretical basis, therefore missing the "Demonstration" step that is part of design science research [30].

Note that every step in the design and evaluation of the FFEAM and its KPIs is described in this thesis document. Especially design choices and feedback analyses are important as "variability is expected in qualitative research" [86].

Guideline 6, Design as a Search Process: "The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment" [26].

That design in this research represented a search process became evident from the fact that every evaluation step led to new insights, thus leading to the exclusion and modification of earlier ideas or proposed solutions. This iterative process of design and evaluations led to a solution that greatly satisfied the design requirements outlined in Section 2.2.

Guideline 7, Communication of Research: "Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences" [26].

This research resulted in the creation of an article on the FFEAM and its accompanying set of KPIs for EA effectiveness. This article is submitted to the "Journal of Enterprise Architecture". Feedback is expected in November, 2014 [87].

The FFEAM will be presented at the "Landelijk Architectuur Congres 2014", a Dutch national architecture congress that is often visited by many practitioners in the field of architecture [88]. This will take place on November 26-27, 2014.

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[1]This was the case for, for example, a paper by Espinosa, Fong Boh and DeLone [85], which was nevertheless found at the end stage of this research

Chapter 7

Conclusion

In this chapter, the main contributions of this research are outlined. Furthermore, recommendations for future research are made, partly based on the previous discussion.

7.1   Main Contributions

This research focused on measuring EA effectiveness, something that is generally deemed difficult to do. This led to the following contributions:

- A broad overview of methods and approaches that can be used to measure EA effectiveness is given. These methods and approaches originate from both academic and grey literature.
- An extensive list of metrics that can be used to measure EA effectiveness is given. These metrics also originate from academic and grey literature, as well as from interviews with several experts in the field.
- A set of *KPIs for EA effectiveness* is given, based on the metrics and context gained from both literature and interviews. Although KPIs should still be based on the organization's business goals and strategy, and stakeholder interests, they represent those metrics that are deemed the most critical for determining EA's success.
- The Focus Framework for Enterprise Architecture Measurements (FFEAM) is presented. This framework shows that focus areas in which EA effectiveness can be measured are: decision-making process, decision-making results, program implementation, and program results. Each KPI for EA effectiveness is linked to one of these focus areas.

This research focused on measuring EA effectiveness, something that is generally deemed difficult to do. The proposed framework and set of KPIs for EA effectiveness are based on both literature and expert views, and are the result of several evaluations with experts and subsequent modifications.

Our proposed solution truly shifts the focus of EA value measurements to EA effectiveness and its most important focus areas. We argue that eventually, every EA practice should be able to prove the extent to which it is effective.

7.2   Recommendations for Future Research

The methods and approaches outlined in Section 4.1.2 mainly focus on benefit areas and measurement frameworks. The actual processes that need to be put in place to be able to execute measurements, although part of maturity, may be important as well. Future research could focus on establishing the processes and governance that are needed for measuring EA effectiveness.

Instead of determining EA effectiveness from an architecture point of view, future research could also focus on what EA customers actually expect from EA. Although KPIs already focus on customer sat-

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isfaction, these are based on suggestions and indications by experts other than the actual customers themselves.

As mentioned during the evaluation session and in line with research by Plessius, Slot, and Pruijt [50], future studies could focus on ways to link the proposed KPIs to actual Balanced Scorecard areas, focusing on financial aspects and thus monetary value as well. This then could eventually be done by linking weights and percentages to the proposed KPIs.

Finally, future research could focus on further evaluating the most recent set of KPIs in practice, i.e., through one or more case studies. This way, the set of KPIs, as well as the FFEAM itself, can be further improved. This would be especially value-adding for, for example, KPI 3, which was newly added based on the evaluation, and KPIs 13, 18 and 21, which are the results of quite large modifications. Also interesting would be to find out more about the context in which KPIs can be used, e.g., to which maturity levels they correspond. Finally, such an approach should also lead to solid examples of how KPIs are eventually linked to several business goals and strategies, and stakeholder interests.

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[1]To make sure the right versions of papers are referenced: Reaccessed means that papers have been accessed before, but that the URL was checked at that date. A doi is given if it was clearly linked to a paper, i.e., it was in the document itself or it could be found using the source url. The citation form is then retrieved from the doi link. If no doi is available, a direct url is given. Generally, recommended citation forms are adopted. If no recommended citation form is given, only information that was clearly evident is included.

List of Figures

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Glossary

Critical system Distinct combination of business, information, applications and infrastructure providing a certain critical service.

Decision-making process Decision making on enterprise-level, is about decision making at the enterprise level and includes building a vision and strategy, formulating and evaluating scenarios, and selecting alternatives and scenarios [7, 68, 82].

Decision-making result *See also: decision-making process* Goals, strategies and program plans resulting from the decision-making process.

EA effectiveness The degree to which EA "is successful in producing a desired result" (Oxford dictionaries' definition of effectiveness [17] applied to EA).

EA involvement Involvement of the EA function in decision making on enterprise level.

EA maturity "The degree of development of the architectural practice, i.e. the whole of activities, responsibilities and actors involved in the development and application of EA within the organization" [1].

EA quality The actual quality of EA products and services [12]. Has more to do with such things as internal EA processes and documentation.

Enterprise architecture A set of artifacts representing the design of an enterprise's business and IT, that alongside a set of principles, roles and processes, direct that enterprise towards a desired future state.

Enterprise-wide program Program "in the interest of the enterprise-wide structures, processes, systems and procedures" [7].

KPIs for EA effectiveness *See also EA effectiveness* Metrics focusing on those effects of EA that are the most critical for determining its success (Parmenter's definition of key performance indicators [24] applied to EA effectiveness).

Program implementation *See also enterprise-wide program* Carrying out enterprise-wide program plans. This focus area is mainly concerned with the way changes are implemented through programs.

Program result *See also enterprise-wide program and program implementation* Results of enterprise-wide programs. This focus area is concerned with the actually delivery of programs and the subsequent effects in operation, i.e. what programs lead to.

Acknowledgements

The Software Improvement Group (SIG) is a Dutch consultancy focused on translating "detailed technical findings concerning software systems into actionable advice for upper management" [89].

Appendix A

Existing Models on EA Benefits
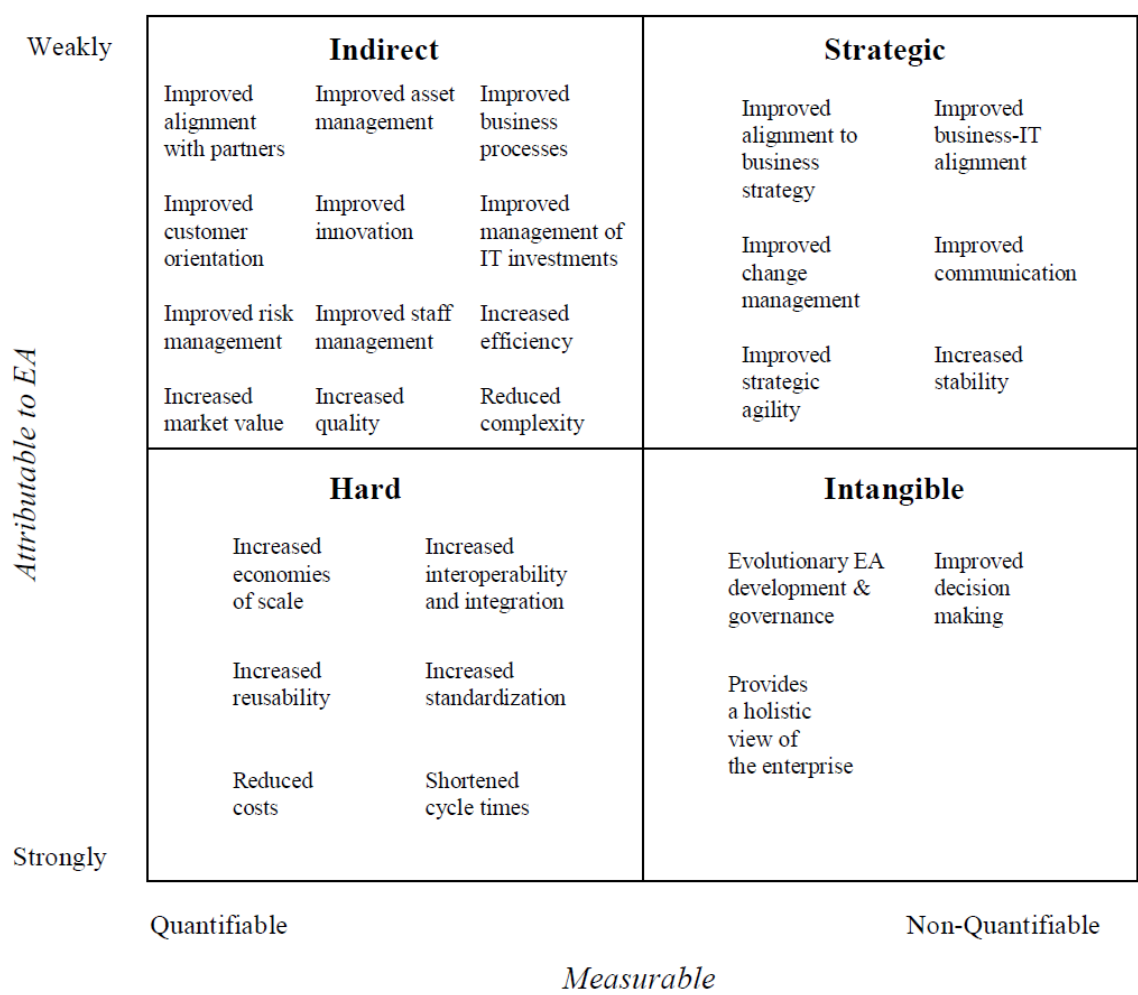
Figure A.1: Niemi's [21] categorization of EA benefits.
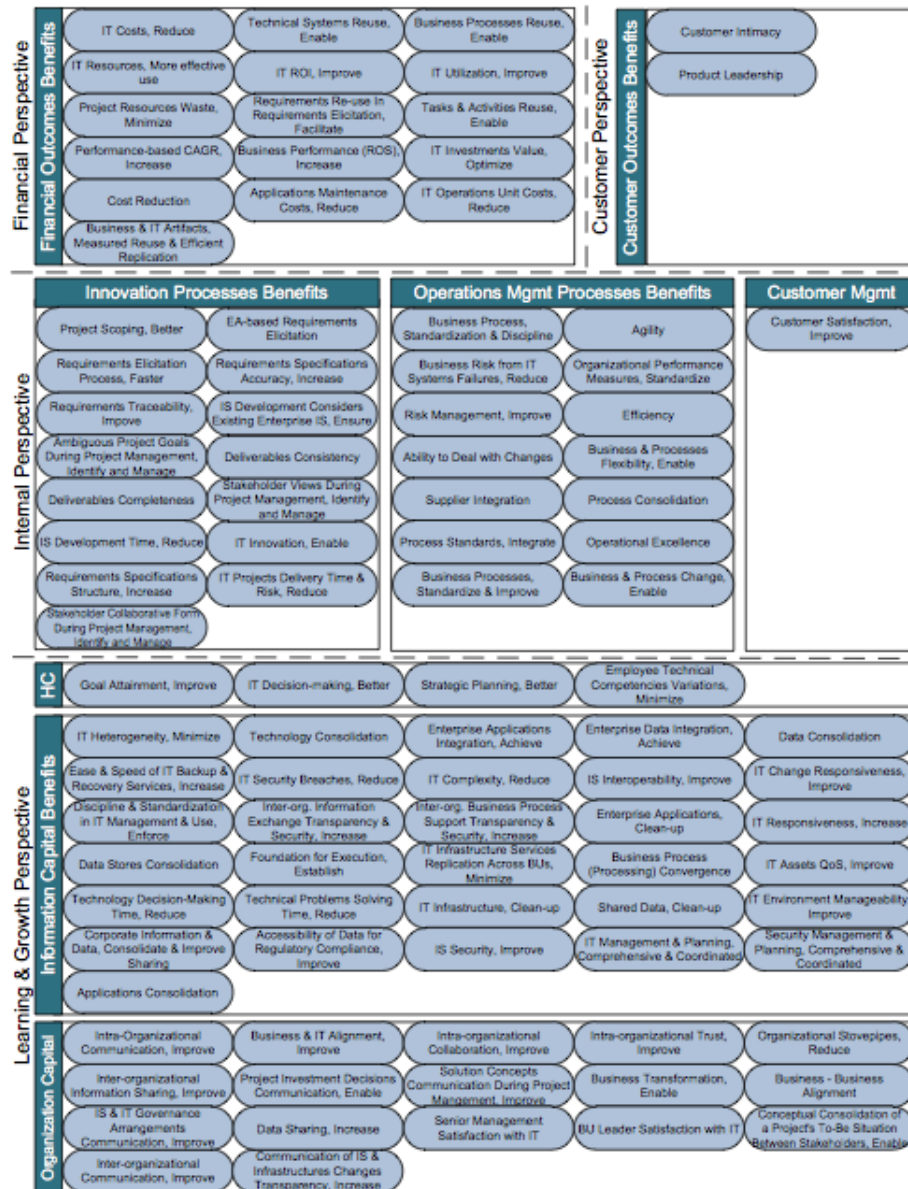
Figure A.2: "Enterprise Architecture Benefits Map", by Boucharas et al. [23].

Appendix B

Literature Review Products

B.1   Structured Literature Review: Lists of Titles

As the focus is on actual measurements regarding EA, the search query used in these databases is:

```
( Abstract:" enterprise  architecture"  or
Abstract:" enterprise  architectures"  or
Abstract:" enterprise  architecting")  and
( Abstract:metric  or  Abstract:metrics  or
Abstract:measure  or  Abstract:measures  or
Abstract:indicator  or  Abstract:indicators  or
Abstract:kpi  or
Abstract:evaluat*  or  Abstract:valu*  or  Abstract:asses*  or  Abstract:measur*)
```

[1]

The following pages show the titles and their filtering as a result of the structured literature review using the IEEEXplore and ACM digital libraries. Red rows in the ACM results represent duplications or non-literature. Grey rows represent books. Orange rows represent interesting titles for which, unfortunately, a free full text could not be found using Google, Google Scholar or a connection to Leiden University.

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[1]Note that an asterisk equals "one or more characters" in both databases. Therefore, "measure" and "measures" are found using "measur*" too, but this way a clear distinction is made between nouns and verbs.

Searching within (Abstract:"enterprise architecture" or Abstract:"enterprise architectures" or Abstract:"enterprise architecting") for:
((Abstract:"enterprise architecture" or Abstract:"enterprise architectures" or Abstract:"enterprise architecting")) and
(Abstract:metric or Abstract:metrics or
Abstract:measure or Abstract:measures or
Abstract:indicator or Abstract:indicators or
Abstract:kpi or
Abstract:evaluat* or Abstract:valu* or Abstract:asses* or Abstract:measur*)

15/10/2013

number	title	title and abstract (EA value?)	fulltext	scan	Read (measurement approach?)
1	National ID project of Nepal: future challenges	x gea			
2	An Ontology-Based Semantics for the Motivation Extension to ArchiMate	1	1	x archi	
3	Integrating EA and BPM Synergistically: Methodologically Combining Planning and Delivery	x			
4	Government enterprise architectures: present status of Bangladesh and scope of development	x GEA			
5	Are we ready for the service oriented architecture?	x soa			
6	Research on the Enterprise' Model of Information Lifecycle Management Based on Enterprise Architecture	x ILM			
7	The Place and Value of SOA in Building 2.0-Generation Enterprise Unified vs. Ubiquitous Communication and Collaboration Platform	x soa			
8	Modeling the Supply and Demand of Architectural Information on Enterprise Level	x EA info gathering			
9	TOGAF 9 Foundation Part 2 Exam Preparation Course in a Book for Passing the TOGAF 9 Part 2 Certified Exam - The How To Pass on Your First Try Certification Study Guide	book			
10	Extending Business Process Execution Language for Web Services with Service Level Agreements Expressed in Computational Quality Attributes	x service			
11	Using Component Business Modeling to Facilitate Business Enterprise Architecture and Business Services at the US Department of Defense	x cbm			
12	Seize the Cloud: A Manager's Guide to Success with Cloud Computing, 1st edition	x cloud book			
13	Essential Software Architecture, 2nd edition	x book			
14	Business service modeling using SOA: a core component of business architecture	x sobsm			
15	Agile Architecture Interactions	x agile			
16	Architecture analysis of enterprise systems modifiability - Models, analysis, and validation	x EA for analysis			
17	Enterprise, Business-Process and Information Systems Modeling: 12th International Conference, BPMDS 2011, and 16th International Conference, EMMSAD ... Notes in Business Information Processing), 1st edition	book			
18	Enterprise Architecture at Work: Modelling, Communication and Analysis, 2nd edition	book			
19	The SIM Guide to Enterprise Architecture, 1st edition	book			
20	An EA-approach to Develop SOA Viewpoints	x soa			
21	Applying design science research for enterprise architecture business value assessments	1	1	1	1
22	TOGAF The Open Group Architecture Framework 100 Success Secrets - 100 Most Asked Questions: The Missing TOGAF Guide on How to achieve and then sustain superior Enterprise Architecture execution	book			
23	Manage Risks through the Enterprise Architecture	1	1	x no measuring	
24	Deriving SOA Evaluation Metrics in an Enterprise Architecture Context	x soa			
25	Enterprise Service Oriented Architecture (ESOA) Adoption Reference	x soa			
26	MDA Redux: Practical Realization of Model Driven Architecture	x mda			
27	Enterprise Architecture: Challenges and Implementations	1	x		
28	A multi-level model-driven regime for value-added tax compliance in ERP systems	x ERP			
29	Integrated Quality of Service (QoS) Management in Service-Oriented Enterprise Architectures	x service			
30	Minitrack Introduction	x?			
31	Designing the Enterprise Architecture Function	1	1		
32	Enterprise Architecture and Information Systems: In Japanese Banking Industry	x soa			
33	Business Driven Technology with Premium Content Card, 3 edition	book			
34	Availability of enterprise IT systems: an expert-based Bayesian framework	1	1	x not EA value	
35	Totally Integrated Enterprises: A Framework and Methodology for Technology Improvement	book			
36	Handbook of Enterprise Systems Architecture in Practice	book			
37	Service Oriented Architecture: Making the Leap, Leveraging Model Driven Architecture and Achieving Software Agility with BPM, SOA and MDA®	x soa			
38	Visual Analysis of Enterprise Models	1	1	x not EA value	
39	Towards a theory on collaborative decision making in enterprise architecture	x EA development			
40	Implementing Cisco IP Switched Networks (SWITCH) Foundation Learning Guide: Foundation learning for SWITCH 642-813, 1st edition	book			
41	Event-Driven Architecture: How SOA Enables the Real-Time Enterprise, 1st edition	book			
42	A system of systems focused enterprise architecture framework and an associated architecture development process	1	1	1	1
43	Enterprise Architecture at Work: Modelling, Communication and Analysis, 3rd edition	book			
44	Enterprise architecture dependency analysis using fault trees and Bayesian networks	1	1	x not EA value	
45	Practice-Driven Research on Enterprise Transformation: 4th Working Conference, PRET 2012, Gdansk, Poland, June 27, 2012, Proceedings	book			
46	Leveraging the Zachman framework implementation using action – research methodology – a case study: aligning the enterprise architecture and the business goals	1	1	1	no metrics
47	Evaluating integration architectures – a scenario-based evaluation of integration technologies	1	1	x not EA value	
48	Enabling a Common and Consistent Enterprise-Wide Terminology: An Initial Assessment of Available Tools	1	x		
49	Adding a Human Perspective to Enterprise Architectures	x EA expansion			
50	The validation and analysis of component-based metadata integration	x component			
51	Evaluating Information Systems Constructing a Model Processing Framework	x info systems			
52	Investigating service-oriented business architecture	1	1	x not EA value	
53	Extended Influence Diagrams for Enterprise Architecture Analysis	1	1	1	x not clear..
54	The FBI Sentinel Project	x fbi sentinel			
55	Dynamic SOA and BPM: Best Practices for Business Process Management and SOA Agility, 1st edition	book			
56	Manage Enterprise Knowledge Systematically: A Knowledge Management System Design Methodology Based on Enterprise Architecture Frameworks	book			
57	Custom-Made Cloud Enterprise Architecture for Small Medium and Micro Enterprises	x cloud EA			
58	Cross-National Interoperability and Enterprise Architecture	1	1	1	1
59	Enterprise Cloud Computing: Technology, Architecture, Applications, 1st edition	cloud book			
60	IT Portfolio Valuation - Using Enterprise Architecture and Business Requirements Modeling	1	1	1	0 portfolio valuation
61	Capability Diagnostics of Enterprise Service Architectures Using a Dedicated Software Architecture Reference Model	x soa			
62	Strategic Business and IT Alignment Assessment: A Case Study Applying an Enterprise Architecture-Based Metamodel	1	1	x not EA value	
63	Designing Solutions with Com+ Technologies	book			
64	Value-Driven IT, 1 edition	book			
65	Design and capabilities of an enhanced naval mine warfare simulation framework	x RMSSEA			
66	Impact of Global Hyperconnectivity and Increased Smartphone Usage on the Delivery and Structure of IT Organizsation in Transport Logistics	x			
67	Business Driven Technology, 3 edition	x duplicate			
68	Winning the 3-Legged Race: When Business and Technology Run Together	book			
69	Practice-Driven Research on Enterprise Transformation: Third Working Conference, PRET 2011, Luxembourg, September 6, 2011, Proceedings, 1st edition	book			
70	Architecturing large integrated complex information systems: an application to healthcare	1	1		
71	Is Your Company Ready for Cloud: Choosing the Best Cloud Adoption Strategy for Your Business, 1st edition	cloud book			
72	Information systems implementation: the big picture	1	1	x not EA value	
73	Extending the Method of Bedell for Enterprise Architecture Valuation	1	1	x uses EA for analysis	
74	Service-oriented system evolution taxonomy and metrics derived from complex adaptive systems theory	x soa			
75	Enterprise Architecture Institutionalization and Assessment	1	x		
76	Combining Defense Graphs and Enterprise Architecture Models for Security Analysis	x security analysis			
77	Pro RFID in BizTalk Server 2009	book			
	Modeling the alignment between business and IS/IT: a requirements engineering perspective	x req en			
79	Architecture and Patterns for IT Service Management, Resource Planning, and Governance: Making Shoes for the Cobbler's Children: Making Shoes for the Cobbler's Children, 2nd edition	book			
80	Business Architecture Elicitation for Enterprise Architecture: VMOST versus Conventional Strategy Capture	1	1	x not EA value	
81	Enterprise, Business-Process and Information Systems Modeling: 13th International Conference, BPMDS 2012, 17th International Conference, EMMSAD 2012	book			

#	Title				
82	Achieving Service-Oriented Architecture: Applying an Enterprise Architecture Approach	book			
83	Enterprise security architectural framework and metrics: application to secure electronic voting systems	x security			
84	Towards a Holistic Information Security Governance Framework for SOA	x soa			
85	Business and Information System Alignment: A Formal Solution for Telecom Services	1	1	1	x no metrics
86	SOA with REST: Principles, Patterns &Constraints for Building Enterprise Solutions with REST, 1st edition	book			
87	Investigating the role of an enterprise architecture project in the business-IT alignment in Iran	1	1	1	1
88	A Framework for Exploring Digital Business Ecosystems	x			
89	Architectural work status: challenges and developmental potential - a case study of three Finnish business enterprises	1	1	1	1
90	The Organizational Impact of Enterprise Architecture: A Research Framework	1	x		
91	Service-level enforcement in web-services-based systems	x service			
92	A group evidential reasoning approach for enterprise architecture framework selection	1	1	x framework selection	
93	Portfolio Performance Measurement Based on Service-Oriented Grid Computing: Developing a Prototype from a Design Science Perspective	x grid			
94	Future research topics in enterprise architecture management - a knowledge management perspective	1	1	x no measuring	
95	E-Government Interoperability: Interaction of Policy, Management, and Technology Dimensions	x e-governance			
96	Software Fortresses: Modeling Enterprise Architectures	book			
97	Enterprise 2.0 Integrated Communication and Collaboration Platform: A Conceptual Viewpoint	x			
98	Tool Support for Enterprise Architecture Management - Strengths and Weaknesses	1	1	x tools	
99	Enterprise Architecture Create Business Value	1	x		
100	Enterprise BigGraph	x big data			
101	Social network analysis as a tool for improving enterprise architecture	1	1	x not EA value	
102	KALCAS: a framework for semi-automatic alignment of data and business processes architectures	1	1	1	x no metrics
103	Enterprise Architecture and IT Governance: A Risk-Based Approach	x			
104	The Role of Coordination and Architecture in Supporting ASP Business Models	x asp			
105	Business Service Definition in Enterprise Engineering - A Value-oriented Approach	x service ?			
106	Enterprise Architecture and Its Role in Solving Business Issues: Case Study of the NSW Department of Lands	1	1	1	0
107	E Governance	x e governance			
108	Top Management Role in the Development of an EA Programme in Five Portuguese Enterprises	1	x		
109	A reference model for IT management responsibilities	1	1	1	0
110	Using enterprise architecture analysis and interview data to estimate service response time	1	1	x not EA value	
111	Architecture analysis of enterprise systems modifiability: a metamodel for software change cost estimation	1	1		
112	EA4UP: An Enterprise Architecture-Assisted Telecom Service Development Method	x EA4UP			
113	Systems engineering and management of enterprise information systems: ecological, architectural, and foundation program issues	x			
114	An Enterprise Architecture Alignment Measure for Telecom Service Development	1	1	1	too specific for telecom
115	Modeling and analyzing service-oriented enterprise architectural styles	x soea			
116	Sun Certified Enterprise Architect for Java EE Study Guide (Exam 310-051), 2 edition	book			
117	Enterprise Architecture as Information Technology Strategy	1	x		
118	Interoperability, enterprise architectures, and IT governance in government	x gov			
119	A process improvement model for improving problem resolution tracking in data centers	1	x		
120	Towards a realistic clinical-guidelines application framework: desiderata, applications, and lessons learned	x			
121	An AHP-based approach toward enterprise architecture analysis based on enterprise architecture quality attributes	1	1	1	0...
122	A New Method for Enterprise Architecture Assessment and Decision-Making about Improvement or Redesign	1	x		
123	Actionable Enterprise Architecture	x AEA			
124	Troux Enterprise Architecture Solutions	book			
125	A proposal for an open solution business process integration and management implementation framework	x soa			
126	A modeling framework for agile and interoperable virtual enterprises	x ve			
127	Service Oriented Architecture: An Integration Blueprint	x soa book			
128	On an Integration of an Information Security Management System into an Enterprise Architecture	1	1	x not EA value	
129	A new way of architecting the enterprise	x soea			

#	Title				
130	An integrated approach for RUP, EA, SOA and BPM implementation	x integr rup			
131	Enterprise architecture analysis with extended influence diagrams	1	1	x	
132	An Experts' Perspective on Enterprise Architecture Goals, Framework Adoption and Benefit Assessment	1	1	1	0 portfolio valuation
133	Modeling Contextual Concerns in Enterprise Architecture	1	1	1	
134	Enterprise Architecture Descriptions for Enhancing Local Government Transformation and Coherency Management: Case Study	x			
135	Complex service design: A virtual enterprise architecture for logistics service	x vea			
136	Modeling digital preservation capabilities in enterprise architecture	x preserv			
137	On the Way from Research Innovations to Practical Utility in Enterprise Architecture: The Build-Up Process	1	x		
138	The Practice of Enterprise Modeling: First IFIP WG 8.1 Working Conference, PoEM 2008, Stockholm, Sweden, November 12-13, 2008, Proceedings, 1st edition	book			
139	An Ontology-Matching Based Proposal to Detect Potential Redundancies on Enterprise Architectures	1	1	x	
140	A Practical Approach to Large-Scale Agile Development: How HP Transformed LaserJet FutureSmart Firmware, 1st edition	book			
141	MAGNA: Middleware for dynamic and resource constrained sensor networks	x magna			
142	EAF2- A Framework for Categorizing Enterprise Architecture Frameworks	1		x comparing frameworks	
143	Evaluation of the Archetypes Based Development	x abd			
144	Meta-Services as Third Dimension of Service-Oriented Enterprise Architecture	x service			
145	Implementing soa: total architecture in practice, First edition	soa book			
146	Comparative advantage model founded on enterprise architecture in Japanese firms	1	x		
147	The IT Organization Modeling and Assessment Tool for IT Governance Decision Support	x itomat			
148	Evaluation of current architecture frameworks	1	1	x comparing frameworks	
149	Assessing the maturity of information architectures for complex dynamic enterprise systems	book			
150	Experimenting with the expressive power of an enterprise architecture framework	x eaif			
151	A multi-level framework for measuring and benchmarking public service organizations: connecting stages-of-growth models and enterprise architecture	1	1	1	x not clear..
152	The dynamic architecture maturity matrix: instrument analysis and refinement	1	1	1	maturity
153	Designing an `adaptive' enterprise architecture	cobit/itil			
154	Open Distribution Software Architecture Using RM-Odp	book			
155	An Empirical Analysis of Cloud, Mobile, Social and Green Computing: Financial Services IT Strategy and Enterprise Architecture	x trends			
156	Using domain-driven design to evaluate commercial off-the-shelf software	x			
157	A fuzzy group multi-criteria enterprise architecture framework selection model	1	1	x framework selection	
158	Revisiting Naur's programming as theory building for enterprise architecture modelling	1	x		
159	Using Enterprise Architecture Models for System Quality Analysis	x means			
160	Internet-Based Self-Services: From Analysis and Design to Deployment	x iss			
161	Green Enterprise Architecture using Environmental Intelligence	x gea			
162	On the relevance of enterprise architecture and IT governance for digital preservation	x dig pres			
163	Study on Enterprise Information Resources Planning - ILEA	x eirp			
164	Enterprise architecture coherence and the model driven enterprise: is simulation the answer or are we flying kites?	x simulation			
165	Composing enterprise mashup components and services using architecture integration patterns	x mash			
166	Virtual enterprise model for enabling cloud computing for SMMEs	x ve			
167	Classification and taxonomy of TEISMEs	x			
168	ICT-project failure in public administration: the need to include risk management in enterprise architectures	1	1	Ea-rm relation	
169	Cooking the Web-ERP	x web-erp			
170	Enterprise Architecture Best Practice Handbook: Building, Running and Managing Effective Enterprise Architecture Programs - Ready to use supporting documents ... Enterprise Architecture Theory into Practice	book			
171	Organizational Interoperability in E-Government: Lessons from 77 European Good-Practice Cases, 1st edition	book			
172	Proposal of a Complete Life Cycle In-Process Measurement Model Based on Evaluation of an In-Process Measurement Experiment Using a Standardized Requirement Definition Process	x			
173	Managing Security and Privacy Integration across Enterprise Business Process and Infrastructure	x RISE			
174	A Tool for Enterprise Architecture Analysis	1	1	1	x no metrics

#	Title				
175	Horizontal Mapping of SCOR Model on Zachman Framework	x SCOR?			
176	Improving arable farm enterprise integration - Review of existing technologies and practices from a farmer's perspective	x			
177	Public IT Investment	book			
178	Virtual Communities Adapted to the EHEA in an Enterprise Distance e-Learning Based Environment	x e-learning			
179	Implementing SOA: Total Architecture in Practice, 1st edition	soa book			
180	A Pragmatic Guide to Business Process Modelling, 2nd edition	book			
181	Enterprise Architecture A to Z: Frameworks, Business Process Modeling, SOA, and Infrastructure Technology	book			
182	Eliciting Business Architecture Information in Enterprise Architecture Frameworks Using VMOST	1	1	vmost	
183	Alignment of Business and IT Architectures in the German Federal Government: A Systematic Method to Identify Services from Business Processes	x identify services			
184	Techniques for service level enforcement in web-services based systems	x service			
185	A novel strategy for multi-resource load balancing in agent-based systems	x agent			
186	Enterprise Network Testing: Testing Throughout the Network Lifecycle to Maximize Availability and Performance, 1st edition	book			
187	Enterprise architecture, IT effectiveness and the mediating role of IT alignment in US hospitals	1	1	1	1
188	Enterprise Architecture: A Framework Supporting System Quality Analysis	x			
189	A viable system perspective on enterprise architecture management	x			
190	Army enterprise architecture technical reference model for system interoperability	x trm			
191	NIST SP 800-37 Revision 1 Guide for Applying the Risk Management Framework to Federal Information Systems	book			
192	Integration of IT strategy and enterprise architecture models	1	1	1	x
193	Enterprise Information Architecture (EIA): Assessment of Current Practices in Malaysian Organizations	x eia malay			
194	Knowledge-based enterprise modelling framework	x kbemf			
195	Capturing Business Strategy and Value in Enterprise Architecture to Support Portfolio Valuation	1	1	1	metrics in citations
196	An Enterprise Architecture Development Method in Chinese Manufacturing Industry	1	x		
197	A modeling framework for agile and interoperable virtual enterprises	x ve			
198	Identification of potential requirements of master data management under cloud computing	x mdm			
199	A research proposal: initial development of operational indicators for measuring US federal public sector organization virtuality	x			
200	Architectural improvement by use of strategic level domain-driven design	1	1	x not EA value	
201	Assessing System Availability Using an Enterprise Architecture Analysis Approach	1	1	x not EA value	
202	A method to define an Enterprise Architecture using the Zachman Framework	1	1	x not EA value	
203	A method for application evaluations in context of enterprise architecture	x app eval			
204	Experience Report: Assessing a Global Financial Services Company on its Enterprise Architecture Effectiveness Using NAOMI	1	1	1	x maturity
205	Service-oriented system evolution taxonomy and metrics derived from complex adaptive systems theory				
206	Using enterprise architecture and technology adoption models to predict application usage	x app usage			
207	Sustainable Enterprise Architecture, 1st edition	book			
	total	66	54	23	6

((("Abstract":"enterprise architecture" OR "Abstract":"enterprise architectures" OR "Abstract":"enterprise architecting") AND ("Abstract":metric OR "Abstract":metrics OR "Abstract":measure OR "Abstract":measures OR "Abstract":indicator OR "Abstract":indicators OR "Abstract":kpi OR "Abstract":evaluat* OR "Abstract":valu* OR "Abstract":asses* OR "Abstract":measur*)))

Number	Title	21-22-11-2013 duplicate?	title and abstract EA Value?	fulltext	scan	Read / Measurement Approach?
1	Performance evaluation for Industrial Automation System Integration based on enterprise architecture standards and application in Cotton Textile Industry		x system maturity			
2	The Value of ITIL in Enterprise Architecture		1	x		
3	Enterprise Coherence Governance in the Public Sector -- Custodial Institutions Agency of the Dutch Ministry of Security and Justice		1	x		
4	Top 10 architecture land mines [enterprise]		x not EA value			
5	EA4UP: An Enterprise Architecture-Assisted Telecom Service Development Method	1				
6	Assessing Risks and Opportunities in Enterprise Architecture Using an Extended ADT Approach		x adt risk			
7	A reference model for IT management responsibilities	1				
8	Enterprise architecture dependent application evaluations		1	x		
9	An Enterprise Architecture Alignment Measure for Telecom Service Development	1				
10	A Tool for Enterprise Architecture Analysis	1				
11	Enterprise Architecture Create Business Value	1				
12	A new AHP-based approach towards Enterprise Architecture quality attribute analysis		x ahp didnt work			
13	Portfolio Performance Measurement Based on Service-Oriented Grid Computing: Developing a Prototype from a Design Science Perspective	1				
14	Meta-Services as Third Dimension of Service-Oriented Enterprise Architecture	1				
15	Maturity model for IT enterprise architecture		1	x		
16	Business and Information System Alignment: A Formal Solution for Telecom Services	1				
17	Alignment of Business and IT Architectures in the German Federal Government: A Systematic Method to Identify Services from Business Processes	1				
18	NOAA's integrated observations and data management and strategic portfolio tools		x NOAA			
19	Enterprise Service Oriented Architecture (ESOA) Adoption Reference		x soa			
20	Design and capabilities of an enhanced naval mine warfare simulation framework	1				
21	Towards a framework for interoperability of executable architectures		1	x		
22	The Organizational Impact of Enterprise Architecture: A Research Framework	1				
23	Enterprise Architecture Institutionalization and Assessment	1				
24	Enterprise architecture: A framework supporting organizational performance analysis		x supporting			
25	A viable system perspective on enterprise architecture management	1				
26	Proposal of a Complete Life Cycle In-Process Measurement Model Based on Evaluation of an In-Process Measurement Experiment Using a Standardized Requirement Definition Process	1				
27	Manage Risks through the Enterprise Architecture	1				
28	Adding a Human Perspective to Enterprise Architectures	1				
29	Using Enterprise Architecture Models for System Quality Analysis	1				
30	Getting the most from your enterprise architecture		1	1	1	Not really effectiveness s0
31	Modeling Contextual Concerns in Enterprise Architecture	1				
32	A New Method for Enterprise Architecture Assessment and Decision-Making about Improvement or Redesign	1				
33	On an Integration of an Information Security Management System into an Enterprise Architecture	1				
34	Eliciting Business Architecture Information in Enterprise Architecture Frameworks Using VMOST	1				
35	A framework for enterprise architecture effectiveness		1	x		
36	Visual Analysis of Enterprise Models	1				
37	Capability Diagnostics of Enterprise Service Architectures Using a Dedicated Software Architecture Reference Model	1				
38	A New Method for Decision Making and Planning in Enterprises		1	1	1	x not measuring effectiveness (as-is measuring)
39	Integrated management of risk information		x risk			
40	Joint Planning & Development Office strategic decision and policy model		x			
41	Analyzing IT impact on organizational structure: A case study		x			
42	Architecting the system of systems enterprise: Enabling constructs and methods from the field of engineering systems		1	1	1	x not measuring effectiveness, tho stressing importance, context of SOS
43	Integrated quality of service (QoS) management in service-oriented enterprise architectures	1				
44	Enterprise Information Architecture (EIA): Assessment of Current Practices in Malaysian Organizations	1				
45	Realizing Greater Business Value of Contemporary RFID Systems		x RFID			
46	Actionable Enterprise Architecture	1				
47	Introduction to Business and Enterprise Architecture: Processes, Approaches and Challenges Minitrack		x?			
48	An evaluation of enterprise architecture frameworks for e-government		1	x		
49	The Place and Value of SOA in Building 2.0-Generation Enterprise Unified vs. Ubiquitous Communication and Collaboration Platform	1				
50	The "systems" nature of enterprise architecture		1	x		
51	Enterprise Architecture: Challenges and Implementations	1				
52	Change impact analysis of enterprise architectures		x CM			
53	A Model-Driven Architecture Approach to the Efficient Identification of Services on Service-Oriented Enterprise Architecture		x SOEA			
54	Introduction to Enterprise Architecture: Challenges [Minitrack Introduction]		1	x		
55	Information resources planning based on enterprise architecture		x IRP EA			
56	Enterprise Architecture and IT Governance: A Risk-Based Approach	1				
57	Business Service Definition in Enterprise Engineering - A Value-oriented Approach	1				
58	DYNSEA â€" A dynamic service-oriented Enterprise Architecture based on S-D-logic		x DYNSEA			
59	Enterprise Architecture Descriptions for Enhancing Local Government Transformation and Coherency Management: Case Study	1				
60	Long-term security of digital information: Assessment through risk management and Enterprise Architecture		x DP			
61	Aligning Business and IT Using Enterprise Architecture		1	x		
62	Army enterprise architecture technical reference model for system interoperability	1				
63	Combining Defense Graphs and Enterprise Architecture Models for Security Analysis	1				
64	Enterprise Architecture: A Framework Supporting System Quality Analysis	1				
65	Ontology model developing based on Semantic Analysis for inter-view consistency in enterprise architecture		x communication			
66	Experience Report: Assessing a Global Financial Services Company on its Enterprise Architecture Effectiveness Using NAOMI	1				
67	An Ontology-Matching Based Proposal to Detect Potential Redundancies on Enterprise Architectures	1				
68	EAF2- A Framework for Categorizing Enterprise Architecture Frameworks	1				

#	Title				
69	Presenting A Method for Benchmarking Application in the Enterprise Architecture Planning Process Based on Federal Enterprise Architecture Framework	1	1	1	x not measuring effectivenes s
70	Real Options in Enterprise Architecture: A Holistic Mapping of Mechanisms and Types for Uncertainty Management	x ROA			
71	IT governance decision support using the IT Organization Modeling and Assessment Tool	x ITOMA T			
72	Enterprise Architecture as Information Technology Strategy	1			
73	Enterprise Architecture and Information Systems: In Japanese Banking Industry	1			
74	An Enterprise Architecture Development Method in Chinese Manufacturing Industry	1			
75	Assessing impact of ICT system quality on operation of active distribution grids	x			
76	Strategic Business and IT Alignment Assessment: A Case Study Applying an Enterprise Architecture-Based Metamodel	1			
77	Developing enterprise archiecture with â€œmodel-evaluate-extendâ€ approach	1	x		
78	Plenary Speech 1P1: Shrinking time-to-market through global value chain integration	x			
79	NENO process: Information systems arbitration process in Enterprise Architecture Project	x NENO			
80	Using Architecture Modeling to Assess the Societal Benefits of the Global Earth Observation System-of-Systems	x GEOS S			
81	Enterprise Architecture and Its Role in Solving Business Issues: Case Study of the NSW Department of Lands	1			
82	Enterprise architecture, implementation, and infrastructure management	1	1	x not really a paper	
83	Enabling a Common and Consistent Enterprise-Wide Terminology: An Initial Assessment of Available Tools	1			
84	An Empirical Analysis of Cloud, Mobile, Social and Green Computing: Financial Services IT Strategy and Enterprise Architecture	1			
85	Extending the Method of Bedell for Enterprise Architecture Valuation	1			
86	IT Portfolio Valuation - Using Enterprise Architecture and Business Requirements Modeling	1			
87	An Experts' Perspective on Enterprise Architecture Goals, Framework Adoption and Benefit Assessment	1			
88	Using component business modeling to facilitate business enterprise architecture and business services at the US Department of Defense	1			
89	Using Architecture Modeling to Assess the Societal Benefits of the Global Earth Observation System of Systems (GEOSS)	x GEOS S			
90	Decision support oriented Enterprise Architecture metamodel management using classification trees	x metam odels			
91	Business Architecture Elicitation for Enterprise Architecture: VMOST versus Conventional Strategy Capture	1			
92	Capturing Business Strategy and Value in Enterprise Architecture to Support Portfolio Valuation	1			
93	Tool Support for Enterprise Architecture Management - Strengths and Weaknesses	1			
94	Research on the Enterprise' Model of Information Lifecycle Management Based on Enterprise Architecture	1			
95	Extended Influence Diagrams for Enterprise Architecture Analysis	1			
96	Agile Architecture Interactions (was: Agile Architecture Insertion Points)	1			
97	Integrating EA and BPM Synergistically: Methodologically Combining Planning and Delivery	1			
98	Horizontal Mapping of SCOR Model on Zachman Framework	1			
99	A Framework for Exploring Digital Business Ecosystems	1			
100	Modeling the Supply and Demand of Architectural Information on Enterprise Level	1			
101	MDA Redux: Practical Realization of Model Driven Architecture	1			
102	Using ArchiMate to Represent ITIL Metamodel	1	x		
103	The Emperor's New Clothes: Redressing Digital Business Ecosystem Design	x			
104	An EA-approach to Develop SOA Viewpoints	1			
105	An Ontology-Based Semantics for the Motivation Extension to ArchiMate	1			

#	Title			
106	Innovative modeling of {Architect@Place} pattern artifacts in ISRUP framework	x ISRUP		
107	Electronics Prognostics Reference Architecture	x		
108	The joint NEO Spiral 1 program: Lessons learned operational concepts and technical framework	1	x	
109	Enterprise Maturity Models: Have We Lost the Plot?	x maturit y		
110	Integration of existing military capability models into the comprehensive capability meta-model	x CCMM		
111	Semantic metadata in enterprise integration	x metada ta		
112	Service Oriented Architecture: Making the Leap, Leveraging Model Driven Architecture and Achieving Software Agility with BPM, SOA and MDAÂ®	x soa		
113	Enterprise BigGraph	1		
114	MAGNA: Middleware for dynamic and resource constrained sensor networks	1		
115	Case study: Merging technology management methods	x not ea value		
116	Enterprise 2.0 Integrated Communication and Collaboration Platform: A Conceptual Viewpoint	1		
117	A Software Factory for Air Traffic Data	x not EA value		
118	Message from the SoEA4EE 2011 Chairs	x SOEA		
119	Analysis and mastering the data migration challenge for SAP FS-PM system environments	x not EA value		
120	ICNS study effort: Update of results & recommendations	x		
121	Study on Enterprise Information Resources Planning - ILEA	1		
122	The 3LGM2-Tool to Support Information Management in Health Care	x not EA value		
123	NextGen integrated communications, navigation, and surveillance study	x nextge n		
124	Methodology for complexity reduction of IT system (adjustment of the sessions' methodology)	x method ology	x	
125	IBM service oriented technologies and management for smarter enterprise	x soa		
126	The role of coordination and architecture in supporting ASP business models	1		
127	A reference model for an improved collaborative business processing in a Moroccan governmental administration	x not EA value		
128	Calculating the Business Importance of Entities in a Service-Oriented Enterprise	1	x	
129	Qualitative and quantitative aspects of cooperation mechanisms for monitoring in service-oriented architectures	x cooper ation mecha nisms		
130	E Governance			
131	Managing Green IT	x green IT lifecycl e		
132	Extending Business Process Execution Language for Web Services with Service Level Agreements Expressed in Computational Quality Attributes	1		
133	Towards a Holistic Information Security Governance Framework for SOA	1		
134	Internet-Based Self-Services: From Analysis and Design to Deployment	1		
135	Managing Security and Privacy Integration across Enterprise Business Process and Infrastructure	1		
136	Strengthening OV-6a Semantics with Rule-Based Meta-models in DEVS/DoDAF based Life-cycle Architectures Development	x		
		70	19	5 4 0

B.2 Metrics from Literature

Table B.1: Metrics categorized under Decision making process with relevance 2, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"(Improved) understanding of business by IT." [46,69]	DP	2	Responsibility of EA to be bridge IT and business.	B-IT alignment
"(Improved) understanding of IT by business." [46,69]	DP	2	Responsibility of EA to be bridge IT and business.	B-IT alignment
"Business perception of IT value (Business perceive IT as a partner in creating value) (IT is seen as a cost and profit center)." [46,69]	DP	2	EA plays a big role in ensuring collaboration between IT and business..	Collaboration and partnership
"Role of IT in strategic business planning (Business and IT develop the strategic plan together)." [46,69]	DP	2	Whether IT is an enabler or driver, or IT and business are seen as co-adaptive. EA plays a big role here.	Collaboration and partnership
"Relationship/trust style (Business and IT are trusted partners)." [46,69]	DP	2	EA plays a big role in ensuring collaboration between IT and business..	Collaboration and partnership
"Traditional, enabler/driver, external (IT has an external scope and is driver and enabler for the business strategy)." [46,69]	DP	2	EA should help in making sure IT is an enabler, but also a driver.	Collaboration and partnership
"Partnership Ratio: IT function involvement with strategic business initiatives and percentage business stakeholders viewing IT as trusted advisor and strategic partner." [61]	DP	2	EA should play a big role here.	Collaboration and partnership
"Time from strategy announcement until a prioritized project pipeline is presented to review and funding bodies." [61]	DP	2	EA plays a big role here through the roadmap and should not be a bottleneck.	Speed and agility
"Percentage of EA ideas relevant to business objectives, relevant to innovation focus." [61]	DP	2	Assuming ideas are not actual decisions. The question here is: percentage of what whole? EA has a big stake here though. It is not as much about the EA ideas that were relevant, but it is about its input during decision making.	Ideas
"Organization's ability to work with external suppliers to leverage shared IT capabilities to create high-value resources." [48]	DP	2	EA should be concerned with ways to leverage IT capabilities with external partners if this is value adding.	Collaboration and partnership
"Organization's ability to manage relationships with outsourcing partners." [48]	DP	2	Outsourcing partners could be important stakeholders and EA may have a big stake in managing relationships with them.	Collaboration and partnership
"Number of times IT is on the board agenda in proactive manner." [80]	DP	2	EA should make sure stakeholders understand the way IT contributes to business and thus increase a feeling of partnership.	Collaboration and partnership
"Percentage critical to business processes, IT services and IT-enabled business programmes covered by risk assessment." [80]	DP	2	During an assessment, EA should make sure all critical aspects are taken into account within the enterprise, both business and IT. Although it depends on what is meant by "covered" and the coverage of the risk assessment may not be a real effect, it is interesting to see whether EA leads to better insights in risks.	Risk and impact
"Satisfaction survey of key stakeholders regarding the transparency, understanding and accuracy of IT financial information." [80]	DP	2	EA should make sure stakeholders understand IT financial information and the way it influences decisions.	B-IT alignment
"Level of business user understanding of how technology solutions support their process." [80]	DP	2	EA is not just about delivering solutions, but especially about communicating and explaining why some solutions may be better than others. Moreover, it is essential for EA to link IT to business processes.	B-IT alignment
"Average time to turn strategic IT objectives into an agreed and approved initiative." [80]	DP	2	EA should not be a bottleneck and has a big stake here through scenario's and roadmaps.	Speed and agility
"Level of business executive awareness and understanding of IT innovation possibilities." [80]	DP	2	EA should also be concerned with innovation and making sure that executives understand the possibilities.	B-IT alignment
"Relationship (Degree to which customers enjoy working with EA). (Architecture customer feedback)" [79,80]	DP	2	At this level, it is especially about whether EA customers regard EA as effective and helpful.	EA Customer

"Common language (improved communication to reduce misunderstandings). (Provides a shared frame of reference to communicate effectively)." [52, 65]	DP	2	Although rather high level, it is of course interesting whether IT and business speak a common language.	Collaboration and partnership
"Perceived complexity (reference information and insight)" [52]	DP	2	Whether EA actually provides insight and oversight for EA customers.	EA Customer
"Provides insight into complex projects." [65]	DP	2	EA is for a great deal about providing insight and oversight for the EA Customer.	EA Customer
"Enables identification of integration possibilities." [65]	DP	2	EA is for a great deal about finding opportunities for integration.	EA Customer
"Facilitates co-operation with other organizations." [65]	DP	2	EA is about collaborating and partnerships.	Collaboration and partnership
"Provides a consistent and coherent overview." [65]	DP	2	EA in general is about providing insight and oversight.	EA Customer
"Identifies and mitigates risk" [65]	DP	2	EA plays a big role in risk identification.	Risk and impact

Table B.2: Metrics categorized under Decision making results with relevance 2, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Percentage of IT initiatives that are aligned, as identified through the EA process." [61]	DR	2	They are identified through the EA process, but more importantly, EA is about aligning IT and business initiatives.	B-IT alignment
"Ratio of opportunities to support a strategy adopted versus not adopted (Ratio opportunities taken versus those not taken)." [61, 79]	DR	2	Depends on the reasons why it was not adopted, but EA should make clear how opportunities can support a strategy.	Strategy implementation
"Number of business strategies that do not map to a funded initiative." [61]	DR	2	If it is about whether business strategies are actually implemented through initiatives, EA of course plays a big role here.	Strategy implementation
"Number of business strategies that map to multiple funded initiatives." [61]	DR	2	If it is about whether business strategies are actually implemented through initiatives, EA of course plays a big role here.	Strategy implementation
"Consistency of business and IT strategies (Percentage enterprise strategic goals and requirements supported by IT strategic goals)." [48, 80]	DR	2	If consistency is about alignment between business and IT strategies, then EA plays a big role here.	B-IT alignment
"Stakeholder satisfaction with the scope of the planned portfolio of programmes and services." [80]	DR	2	EA is for a great deal about portfolio management of programmes and services. What is important is how satisfied stakeholders are with it.	Program portfolio
"Percentage IT value drivers mapped to business value drivers." [80]	DR	2	IT should enable buisness and EA plays a big role in this.	B-IT alignment
"Ratio and extent of erroneous business decisions where erroneous or unavailable information was key factor." [80]	DR	2	If it is about information where EA should have helped, EA of course plays a big part here.	Investments
"Perceived value (User satisfaction with EA decisions)." [79]	DR	2	EA Customer perception of EA decisions is important.	EA Customer
"Due to architecture analyses and/or scenarios of the impact on the market are made." [50]	DR	2	It is not about whether impact is assessed, but whether EA improves understanding during assessments.	Risk and impact
"Due to architecture analyses and/or scenarios of the impact on the customer are made." [50]	DR	2	It is not about whether impact is assessed, but whether EA improves understanding during assessments.	Risk and impact

Table B.3: Metrics categorized under Program implementation with relevance 2, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Comparing project completion times and performance improvement (in terms of deliverable success) of architecture- aligned and non-compliant projects. (Timeliness (Staying within project time))(Reduce time to deliver IT projects)(saves project time) (duration of procurement projects)." [45, 61, 64, 65, 74, 79]	PI	2	Many papers aim at finding correlations between architecture and project time.	Project completion
"Extent to which projects have been able to leverage EA information (determined through survey)" [61]	PI	2	Whether EA information helped during the project.	EA Customer

"Rate of execution of executive IT-related decisions." [80]	PI	2	If executives make IT-related decisions, they leave the roadmap and details to the enterprise architects. Architects should take a form of responsibility for the execution, especially when it is about enterprise-wide decisions.	Project completion
"Number of significant IT-related incidents not identified in risk assessment (Not previously identified risks occurred, Calculation: Number of occurred but not previously identified risks divided by the total number of occurred risks)." [71, 80]	PI	2	Especially when it is about IT-related incidents that were significant for business, it may very well be about things the EA function could have foreseen.	Risk and impact
"Level of satisfaction of business executives with IT's responsiveness to new requirements (IT responsiveness satisfaction index, Calculation: Number of satisfied stakeholders divided by the total number of stakeholders)." [71, 80]	PI	2	EA in general has a big stake in executives' satisfaction with IT.	Speed and agility
"Number of business process changes that need to be delayed or reworked because of technology integration issues." [80]	PI	2	EA is for a great deal about integration.	Integration
"Number of IT-enabled business programmes delayed or incurring additional cost due to technology integration issues." [80]	PI	2	EA is for a great deal about integration.	Integration
"Project performance index (Measurement of the success of the project delivery in the 3 dimensions time, budget and quality). Calculation: Sum of achieved project goals divided by the number of goals. (expected and variance of budget, expected and variance of time)(Results in project quality) (successful execution of IT projects)." [64, 65, 68, 71]	PI	2	EA should not become a bottleneck and has responsibility with regard to EA projects, especially when it is about enterprise-wide projects.	Project completion
"Previously identified risks occurred (A measure of the efficacy of IT risk management). Calculation: Number of occurred and previously identified risks divided by the total number of occurred risks." [71]	PI	2	Identified or not, if they were significant to business, EA has some stake here.	Risk and impact
"Customer satisfaction with execution and result." [68]	PI	2	Especially interesting is whether EA helped during execution.	EA Customer
"Enables working with project complexity." [65]	PI	2	Whether EA actually helps reduced complexity during project implementation.	EA Customer

Table B.4: Metrics categorized under Program results with relevance 2, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Percentage re-use of architectural components including services." [61]	PR	2	If it is about components and services over domains etc. on enterprise level, then it is definitely a responsibility of EA.	Complexity
"Cost savings through re-use of software components, standardized purchase agreements, and common product sets (savings from reuse). " [56, 61, 78, 79]	PR	2	As reuse is a responsibility of EA, this form of cost savings may be attributed to EA.	IT Costs
"Number of new IT-enabled business capabilities (or features or services) within a given budget time and the revenue generated." [61, 74]	PR	2	Although revenue is not easily claimed, it is interesting whether new IT-enabled business capabilities are actually implemented.	Claims met
"Reduction in the rate of urgent infrastructure projects and number of support products (Occurrence of short-lived products)." [61, 74]	PR	2	It is about "urgent", meaning apparently something really short-term. EA should have short-term aspects, but in a long-term view, so definitely has responsibility here. Assuming support products here mean temporary solutions.	Short-term solutions
"Percentage of applications used by more than one business." [61]	PR	2	Reuse of applications on enterprise level is definitely a responsibility of EA.	Complexity
"Percentage of EA ideas implemented, trends and patterns." [61]	PR	2	What an "EA idea" actually is and who owns this idea is hard to track, but it is about meeting claims on a certain level.	Claims met
"Improvement in "anytime, anywhere, anyway" access to information." [61, 73]	PR	2	This is linked to integration and should be a responsibility of EA on enterprise level.	Integration

"Number of new processes identified and improved (number of processes improved) (number of new business processes identified and improved)." [61, 73, 76]	PR	2	On an enterprise level, if they were indeed identified by EA, it could be seen as an effect of EA. More importantly, it is about meeting claims.	Claims met
"Total and targeted cost savings achieved." [76]	PR	2	To a certain extent, enterprise architecture has the responsibility of meeting claims.	Claims met
"Percentage IT services where expected benefits realised (IT investment delivering predefined benefits)." [71, 80]	PR	2	On enterprise level, EA could be held responsible for its investments.	Claims met
"Percentage IT-enabled investments where claimed benefits met or exceeded." [80]	PR	2	On a higher level, this could be linked to EA.	Claims met
"Number of business disruptions due to IT service incidents." [80]	PR	2	Depends on the kind of incident of course, but EA definitely has a big stake in this.	Risk and impact
"Percentage business stakeholders satisfied that IT service delivery meets agreed-upon service levels." [80]	PR	2	Key here is the fact that it was agreed-upon and that it is about business satisfaction with IT.	User satisfaction with IT
"Percentage users satisfied with quality of IT service delivery." [80]	PR	2	EA has a big stake in user's satisfaction with IT and a responsibility to both internal and external users.	User satisfaction with IT
"Percentage of business process owners satisfied with supporting IT products and services. " [80]	PR	2	EA has a big stake in user's satisfaction with IT.	User satisfaction with IT
"Number of critical business processes supported by up-to-date infrastructure and applications. " [80]	PR	2	It is about critical business processes and how they are supported by IT, which is definitely an area of EA.	IT support
"Satisfaction levels of business and IT executives with IT-related costs and capabilities." [80]	PR	2	EA should take into account the satisfaction levels of both business and IT with costs and, especially, capabilities.	User satisfaction with IT
"Number of business processing incidents caused by technology integration errors." [80]	PR	2	EA is for a great deal about integration.	Integration
"Number of applications or critical infrastructures operating in silos and not integrated." [80]	PR	2	EA is for a great deal about integration.	Integration
"Number of business process incidents caused by non-availability of information." [80]	PR	2	Depends of course on the kind of information, but EA could play a big role here through integration.	Integration
"Project benefits realised that can be traced back to architecture involvement(e.g. cost reduction through reuse)" [80]	PR	2	Although rather high level, it is of course interesting whether benefits can be traced back to enterprise architecture involvement.	Claims met
"Synthesis of diverse technologies (reduction in variability)." [53, 69]	PR	2	Although the metric is a bit high level, it may be an important effect of enterprise architecture.	Complexity
"Reduced number of vendors of the same technology over time. " [63]	PR	2	EA definitely has a stake in standardizing technology.	Complexity
"Reduced version released diversity." [63]	PR	2	EA definitely has a stake in reducing the number of versions.	Complexity
"Physical complexity (Amounts and amount of sorts of systems)." [52]	PR	2	Although the metric is a bit high level, it may be an important effect of enterprise architecture.	Complexity
"Alignment (with management intentions)." [52]	PR	2	Although the metric is a bit high level, it may be an important effect of enterprise architecture.	Claims met
"Integration (combined functionalities into one or at least less applications. Consolidation of data and systems, easy interconnectivity, interfaces, data e.g. by standardization)." [52]	PR	2	EA is for a great deal about integration.	Integration
"Percentage delivered of intended results." [68]	PR	2	EA may have responsibility in the extend to which results are reached.	Claims met
"Functional fit (match between planned and delivered functionality) (Results in project functionality)." [65, 68]	PR	2	EA may have a big stake in the extend to which results are reached.	Claims met
"Technical fit (match between planned and delivered non-functional characteristics)." [68]	PR	2	EA may have a big stake in the extend to which results are reached.	Claims met
"Operational departments' satisfied with IT." [64]	PR	2	EA has a big stake in user's satisfaction with IT.	User satisfaction with IT

Table B.5: Metrics categorized under Decision making process with relevance 1, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.

Name	FA.	Rv.	Reason	Cat.
"Protocol rigidity (Less communication protocols and more informal communication)." [46, 69]	DP	1	EA is for a great deal about communication, but the link with formal or informal protocols is questionable.	Communication
"Shared goals, risks, rewards/penalties (Risks and rewards, concerning goal achievement, are shared among Business and IT)." [46, 69]	DP	1	Shared goals are important, but shared rewards is questionable. Moreover, may be a bit high level.	B-IT alignment
"Innovation, entrepreneurship (Innovation and entrepreneurship by the employees is the norm) (Same by management)." [46, 69]	DP	1	EA should leave room for innovation, but whether it is the norm has more to do with culture.	Innovation
"Management style (Management style is relationship based)." [46, 69]	DP	1	It is hard to say EA influences one's management style.	Communication
"Social, political, trusting environment (A trusted environment is created by valued partnerships)." [46, 69]	DP	1	A little bit vague, and maybe more about culture.	Collaboration and partnership
"Forecast Accuracy: Ability of the sales function to make accurate predictions regarding demand for products and services." [61]	DP	1	Hard to link to EA, as it is subject to multiple influences.	EA Customer
"Transformation Ratio: Organization's ability to structure SLA's that are "win-win" for both organization and customer." [61]	DP	1	Hard to link to EA as it is subject to multiple influences.	Customer
"Improved channel profitability index: identifies and evaluates alternative methods to reach and serve customers in current and targeted markets." [61]	DP	1	Although EA may play its part in the evaluation of alternatives, this metric is a bit vague and misses some context.	Business
"Number of ideas generated through communities/crowd sourcing." [61]	DP	1	Assuming ideas are not actual decisions. Number of ideas in itself is hard to track, especially who had them and whether they got them thanks to insights brought by EA.	Ideas
"Percentage of business-initiated ideas and percentage of IT-initiated ideas." [61]	DP	1	Assuming ideas are not actual decisions. Number of ideas in itself is hard to track, especially who had them and whether they got them thanks to insights brought by EA.	Ideas
"Percentage of ideas from internal collaboration." [61]	DP	1	Assuming ideas are not actual decisions. Number of ideas in itself is hard to track, especially who had them and whether they got them thanks to insights brought by EA.	Ideas
"Improvement in frontier analysis and response to environmental change. " [61]	DP	1	In the analysis part, of course EA should play a part. However, whether it was done better thanks to EA is hard to track. Also, response to environmental change is hard to link to EA.	Speed and agility
"Accuracy Index: This shows the ability of the regulatory team of an organization to provide accurate and timely information for stakeholders, and hence the ability to be transparent. " [61]	DP	1	Transparency is important, but this is quite high level and is hard to link to EA.	Collaboration and partnership
"Advisory Index: This shows the involvement of finance and/or regulatory teams of an organization with strategic business initiatives. " [61]	DP	1	EA is about collaborating, so it has some stake in this, but it is hard to link to EA's influence.	Collaboration and partnership
"Stakeholder satisfaction with levels of IT innovation expertise and ideas." [80]	DP	1	Assuming ideas are not actual decisions. Not clear about whose ideas this is.	Ideas
"Decision-making is steered by partnerships." [69]	DP	1	EA is about collaborating and communicating, partnerships. However, this metric is a bit high level as it is not clear what partnerships are meant.	Collaboration and partnership
"Adjustability of business objectives to the changes." [69]	DP	1	Hard to link to EA. Also, the metric misses context. What changes?	Speed and agility

Table B.6: Metrics categorized under Decision making results with relevance 1, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Number of new products licensed versus existing licenses leveraged." [61]	DR	1	Hard to say that EA influences this.	Innovation
"Number of cases where new technology was not adopted " [61]	DR	1	It depends on the reason why the new technology was not adopted. Whether it was because it is not in line with architecture, in line with business, etc.	Investments
"Improved market target (target market) index: Reflects the organization's decisions related to its participation depending on the size and growth rates of the markets." [61, 73]	DR	1	EA could have influence on the decision making part in some sense, but may be beyond EA's influence.	Business

"Percentage enterprise risk assessments including IT-related risk." [80]	DR	1	It is not about whether risk assessments are done, but whether IT-related risks are also included. However, this may not have a direct link with EA.	Risk and impact
"Number of approved initiatives resulting from innovative IT ideas." [80]	DR	1	EA could play a role in this, but what kind of IT ideas and who came up with them is hard to track.	Innovation
"Business case quality (Measure of the stability of the ROI estimation over the project life time). Calculation: Estimated ROI at project proposal divided by estimated ROI at project end." [71]	DR	1	Interesting, because better ROI estimations should be made thanks to EA. However, this may be subject to many influences.	Planning
"Forecast quality (A measure of the forecasting accuracy of IT budgets. This measure is significant if funds are held for IT which are then not needed, causing a shortage elsewhere). Calculation: Actual IT costs for certain period divided by the forecasted costs for the same period." [71]	DR	1	Interesting, because better forecasts should be made thanks to EA. However, this is subject to man influences.	Planning

Table B.7: Metrics categorized under Program implementation with relevance 1, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Change readiness (There is high and focused change readiness throughout the organization) (Same among management)." [46, 69]	PI	1	EA has some stake in communicating change throughout the organization, but actual readiness may be hard to link to EA's influence.	Change readiness
"Time taken to complete specific phases of the Software Development Life Cycle." [61]	PI	1	What is important here is that EA should not become a bottleneck. However, this may be too low level for EA.	Project completion
"Total cost of application development (AD) staff and tools to modify applications over time." [61]	PI	1	Could be part of the scenario analysis linked to EA. However, may be hard to link to EA as it is subject to multiple influences.	IT Costs
"R&D Success Index: Ability of the product development team to introduce new products and services to the market. (new products launched in past 12 months)" [61, 73]	PI	1	EA does have a stake in deciding whether the organization should offer certain products and what it means for the structure. However, it is a long way to the actual market.	Innovation
"Time from identification of Enterprise Business Strategy to implementation and the number of EBS's implemented." [61]	PI	1	Traceability to EA's influence is difficult here as it is subject to multiple influences.	Speed and agility
"Number of identified emerging technologies implemented." [61]	PI	1	EA has a stake here at enterprise level, but the metric misses some context.	Innovation
"Percentage of successful projects in which the EA team participated. " [61]	PI	1	Although the percentage of successful projects is interesting, the participation of EA is more about involvement or compliance, Moreover, it is hard to say that the projects were successful thanks to EA.	Project completion
"Response time to business demands." [74]	PI	1	Depends on whose response. Hard to link to EA as it is subject to many influences.	Speed and agility
"Rate of disruptions, failures, delays." [74]	PI	1	If there are disruptions, failures and delays, EA has may have some stake in this. The metric is a bit high level though, unclear what kind of disruptions are meant.	Project completion
"Organization's speed of response to stakeholder needs." [48]	PI	1	EA should not be a bottleneck, but it is hard to trace back to EA as it is subject to many influences.	Speed and agility
"The speed at which the organization can enter new markets." [48]	PI	1	Really hard to link to EA as it is subject to many influences.	Speed and agility
"Organization's ability to quickly respond to changes in regulations. (Number of new regulations implemented within the permitted timeframe)" [48, 61]	PI	1	Really hard to link to EA as it is subject to many influences.	Speed and agility
"Rate at which the organization can introduce new products/services (Time-to-market for new products) (Shortest time to market) (Improvement) (Decrease in TTM for new products –and the revenue generated–)(TTM compared to competitors). " [48, 49, 56, 61, 69, 73, 76]	PI	1	Really hard to link to EA as it is subject to many influences.	Speed and agility

"Level of business user satisfaction with quality of management information." [80]	PI	1	EA has some stake in communicating, but what information is meant here is not clear.	Information provision
"Responsiveness to change in customers' preferences, demands." [69]	PI	1	Hard to link to EA as it is subject to many influences.	Speed and agility
"Responsiveness to market and technological changes and trends." [69]	PI	1	Hard to link to EA as it is subject to many influences.	Speed and agility
"Responsiveness to social, regulatory, and environmental issues." [69]	PI	1	Hard to link to EA as it is subject to many influences.	Speed and agility
"Shortest time between identifying necessary changes and acting upon that identification" [69]	PI	1	EA could have some stake in this, but "shortest time" is rather vague and it is not clear what kind of actions are meant.	Speed and agility
"Costs of inadequate change specifications (Measurement of the financial losses caused by inadequate change specifications)." [71]	PI	1	Although EA could have a stake in this, it could be really difficult to link back to EA.	Costs
"Employee satisfaction index (A measure of IT employee satisfaction based on a survey)." [71]	PI	1	IT employee satisfaction with what?	EA Customer
"Due to architecture the ability to react on external changes had increased." [50]	PI	1	Really hard to link to EA as it is subject to many influences.	Speed and agility
"Greater flexibility in business processes." [45]	PI	1	Metric a bit high level and subject to many influences.	Speed and agility
"Saves project resources." [65]	PI	1	Hard to link resources to EA.	Resources
" Speeds up project initialization." [65]	PI	1	This may be too low level for EA.	Speed and agility

Table B.8: Metrics categorized under Program results with relevance
1, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"ROI, ROE, ROA, IRR, B/CR, NPV, BEP." [61, 66, 67]	PR	1	At decision making level EA may use this, but the actual realization at project level is subject to many influences.	Financial appraisal methods
"Reduction in number of manual interfaces." [61]	PR	1	May be a bit too low level for EA.	Complexity
"Cutover costs for upgrades/conversions." [61, 74]	PR	1	Something EA should be concerned about, but hard to link back.	IT Costs
"Number of outages (downtime) reported." [61]	PR	1	EA here is concerned with the type of outages and what the impact was on business. The number of outages in itself may not be that interesting for measuring EA effectiveness.	IT Performance
"Improvement in downtime or availability measures, amount of downtime during "go live" phases of projects." [61,74]	PR	1	EA has responsibility here when it goes wrong and it is about EA programs. However, an improvement is hard to link to being thanks to EA.	IT Performance
"Number of infrastructure change management requests." [61]	PR	1	Improved infrastructure could lead to less change requests, but this is subject to multiple influences.	Planning
"Percentage of capacity used or volume of unused capacity." [61]	PR	1	Use and redundancy can be areas of EA. However, it depends on what is meant by capacity.	Resources
"IT support performance: Measures how well the IT team supports its users with IT support activities (time-to-respond and time-to-resolve)." [61]	PR	1	Hard to link to EA as it is subject to multiple influences. The IT team is bigger than EA.	IT support
"Service level effectiveness: Measures the effectiveness of the expected service levels in place in an organization with all its IT Users." [61]	PR	1	EA could have some stake in this, but the metric is rather broad.	Claims met
"IT Total Cost of Ownership." [61]	PR	1	May be difficult to link to EA, though EA should be concerned with TCO.	IT Costs
"IT cost per employee per year." [61]	PR	1	Linking total IT cost per employee to EA is difficult.	IT Costs
"Systems Performance: Percentage of time that the IT organizational systems and applications and infrastructure (both hardware and software) supported by the IT unit and its service providers are performing well within their specified objectives. (Time system is available to the organization/time system expected to be available to the organization)." [61, 73]	PR	1	EA has responsibility here when it goes wrong and it is about EA programs. However, this may be more on the operational level of IT and can be hard to link to EA.	Claims met
"Cost-of Sales index: shows how cost-efficiently sales team can turn prospects to customers." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Customer acquisition and costs involved)New customers acquired versus customer groups targeted)." [61, 76]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer

"Customer Lifetime Value: Present value of all future profits obtained from a customer over the life of their relationship with a firm." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Customer Equity: lifetime value of current and future customers." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Customer Retention: how well existing customer needs are identified and satisfied." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Cross selling: Selling related products to current customers." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"On-time delivery: ability of organization to meet customer expectations, time taken to satisfy order or request." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Sales Opportunity Index: How successfully organization can cultivate prospects for its products and services." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Business
"Sales Cycle Index: Ability of the sales function to manage duration of sales process - tracking process to record when initial contacts with prospects are made and close date." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Speed and agility
"Sales Close Index: How successfully the sales function can turn prospects into customers. " [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Sales Price Index: How successfully the sales function can complete a particular business without reducing price and therefore margin." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Business
"Customer Service Accuracy: Measures the availability and accuracy of information needed to complete a specific order." [61]	PR	1	EA is about information, but depends on what kind.	Information provision
"Customer Service Performance: Measures organization's ability to fulfill customer requests as per agreed performance guidelines." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Customer Care Performance: Measures critical aspects of customer service and efficiency of customer care team to handle and close requests within SLAs (Customer care requests Within SLA / total customer care Requests). " [61, 73]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Order Fill-rate: Organization's ability to meet customer expectations." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Material quality (damages, defects). supplied to customer (Improved quality)." [61, 77]	PR	1	Really hard to link to EA as it is subject to many influences.	Product quality
"Agreement effectiveness of SLA's: overall effectiveness of SLA's in place with organization's customers. Data can be obtained through quarterly surveys (SLAs met)" [61, 71]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Average customer waiting time, customer handling time and wrap-up time." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Labor cost per call." [61]	PR	1	Really hard to link to EA as it is subject to many influences and may be too low level.	Costs
"Number of calls handled per agent per hour, number of calls handled per team shift." [61]	PR	1	Really hard to link to EA as it is subject to many influences and may be too low level.	Customer
"Percentage of calls "one and done" versus handed off/escalated and number of agent touches until case resolved." [61]	PR	1	Really hard to link to EA as it is subject to many influences and may be too low level.	Customer
"Workforce utilization rate (number of agents per shift)" [61]	PR	1	May be too low-level for EA.	Resources
"Feedback through customer surveys" [61]	PR	1	Depends of course on the kind of feedback. One should try to find aspects that could be linked to EA.	Customer
"Percentage increase in market capitalization or market share (The market share increased due to architecture)" [50, 61, 73, 77]	PR	1	Something the board would like to see, but this is really hard to link to EA as it is subject to many influences.	Business

"Improved market coverage index: Reach of sales to generate revenue in countries where market demand exists." [61, 73]	PR	1	Really hard to link to EA as it is subject to many influences.	Business
"Opportunity/threat index: The potential of an organization to grow or shrink market share depending on the level of competition in the industries in which it participates (Sum(Market Share index for top 5 revenue leaders))" [61, 73]	PR	1	Really hard to link to EA as it is subject to many influences.	Business
"Percentage increase in quality and number of changes found in new products and services offered by the organization." [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Product quality
"Time required to complete key business-to-business tasks." [61]	PR	1	Depends on the kinds of tasks and what EA's stake is	Speed and agility
"Improvement in the time for report products and accuracy of information." [61]	PR	1	EA should be concerned with information provision, but improvements could be hard to trace back to EA. Also, what kind of information?	Information provision
"Cost of customer innovation versus partner networks. " [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Innovation
"Number of micronetworks and connections made to other communities." [61]	PR	1	Depends on the kind of connections.	Collaboration and partnership
"Number of business processes documented and optimized. " [61]	PR	1	Documented is not that interesting, optimized is.	Business
"Number of lawsuits filed. " [61]	PR	1	Really hard to link to EA as it is subject to many influences.	Regulatory
"Compliance Index: The ability of an organization' s finance and regulatory teams to abide by laws and regulations to carry out smooth business operations. " [61]	PR	1	Not clear how EA influences this.	Regulatory
"Cost-of-Service Index: The overall cost to provide finance and regulatory support and advisory services to the organization. " [61]	PR	1	Not clear how EA influences this.	Costs
"Relative ease of access to information." [74]	PR	1	EA is for a great deal about information provision. However, it is not clear what kind of information is meant or at what level.	Information provision
"Organization's ability to tailor products/ services to individual stakeholder needs" [48]	PR	1	Really hard to link to EA as it is subject to many influences.	Customization
"Organization's ability to manage relationships with contracted caregivers not employed by the organization." [48]	PR	1	Really hard to link to EA and may be too low level.	Collaboration and partnership
"Market share index (revenue of organization's offered products and services/total revenue of ISIC code selected industries)." [73]	PR	1	Really hard to link to EA as it is subject to many influences.	Business
"(Reduction in the) number of authorative sources for critical information assets. " [61, 73]	PR	1	Metric may be a bit too specific.	Security
"Number of assets (both business and IT) requiring maintenance reduced." [73]	PR	1	May be related to reuse, but very indirectly.	Maintenance
"Service performance (time service is available to the customer/time service expected to be available to customer)." [73]	PR	1	Really hard to link to EA as it is subject to many influences.	Performance
"Number of unauthorized accesses and changes to process, information and technology (including applications)." [61, 73]	PR	1	Really hard to link to EA as it is subject to many influences.	Security
"IT Total Cost index (sum of IT-related TCO/ total revenue of organization)" [73]	PR	1	Although important, hard to link to EA as it is subject to many influences.	IT Costs
"Cost/income ratio" [76]	PR	1	Really hard to link to EA as it is subject to many influences.	Costs
"Number of new challenges and services developed for the customer." [76]	PR	1	On enterprise level EA could have been an initiator, but the metric is a little vague (challenges).	Customer
"Customer care performance changes for specific channels and services." [76]	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Number of security incidents causing business disruption or public harassment." [80]	PR	1	Depends on the kind of incident.	Security
"Time to grant, change and remove access privileges, compared to agreed-upon service levels." [80]	PR	1	May be too low-level for EA.	Claims met

"Shortest time of educating employees" [69]	PR	1	Hard to link to EA as it is subject to many influences.	Training
"Shortest time of operation (time needed for end-to-end chain)" [69]	PR	1	Really hard to link to EA as it is subject to many influences.	Speed and agility
"Customization of products/services" [69]	PR	1	EA could have some stake in customization, but it is unclear what kind of customization is meant.	Customization
"EA guiding ratios." [60]	PR	1	Decisions based on these ratios.	Appraisal method
"Reduced costs (controls costs) (cost savings and cost avoidance)(decreased costs)." [65, 72, 76, 77]	PR	1	Quite high level, and hard to link to EA as it is subject to many influences.	Costs
"Beating competitors (competititive performance in terms of market share and sales)." [49, 77]	PR	1	Really hard to link to EA as it is subject to many influences.	Competitive advantage
"Tighter customer relationships." [77]	PR	1	Quite high level, and hard to link to EA as it is subject to many influences.	Customer
"Revenues generated by new business initiatives during the time to market won by improved agility." [78]	PR	1	This is really hard to measure and link back to EA as it is subject to many influences.	Speed and agility
"Incident duration (calculation of the average incident duration by severity level)" [71]	PR	1	Depending on the kind of incidents, subject to multiple influences.	Risk and impact
"Customer satisfaction index (A measure of customer satisfaction)(customer satisfaction)(the customer satisfaction increased due to architecture)." [49, 50, 71]	PR	1	Which customers, when, where? Hard to link to EA, may be subject to many influences.	Customer
"Defects uncovered prior to production." [71]	PR	1	May be important, but difficult to link to EA as it is subject to multiple influences.	Product quality
"Unexpected service interruption duration. " [71]	PR	1	Hard to link to EA as it is rather low level and subject to many influences.	Performance
"Reopened incidents." [71]	PR	1	Really hard to link to EA as it is subject to many influences.	
"IT cost (total, application maintenance, and IT operations unit cost)." [45, 49, 55]	PR	1	Although an important aspect of EA, it is hard to link general IT cost to EA effectiveness.	IT Costs
"Operational Excellence." [49]	PR	1	Really hard to link to EA as it is subject to many influences.	Competitive advantage
"Percentage revenue generated from new products." [53]	PR	1	Really hard to link to EA as it is subject to many influences.	Business
"IT Infrastructure portfolio quality (in terms of service performance levels and costs)." [72]	PR	1	Hard to link to EA as it is subject to many influences.	Performance

Table B.9: Metrics categorized under Decision making process with relevance 0, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Business sponsor/champion (CEO is IT sponsor/champion)." [46, 69]	DP	0	He should understand it, but may not have to be a great sponsor. Also, EA cannot help it if the CEO is not a "champion".	B-IT alignment
"Percentage of ideas sourced externally." [61]	DP	0	Assuming ideas are not actual decisions. Not clear how this is related to EA and rather unclear metric.	Ideas
"Average ideas per month for top 10 most active customers." [61]	DP	0	Assuming ideas are not actual decisions. Not clear how this is related to EA and rather unclear metric.	Ideas

Table B.10: Metrics categorized under Program implementation with relevance 0, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Feasibility study performance index (Measurement of the efficiency of the feasibility studies development process)." [71]	PI	0	Not clear how this is related to EA.	Study completion

Table B.11: Metrics categorized under Program results with relevance
0, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Number of identifiable lead customers and percentage of their participation level." [61]	PR	0	Not clear how this is related to EA.	Customer
"Customer satisfaction with agent knowledge/attitude" [61]	PR	0	Not clear how this is related to EA.	Customer
"Service desk calls caused by inadequate training." [71]	PR	0	Not clear how this is related to EA.	Training

Table B.12: Metrics that were categorized otherwise, shown by name,
focus area, relevance, and reason.

Name	FA.	Rv.	Reason
"Inter/Intra organizational learning." [46]	None	NA	Metric too high level.
"Knowledge sharing (within and between business IT and extra-enterprise)." [46, 69]	None	NA	Too high level and maybe more about governance.
"Liaison breadth/effectiveness (broader and more effective internal and extra-enterprise liaison(s))." [46, 69]	None	NA	Too high level and maybe more about governance.
"IT metrics (are available concerning technical performance, cost efficiency, ROI, cost effectiveness and external partners)." [46, 69]	Maturity and governance	NA	If they are not there, EA should make sure they are as they are needed for effective decision making. However, it is not necessarily an effect, more a governance aspect.
"Business metrics (are available concerning technical performance, cost efficiency, RIO, cost effectiveness and external partners)." [46, 69]	Maturity and governance	NA	If they are not there, EA should make sure they are as they are needed for effective decision making. However, it is not necessarily an effect, more a governance aspect.
"Balanced metrics (Business and IT performance is assessed using mutually dependent indicators, with respect to external partners)." [46, 69]	Maturity and governance	NA	If they are not there, EA should make sure they are as they are needed for effective decision making. However, it is not necessarily an effect, more a governance aspect.
"Service level agreements (are used throughout the enterprise, extended to external partners)." [46, 69]	Maturity and governance	NA	Whether they are used does not say anything about effectiveness.
"Benchmarking (is routinely performed, with feedback from external partners)." [46, 69]	Maturity and governance	NA	Whether this is done does not say anything about effectiveness.
"Formal assessments/reviews (are performed routinely)." [46, 69]	Maturity and governance	NA	Whether this is done does not say anything about effectiveness.
"Continuous improvement (takes place based on the assessments using routine practices)." [46, 69]	None	NA	Metric too high level.
"Business strategic planning (is integrated across and outside the enterprise)." [46, 69]	Maturity and governance	NA	May be more about governance.
"IT strategic planning (is integrated across and outside the enterprise)." [46, 69]	Maturity and governance	NA	May be more about governance.
"Reporting/organization structure (There is a federated reporting/organization structure where the CIO reports to the CEO)." [46, 69]	Maturity and governance	NA	Structure sais nothing about effectiveness.
"Budgetary control." [46]	None	NA	Metric too high level.
"IT investment management." [46]	None	NA	Metric too high level.
"Steering committee(s)." [46]	Maturity and governance	NA	Whether they exist (?) does not say anything about effectiveness.
"Prioritization process (based on added value, extended to the added value of external partners)." [46, 69]	Maturity and governance	NA	Existence of such a process does not say anything about effectiveness.
"IT program management (based on continuously improved standards)." [46, 69]	Maturity and governance	NA	Existence of management does not say anything about effectiveness.
"Standards articulation (Enterprise and inter-enterprise standards are specified and maintained)." [46, 69]	Maturity and governance	NA	Whether standards are there or not does not say anything about effectiveness.
"Architectural integration enterprise (The EA is integrated vertically, from strategy to operations)." [46, 69]	Maturity and governance	NA	Rather high level and not about effectiveness.
"Architectural integration inter-enterprise (The EA is integrated horizontally, between business units)." [46, 69]	Maturity and governance	NA	Rather high level and not about effectiveness.

"Architectural transparency, flexibility (The EA is transparent and flexible across the organization, change projects shape EA)." [46, 69]	Maturity and governance	NA	Not about EA effectiveness.
"Locus of power (Executives, including CIO and partners, have decision power)." [46, 69]	Maturity and governance	NA	Who has power is more about governance, not effectiveness.
"Career crossover (Employees can switch careers across the organization) (Managers can switch roles)." [46, 69]	Maturity and governance	NA	Not about EA effectiveness.
"Education, cross-training (Education and cross-training is possible across the organization) (Same between management roles)." [46, 69]	Maturity and governance	NA	Not about EA effectiveness.
"Percentage Re-use and repeat of common designs that speed decision-making with less time to complete design." [61]	Architecture	NA	Seems to be focused more on the quality of the designs, although the speed of decision-making is interesting.
"Number of projects, design artifacts reviewed, at what level they are reviewed, and the number of rejections per project reviewed." [61]	EA use and compliance	NA	This is more about EA compliance.
"Number of projects to raise EA exemption." [61]	EA use and compliance	NA	Part of the bottom-up feedback. Interesting are the reasons why.
"Number of IT trends planned for in the future state architecture." [61]	Architecture	NA	It should be about IT trends linked to business. Also, a number of IT trends in itself does not say much.
"Sigma value." [61]	None	NA	Metric not clear.
"To-complete Performance Index." [61]	None	NA	Metric not clear.
"Product Portfolio Index: Identifies and validates current and projected customer needs in existing and targeted markets." [61, 73]	None	NA	Metric not clear.
"Increase in the ability of the EA team to respond effectively to new business opportunities." [61]	None	NA	Metric too high level.
"Number of environmental/industry trends articulated in future-state architecture" [61, 73]	Architecture	NA	What is planned in the future-state architecture does not say anything about effectiveness.
"Measuring productivity through resource management." [61]	None	NA	Metric not clear.
"Size of the innovation team." [61]	Maturity and governance	NA	The size of the innovation team does not say anything about its effectiveness.
"Innovation funding as a percentage of revenue." [61]	Maturity and governance	NA	Although EA is about frames etc., there should still be some room for innovation. EA has some stake here, but funding in itself may not be part of effectiveness.
"Innovation funding as a percentage of IT spending." [61]	Maturity and governance	NA	Innovation funding as a percentage of IT spending may be more important to EA than innovation funding as a percentage of revenue. Funding, however, may not be part of effectiveness.
"Percentage of teams participating in definition and usage of metrics" [61]	Maturity and governance	NA	Although interesting, this is not about effectiveness.
"Number of innovation events or campaigns conducted." [61]	Maturity and governance	NA	A number of events or campaigns does not say anything about EA effectiveness.
"Regional or geographic demographic comparisons of customers." [61]	None	NA	Metric not clear.
"Trends in customers (increase/decline) for top 10 most active customers." [61]	None	NA	Metric not clear
"Number of certified architects per project and vice versa." [61]	EA use and compliance	NA	This is more about involvement and compliance at project level.
"Amount of architect time per project." [61]	EA use and compliance	NA	This is more about involvement and compliance at project level.
"Amount of time the EA group spends supporting critical business planning activities and decision-making." [61]	EA involvement	NA	This is more about EA involvement during decision making.
"Percentage reduction in the number of compliance waivers issued." [61]	EA use and compliance	NA	This is more about EA compliance.
"Percentage of EA compliance waivers due to future-state architecture not meeting business needs." [61]	EA use and compliance	NA	This is more about EA compliance, especially feedback from business.
"Percentage of projects identified through the EA process compared to ad hoc identification." [61]	EA involvement	NA	Assuming identification happens at decision making level, this is more about EA involvement.
"Number of projects funded and implemented as identified by the EA process." [61]	EA use and compliance	NA	It is about which projects, as identified by the EA process, have actually been implemented. However, this may be more about EA involvement or use and compliance.

"Number of business lines that consult the EA team. Number of times the EA teams are consulted for advice and guidance. " [61]	EA use and compliance	NA	This is more about EA's use by business lines.
"Number of new projects that trigger a change in EA." [61]	EA use and compliance	NA	This is about the feedback loop of project compliance.
"Number of projects progressed with EA review required" [61]	Maturity and governance	NA	This is more about governance or compliance.
"Amount of customization. " [61]	None	NA	Metric too high level.
"Number of to-be architectures defined." [61]	Architecture	NA	This is about the architecture itself.
"Number of domains that have future state defined." [61]	Architecture	NA	This is about the architecture itself.
"Number of projects that leverage the EA repository for future-state designs. " [61]	EA use and compliance	NA	This is about EA's use or compliance.
"Rate of business-to-business innovation the EA process enables by improved anecdotal documentation. " [61]	None	NA	Metric not clear.
"Number of EA artifacts used in budget and program planning activities. " [61]	EA involvement	NA	This is about EA involvement during planning.
"Number of EA artifacts produced and circulated yearly and replaced/refreshed annually. " [61]	Architecture	NA	This is about the architecture itself.
"Extent to which the EA website is used by business and others (number of EA website visitors). " [61]	EA use and compliance	NA	This is about EA's use or compliance, involvement.
"Number of attendees at EA initiated meetings over time. " [61]	Maturity and governance	NA	This is more about the architecture function or governance.
"Amount of time (engagement) EA team spends with the outsourcing team. " [61]	EA involvement	NA	This is more about EA's involvement with the outsourcing team.
"Employee awareness regarding EA team activities (obtained through survey). " [61]	Maturity and governance	NA	This is not about EA effectiveness.
"Number of internal/external audit filings." [61]	Maturity and governance	NA	This is more about governance.
"Number of overdue regulatory filings." [61]	Maturity and governance	NA	Not about EA effectiveness and rather unclear.
"Number of censures, fines and warnings by local regulators." [61]	Maturity and governance	NA	This is not about EA effectiveness.
"Accuracy and completeness of documentation." [61]	Architecture	NA	This is more about the architecture itself.
"Percentage of software lacking license documentation." [61]	Maturity and governance	NA	Whether they have license documentation does not say anything about effectiveness.
"Count and percentage of unauthorized software. " [61]	Maturity and governance	NA	Although this is about standardization, it has more to do with governance issues.
"Number of designs/projects 100 procent compliant with EA standards. " [61]	EA use and compliance	NA	This is more about EA compliance.
"Number that would have achieved compliance at or above a given level." [61]	EA use and compliance	NA	This is more about EA compliance.
"Percentage of transactions that adhere to master data standards." [61]	EA use and compliance	NA	Not about EA effectiveness and rather unclear.
"Percentage of projects that follow clearly defined governance. " [61]	Maturity and governance	NA	This is more about maturity and governance.
"Number of backlogged projects waiting for architecture governance. " [61]	Maturity and governance	NA	This is more about maturity and governance.
"Number of projects that complete self-certification in all stages." [61]	Maturity and governance	NA	This is more about maturity and governance.
"Number of internal audit raisings and assessing the management of the regulatory finding." [61]	None	NA	Metric not clear.
"IT product diversity." [74]	None	NA	Metric too high level.
"Product support costs." [74]	None	NA	Metric too high level.
"Monitoring/tracking performance." [74]	None	NA	Metric not clear.
"More reuse." [74]	None	NA	Metric too high level.
"Alignment with business strategy." [74]	None	NA	Metric too high level.
"Existence of business plan to use existing technology to enter new market segments." [48]	Maturity and governance	NA	The existence of such a plan does not have anything to do with effectiveness.
"Existence of business plan to develop new technologies for new kinds of products/services." [48]	Maturity and governance	NA	The existence of such a plan does not have anything to do with effectiveness.
"Percentage of time each EA role (is occupied or spends) in strategic and business planning process." [61, 73]	EA involvement	NA	This is about how much EA is involved with business planning.

"Number of new business plans executed with the help of EA. (Number of new business plans with EA involvement.)" [73, 76]	EA use and compliance	NA	This seems to be focused on whether EA was used and involved.
"Percentage executive management roles with clearly defined accountabilities for IT decisions." [80]	Maturity and governance	NA	This is more about governance.
"Frequency of IT strategy committee meetings." [80]	Maturity and governance	NA	This is more about governance.
"Update frequency of risk profile." [80]	Maturity and governance	NA	Update frequency does not say anything about effectiveness.
"Percentage IT-enabled investments where benefit realisation monitored through full economic life cycle." [80]	Maturity and governance	NA	Says something about maturity or governance.
"Percentage investment business cases with clearly defined and approved expected costs and benefits. " [80]	Maturity and governance	NA	Having these business cases does not say anything about effectiveness.
"Percentage IT services with clearly defined and approved operational cost and expected benefits." [80]	Maturity and governance	NA	Defining this does not say anything about effectiveness.
"Satisfaction of business users with training and user manuals." [80]	Maturity and governance	NA	Not about EA effectiveness.
"Number of IT services with outstanding security requirements." [80]	None	NA	What is an outstanding security requirement? Also, it may not be about EA effectiveness.
"Frequency of security assessment against latest standards and guidelines." [80]	Maturity and governance	NA	Security assessments are needed, but the frequency of the assessments is not about EA effectiveness.
"Frequency of capability maturity and cost optimization assessments." [80]	Maturity and governance	NA	These assessments are needed, but the frequency of the assessments is not about EA effectiveness.
"Trend of assessment results. " [80]	None	NA	Metric too high level.
"Number of exceptions to architecture standards and baselines applied for and granted." [80]	EA use and compliance	NA	This is more about EA compliance, especially feedback.
"Percent projects using enterprise architecture services." [80]	EA use and compliance	NA	This is more about EA's use or compliance.
"Date of last update to domain and/or federated architectures." [80]	Architecture	NA	This is more about the architecture itself.
"Number of identified gaps in models across enterprise, information, data, application and technology architecture domains." [80]	Architecture	NA	This is more about the architecture itself.
"Percent projects that use the framework and methodology to re-use defined components." [80]	EA use and compliance	NA	This is more about EA's use or compliance.
"Number of people trained in methodology and tool set." [80]	Maturity and governance	NA	Not about EA effectiveness.
"Flexible product model." [69]	None	NA	Metric too high level.
"Flexible IT systems." [69]	None	NA	Metric too high level.
"High product quality" [69]	None	NA	Metric too high level.
"High IT quality" [69]	None	NA	Metric too high level.
"Customization of IT systems" [69]	None	NA	Metric too high level.
"Reduced number of aged internal standards." [63]	Maturity and governance	NA	A reduced number of aged standards does not say anything about effectiveness. It may be more about EA itself.
"Reduced review process cycle time." [63]	None	NA	Unclear what review process it is about.
"User evaluation of effectiveness." [63]	None	NA	Metric too high level: Which users, what effectiveness?
"Quality measures of financial efficiency, business effectiveness and architecture process." [63]	None	NA	Metric too high level.
"Improved quality." [77]	None	NA	Metric too high level.
"Identifying and minimizing interventions." [75]	None	NA	Metric too high level.
"Percentage reuse of existing frameworks." [75]	Maturity and governance	NA	Depending on the kind of frameworks used, not about effectiveness.
"Percentage of IT budget allocated to growth initiatives." [75]	Maturity and governance	NA	Although EA has a stake in trying to get enough budget for growth and innovation and providing room for growth and innovation, the budget allocated to such initiatives may not say much about EA effectiveness.
"Quality of service (User perception of EA quality). (Architecture customer feedback regarding quality of information provided)" [79, 80]	Architecture	NA	More about EA quality.

"Application continuity plan availability (A measure of how completely IT continuity plans for business critical applications have been drawn and tested up for the IT's application portfolio)." [71]	Maturity and governance	NA	Whether these plans are available does not say anything about effectiveness.
"Backuped key roles (A measure of how completely qualified personnel has been built up)." [71]	Maturity and governance	NA	Not about EA effectiveness.
"Service portfolio methodology analysis (Indicates the extent to which IT services are analyzed according to a given service portfolio methodology)." [71]	Maturity and governance	NA	Whether a certain methodology is used is not effectiveness.
"Project's employee and contractor mix (A measure of the degree strategic and operational IT projects deviate from the intended employee and contractor mix)" [71]	Maturity and governance	NA	Not about EA effectiveness.
"PM guideline adherence (This measure indicates to which extent IT projects adhered to PM methodology)" [71]	Maturity and governance	NA	Whether a certain methodology is used is not effectiveness.
"SLA diffusion (A measure of how completely SLAs have been drawn up for an organizations IT service portfolio." [71]	Maturity and governance	NA	Whether SLAs are drawn up does not say anything about EA effectiveness.
"Application criticality ratings (A measure of how completely application criticality is being performed for the IT application portfolio)." [71]	Maturity and governance	NA	As derived from the source, this is more about governance.
"IT process standard adherence, application (Based on a management review, indicates the extent to which IT applications adhered to standardized IT processes)." [71]	EA use and compliance	NA	As derived from the source, this is more about which applications are compliant or not.
"Project compliance to target architecture." [71]	EA use and compliance	NA	More about EA compliance.
"Workplace inspection (A measure of how workplace rules are attained to by employees)." [71]	Maturity and governance	NA	Not about EA effectiveness.
"IT processes measured by KPIs." [71]	Maturity and governance	NA	More about governance.
"Project's quality plan availability (a measure of the efficacy of IT quality assurance management). " [71]	Maturity and governance	NA	Whether these plans are available does not say anything about effectiveness.
"Projects with quality manager who is not project manager (Degree of seperation of quality and management responsibilities within IT projects)." [71]	Maturity and governance	NA	Not about EA effectiveness.
"Audit findings" [71]	EA use and compliance	NA	As derived from source, more about EA compliance.
"Employees in strategic focus areas (A measure taking a resource perspective of the need to increase the amount of effort expended on strategic focus areas according to IT strategy)." [71]	Maturity and governance	NA	Not about EA effectiveness.
"Skill profile description availability (A measure of how completely job descriptions and HR planning have been drawn up)." [71]	Maturity and governance	NA	Not about EA effectiveness.
"Employee qualification (A measure of the performance of the training and HR process)." [71]	Maturity and governance	NA	Not about EA effectiveness.
"IT staff training (A measure of how completely IT training plans have been assigned and completed)." [71]	Maturity and governance	NA	Not about EA effectiveness.
"Employees in innovative projects (Resource perspective of the need to increase the amount of effort spent on innovative projects)." [71]	Maturity and governance	NA	Innovation is important, but EA effectiveness is not about the number of people working on it.
"Application portfolio methodology analysis (extent to which applications are analyzed according to a given application portfolio methodology)." [71]	Maturity and governance	NA	Whether a certain methodology is used is not effectiveness.
"IT process standard adherence, service (extent to which IT services adhered to standardized IT processes)." [71]	Maturity and governance	NA	As derived from the source, this is more about governance.
"Business application technology standards compliance." [71]	EA use and compliance	NA	More about compliance.
"IT roles staffed." [71]	Maturity and governance	NA	More about maturity or governance.

"Background checks." [71]	Maturity and governance	NA	Not about EA effectiveness.
"Action plans for critical IT risks. " [71]	Maturity and governance	NA	Whether these plans are available or not does not say anything about effectiveness.
"Feasibility study satisfaction index." [71]	None	NA	Metric not clear.
"Maintenance projects effort." [71]	None	NA	Metric not clear.
"Business applications compliant with IT architecture and technology standards." [71]	EA use and compliance	NA	More about compliance and feedback.
"Procurement policies compliance." [71]	EA use and compliance	NA	More about EA compliance.
"IT continuity plans for business applications supporting critical processes. " [71]	Maturity and governance	NA	Whether these plans are available does not say anything about effectiveness.
"Password standard compliance." [71]	EA use and compliance	NA	Actually even too low for project compliance.
"Critical IT processes monitoring." [71]	Maturity and governance	NA	More about governance.
"KPI targets met." [71]	None	NA	Metric too high level.
"IT component category standardization. " [71]	None	NA	Metric not clear.
"Safeguarding and facilitating change." [52]	None	NA	Too high level, also the way it is measured.
"Decision making." [49]	None	NA	Too high level, also the way it is measured.
"The role of the customer in the architecture is in accordance with the importance of the customer for the organization." [50]	Architecture	NA	More about the architecture itself, not about effectiveness.
"The role of the market in the architecture is in accordance with the importance of the market for the organization." [50]	Architecture	NA	More about the architecture itself, not about effectiveness.
"Cross-governmental interoperability." [45]	None	NA	Metric too high level.
"Impose service delivery." [45]	None	NA	Metric too high level.
"Support and enable business change." [45]	None	NA	Metric too high level.
"Improve process effectiveness." [45]	None	NA	Metric too high level.
"Better align business and IT organizations, (aligns business and IT)." [45,65]	None	NA	Metric too high level.
"Infrastructure renewal." [45]	None	NA	Metric too high level.
"Legacy transformation." [45]	None	NA	Metric too high level.
"Enable outsourcing." [45]	None	NA	Metric too high level.
"Resource management." [45]	None	NA	Metric too high level.
"Enables management to pursue a strategy that is optimal for the entire enterprise." [65]	None	NA	Metric too high level.
"Allows for complexity to be managed." [65]	None	NA	Metric too high level.
"Improves agility. (Increased agility)." [65, 76]	None	NA	Metric too high level.
"Mission performance." [72]	None	NA	Metric not clear.
"Measuring EA program value." [72]	Maturity and governance	NA	More about whether measurement is done.
"Reduced complexity." [76]	None	NA	Metric too high level: what complexity?
"Reduced risk." [76]	None	NA	Metric too high level.
"Strategy momentum." [79]	None	NA	Metric too high level.
"Financial impact." [79]	None	NA	Metric too high level.
"Skills and capability growth." [79]	Maturity and governance	NA	Seems to be more about the architects themselves.
"EA process improvement." [79]	Maturity and governance	NA	Seems to be more about governance.

Appendix C

Survey and Interview Setup and Products

C.1 Survey and Interview Questions Asked

C.1.1 Input Survey Questions

A list of the questions used for the online survey as what they looked like on "Instant.ly" is shown on the following pages. [1]

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[1]The survey was made using "Instant.ly" on the 14th of january 2014 and adjusted slightly on the 16th of january after some suggestions by the first interviewee. The one shown is the final version.

Value of enterprise architecture

Page 1

Q1: SINGLE LINE TEXT
Please enter the ID that has been given to you:

Q2: DESCRIPTIVE TEXT

  The following questions are about your role and experience within the field of
  enterprise architecture.

Q3: SINGLE LINE TEXT
What is your primary role within your organization? (e.g. CIO, architect, consultant..)

Q4: MULTI-SELECT LIST
How are you involved with enterprise architecture? (multiple answers possible)

  1 ☐ I am involved with the development of enterprise architecture.
  2 ☐ I use enterprise architecture.
  3 ☐ I provide expertise on enterprise architecture.
  4 ☐ Other, please specify: [Open-ended answer]

Q5: SINGLE LINE TEXT
For approximately how long have you been active in the field of enterprise
architecture?

Q6: SINGLE-SELECT LIST
Are you in possession of certain certifications with regard to enterprise architecture?

  1 ☐ No.
  2 ☐ Yes, please specify: [Open-ended answer]

Q7: SINGLE-SELECT LIST
What is the highest degree you have obtained?

  1 ☐ High school.
  2 ☐ MBO.

  3 ☐ HBO.
  4 ☐ Bachelor WO.
  5 ☐ Master WO/DRS.
  6 ☐ Doctorate (PHD).
  7 ☐ Other, please specify: [Open-ended answer] .

Q8: SINGLE LINE TEXT
In which field did you obtain this degree?

Page 2

Q9: DESCRIPTIVE TEXT

  The following questions deal with the practice of enterprise architecture within your
  organization. Note that if you are a consultant or otherwise not able to answer these
  questions: the questions on this page can be left open.

Q10: SINGLE LINE TEXT
What type of industry is your organization in?

Q11: SINGLE LINE TEXT
How many people are employed by your organization?

Q12: SINGLE LINE TEXT
What is the approximate number of applications used within your organization?

Q13: COMMENT BOX
What is the role of IT within your organization? (e.g. mainly supportive, part of the core
business)

Q14: SINGLE-SELECT LIST
Does your organization have an enterprise architecture?

  1 ☐ Yes.
  2 ☐ It is being developed.
  3 ☐ No.
  4 ☐ I do not know.
  5 ☐ Other, please specify: [Open-ended answer]

Q15: SINGLE LINE TEXT
Who is ultimately responsible for the enterprise architecture within your organization?

Q16: MULTI-SELECT LIST
Are measurements performed with regard to enterprise architecture within your organization? (multiple answers possible)

1 ☐ Yes, enterprise architecture maturity is assessed.
2 ☐ Yes, enterprise architecture effectiveness (e.g. results or effects of enterprise architecture) is measured.
3 ☐ Yes, enterprise architecture quality is determined.
4 ☐ No.
5 ☐ Other, please specify: [Open-ended answer]

Page 3

Q17: DESCRIPTIVE TEXT

The following questions deal with your view on enterprise architecture and are all mandatory.

Q18: SINGLE-SELECT LIST
How valuable would you say enterprise architecture is for an organization?

1 ☐ Enterprise architecture is very valuable.
2 ☐ Enterprise architecture adds value.
3 ☐ Enterprise architecture is of little value.
4 ☐ Enterprise architecture does not add any value.
5 ☐ Other, please specify: [Open-ended answer]

Q19: SINGLE LINE TEXT
Who would you say are the major stakeholders with regard to enterprise architecture?

Q20: COMMENT BOX
What are the main goals for adopting and implementing enterprise architecture?

Q21: COMMENT BOX
What are other reasons for adopting and implementing enterprise architecture?

Q22: MULTI-SELECT LIST
Do you use an enterprise architecture framework? (multiple answers possible)

1 ☐ Togaf.
2 ☐ Zachman.
3 ☐ E2AF.
4 ☐ DYA.
5 ☐ FEA.
6 ☐ Other, please specify: [Open-ended answer]
7 ☐ None.

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Q23: DESCRIPTIVE TEXT

The following questions are concerned with measuring the effectiveness of enterprise architecture, i.e. the effects or results of enterprise architecting, and are all mandatory.

Q24: SINGLE-SELECT LIST
How important do you think it is to measure enterprise architecture effectiveness?

1 ☐ Very important.
2 ☐ Important.
3 ☐ Of little importance.
4 ☐ Not important.
5 ☐ Other, please specify: [Open-ended answer]

Q25: COMMENT BOX
Please elaborate:

Q26: SINGLE-SELECT LIST
How often do you think enterprise architecture effectiveness should be measured?

1 ☐ Daily.
2 ☐ Weekly.
3 ☐ Monthly.
4 ☐ Yearly.
5 ☐ Other, please specify: [Open-ended answer]

Q27: COMMENT BOX
Please elaborate:

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Q28: COMMENT BOX

What metrics could be used to measure enterprise architecture effectiveness?

Q29: COMMENT BOX

Which of these metrics would you say are true Key Performance Indicators?

Q30: MULTI-SELECT LIST

What would you say are the most important factors influencing the choice of EA
effectiveness KPI's? (multiple answers possible)

1 ☐ Enterprise architecture maturity stages.
2 ☐ Organization's strategy.
3 ☐ Usage of enterprise architecture framework.
4 ☐ IT goals.
5 ☐ Business goals.
6 ☐ Enterprise architecture layers.
7 ☐ Specific enterprise architecture goals.
8 ☐ Stakeholder interests.
9 ☐ Organization's operating model.
10 ☐ Other, please specify: [Open-ended answer]

Thank You Page

Thank you very much for participating! Your answers have been taken into account.
Have a nice day!

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https://www.instant.ly/survey/52d4f2ede4b0c50a9ce4f711/print

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C.1.2 Interview Questions

Organization - Not consultants

1. What is the organization's mission/vision?
2. How is the organization structured?
3. What is the organization's strategy direction?
4. Why did the organization adopt EA? What were the EA goals?
5. How is the organization structured?

EA value

6. What is Enterprise Architecture according to you?
7. How does EA bring value according to you?
8. Do you assess the value of EA?/How would you assess the value of EA? Effectiveness?
9. What has EA led to up until now?/ What could EA lead to according to you?
10. How does EA help with achieving organizational goals? (causality)
11. Who are the most important stakeholders of the EA function?

Measuring approaches

12. Do you think it is important to measure EA effectiveness?
13. Is there a measurement approach for measuring the effectiveness of EA?/What kind of approach could be taken?
14. What challenges arise when measuring EA effectiveness?
15. How would you deal with causality when measuring EA effectiveness?
16. In what stage of the EA effort do you measure EA effectiveness?/When do you think you should measure EA effectiveness? (Document, Analyze, Plan, Implement, Migration)
17. Do you think measurement of EA effectiveness should be done continously? Why/why not.
18. In what stage of EA maturity did you start measuring EA effectiveness?/ When should you start measuring EA effectiveness?
19. By whom is EA effectiveness measured?/By whom do you think it should be measured?
20. Are results already evident?/When would you expect to see any results? How?

Metrics and KPIs

21. What metrics do you use for measuring EA effectiveness?/What metrics can be used for measuring EA effectiveness?
    Why these?
    What do they mean, how are they measured? What kind of data do you need? How often?
    How are they related to the EA implementation? (causality)
22. How would you define a key performance indicator?
23. Which metrics would you consider to be the true key performance indicators?
    Why these? How did you come to these?

Relations - Input: survey

24. Why do you think KPIs should be based on ...?
    Which factors played a roll for this decision?
25. How do they relate to ..?
26. Why is this essential to measuring EA effectiveness?

Potential follow-up

27. Would you be willing to participate in a potential follow-up interview?

C.2 Survey and Interview Products

C.2.1 Input Survey Summary Report

The following pages show the summary report of the survey results as retrieved from Instant.ly [38] after all respondents had answered the questions.

C.2.2 Collection of Codes and their Occurence after Coding

The following pages show the raw codes and their occurence as a result from open coding. This includes codes on the survey results as well.

Category	Code	Cases	% Cases	Category	Code	Cases	% Cases
EA goals and effects	Adaptable/changeable	3	17,60%	EA goals and effects	Underpinning vision and strategy	1	5,90%
EA goals and effects	Agility	6	35,30%	EA goals and effects	Understanding organizational coherence	2	11,80%
EA goals and effects	Alignment	6	35,30%	EA goals and effects	Validation	1	5,90%
EA goals and effects	Application rationalization	1	5,90%	EA pitfalls and challenges	"Phone book"	8	47,10%
EA goals and effects	Avoid proliferation of assets	1	5,90%	EA pitfalls and challenges	Architects colluding with stakeholders	3	17,60%
EA goals and effects	Business vs IT goals	10	58,80%	EA pitfalls and challenges	Authority	1	5,90%
EA goals and effects	Business-IT Understanding	1	5,90%	EA pitfalls and challenges	Avoiding IT too much	2	11,80%
EA goals and effects	Collective rules	1	5,90%	EA pitfalls and challenges	Becoming too operational	1	5,90%
EA goals and effects	Creating optionality	1	5,90%	EA pitfalls and challenges	Bottleneck	8	47,10%
EA goals and effects	Dealing with complexity	7	41,20%	EA pitfalls and challenges	Braking	3	17,60%
EA goals and effects	Defining objectives for future development	1	5,90%	EA pitfalls and challenges	Choosing one solution too fast	1	5,90%
EA goals and effects	Direct vs indirect effects	3	17,60%	EA pitfalls and challenges	Considering frameworks truth	1	5,90%
EA goals and effects	Efficiency in implementation	1	5,90%	EA pitfalls and challenges	Data not included	1	5,90%
EA goals and effects	Enable business	2	11,80%	EA pitfalls and challenges	Dealing with stakeholders	1	5,90%
EA goals and effects	Extendable	1	5,90%	EA pitfalls and challenges	EA too much IT	4	23,50%
EA goals and effects	Focus	1	5,90%	EA pitfalls and challenges	Expectations too big	1	5,90%
EA goals and effects	Future focus	1	5,90%	EA pitfalls and challenges	External impulses	1	5,90%
EA goals and effects	Help during decision making	11	64,70%	EA pitfalls and challenges	Forgetting kinds of costs	1	5,90%
EA goals and effects	Impact analysis	1	5,90%	EA pitfalls and challenges	Formulate choices in principles	1	5,90%
EA goals and effects	Improved time to market	2	11,80%	EA pitfalls and challenges	Fragmented decision making	1	5,90%
EA goals and effects	Increased ability to change	3	17,60%	EA pitfalls and challenges	Getting involved everywhere	2	11,80%
EA goals and effects	Increased business value of software	1	5,90%	EA pitfalls and challenges	Insight can be a threat	1	5,90%
EA goals and effects	Increased flexibility	5	29,40%	EA pitfalls and challenges	IT architects do not understand business	1	5,90%
EA goals and effects	Input on technology driven opportunities	1	5,90%	EA pitfalls and challenges	It costs money	1	5,90%
EA goals and effects	Insight current applications	2	11,80%	EA pitfalls and challenges	Ivory tower	4	23,50%
EA goals and effects	Insight in and lower costs	7	41,20%	EA pitfalls and challenges	Least common denominator	1	5,90%
EA goals and effects	Integration	1	5,90%	EA pitfalls and challenges	Legacy systems	1	5,90%
EA goals and effects	IT contribution to business	1	5,90%	EA pitfalls and challenges	Longer project times	1	5,90%
EA goals and effects	IT lifecycle management	1	5,90%	EA pitfalls and challenges	Loss of freedom	1	5,90%
EA goals and effects	Mergers and acquisitions	1	5,90%	EA pitfalls and challenges	Maintaining	1	5,90%
EA goals and effects	Outsourcing	1	5,90%	EA pitfalls and challenges	More costs	1	5,90%
EA goals and effects	Portfolio management	2	11,80%	EA pitfalls and challenges	No match	1	5,90%
EA goals and effects	Preventing silos	1	5,90%	EA pitfalls and challenges	No room for experimenting	1	5,90%
EA goals and effects	Project execution	1	5,90%	EA pitfalls and challenges	Non-mature	1	5,90%
EA goals and effects	Reduced lead times	1	5,90%	EA pitfalls and challenges	Non-mature organization	1	5,90%
EA goals and effects	Regulatory compliance	1	5,90%	EA pitfalls and challenges	Not being able to show value	1	5,90%
EA goals and effects	Reuse	4	23,50%	EA pitfalls and challenges	Not doing EA right	6	35,30%
EA goals and effects	Risk management	2	11,80%	EA pitfalls and challenges	Not measuring	1	5,90%
EA goals and effects	Shared vocabulary	3	17,60%	EA pitfalls and challenges	Not taking responsibility	4	23,50%
EA goals and effects	Simplicity	1	5,90%	EA pitfalls and challenges	Only current situation	1	5,90%
EA goals and effects	Standard and taylored solutions	1	5,90%	EA pitfalls and challenges	Only executing rules/principles	2	11,80%
EA goals and effects	Standardization	3	17,60%	EA pitfalls and challenges	Overenthusiastic	1	5,90%
EA goals and effects	Streaming	1	5,90%	EA pitfalls and challenges	Powerpoint/visio	2	11,80%
EA goals and effects	Support business transformations	3	17,60%	EA pitfalls and challenges	Principles too abstract	1	5,90%
EA goals and effects	Sustainability of components	1	5,90%	EA pitfalls and challenges	Quantifying business value	1	5,90%
EA goals and effects	Synergy	5	29,40%	EA pitfalls and challenges	Resistance (to change)	5	29,40%
EA goals and effects	Translate business and IT strategy into landscape	1	5,90%	EA pitfalls and challenges	Selling EA to business	1	5,90%
EA goals and effects	Translate business strategy to IT strategy	3	17,60%	EA pitfalls and challenges	Shortcyclic changes	3	17,60%
EA goals and effects	Transparency	1	5,90%	EA pitfalls and challenges	Short-term thinking	3	17,60%
EA goals and effects	Tuning	1	5,90%	EA pitfalls and challenges	Staying a mystery	1	5,90%

Category	Code	Cases	% Cases	Category	Code	Cases	% Cases
EA pitfalls and challenges	Staying on strategic level	1	5,90%	EA stakeholders	IT Manager	4	23,50%
EA pitfalls and challenges	Structure not taken into account	1	5,90%	EA stakeholders	IT staff	1	5,90%
EA pitfalls and challenges	Theory vs practice	1	5,90%	EA stakeholders	Lead/Chief architect	5	29,40%
EA pitfalls and challenges	Thinking as-is is static	3	17,60%	EA stakeholders	Line managers	1	5,90%
EA pitfalls and challenges	Thinking EA is IT	1	5,90%	EA stakeholders	Manager I/ESS	1	5,90%
EA pitfalls and challenges	Thinking EA makes decisions	1	5,90%	EA stakeholders	Middle management	2	11,80%
EA pitfalls and challenges	Too big and complex	1	5,90%	EA stakeholders	Nr of enterprise architects	2	11,80%
EA pitfalls and challenges	Too detailed to-be	3	17,60%	EA stakeholders	Organization's customer	2	11,80%
EA pitfalls and challenges	Too little influence	1	5,90%	EA stakeholders	Other achitects	4	23,50%
EA pitfalls and challenges	Too much architecture	2	11,80%	EA stakeholders	Portfolio managers	2	11,80%
EA pitfalls and challenges	Too much other work	2	11,80%	EA stakeholders	Program manager	1	5,90%
EA pitfalls and challenges	Too much visionary	1	5,90%	EA stakeholders	Project architect	2	11,80%
EA pitfalls and challenges	Top-down failure	1	5,90%	EA stakeholders	Project management	4	23,50%
EA pitfalls and challenges	When are you an architect	1	5,90%	EA stakeholders	Segment architect	1	5,90%
EA pitfalls and challenges	Wrong people architect	1	5,90%	EA stakeholders	Solution architects	11	64,70%
EA pitfalls and challenges	Wrong team setup	1	5,90%	EA stakeholders	Strategic architect	1	5,90%
EA relations	EA and agile	1	5,90%	EA stakeholders	Tactical architect	1	5,90%
EA relations	EA and business model canvas	1	5,90%	EA value	After implementation	1	5,90%
EA relations	EA and business movement	1	5,90%	EA value	Business goals	4	23,50%
EA relations	EA and cost models	1	5,90%	EA value	Consistency	3	17,60%
EA relations	EA and crisis	1	5,90%	EA value	Costs and revenue	1	5,90%
EA relations	EA and culture	1	5,90%	EA value	Data architects	1	5,90%
EA relations	EA and customer/product	1	5,90%	EA value	EA quality	1	5,90%
EA relations	EA and EA goals	2	11,80%	EA value	Effectiveness and documenting	1	5,90%
EA relations	EA and mission/vision	4	23,50%	EA value	Effectiveness in guiding implementation/governance	6	35,30%
EA relations	EA and organization size	2	11,80%	EA value	Effectiveness more than maturity	8	47,10%
EA relations	EA and organization type	2	11,80%	EA value	Effectiveness over quality	1	5,90%
EA relations	EA and salary	2	11,80%	EA value	Enhancing enterprise performance	1	5,90%
EA relations	EA and stakeholders	1	5,90%	EA value	Exploitation	1	5,90%
EA relations	EA and strategy	3	17,60%	EA value	Holistic thinking	2	11,80%
EA relations	EA and structure	4	23,50%	EA value	Impact	2	11,80%
EA stakeholders	(Business) users	2	11,80%	EA value	Insight and oversight	10	58,80%
EA stakeholders	All the same	1	5,90%	EA value	Insight current	1	5,90%
EA stakeholders	Business	4	23,50%	EA value	Long-term thinking	1	5,90%
EA stakeholders	Business divisions	1	5,90%	EA value	Making descriptions everyone understands	1	5,90%
EA stakeholders	Business manager	7	41,20%	EA value	Owned by organization	1	5,90%
EA stakeholders	Business owners	1	5,90%	EA value	Realising business strategy	3	17,60%
EA stakeholders	Business vs IT	14	82,40%	EA value	Strategic thinking	2	11,80%
EA stakeholders	Central vs decentral	1	5,90%	EA value	Value of solution architecture	4	23,50%
EA stakeholders	CIO's of domains	1	5,90%	EA value	Who uses EA	3	17,60%
EA stakeholders	CxO/senior management/board	13	76,50%	KPI relations	Balanced Scorecard	1	5,90%
EA stakeholders	Domain architect	4	23,50%	KPI relations	Context	2	11,80%
EA stakeholders	Enterprise architect	9	52,90%	KPI relations	Direct vs indirect from EA	2	11,80%
EA stakeholders	External (consult)	6	35,30%	KPI relations	Externally focused	1	5,90%
EA stakeholders	Higher management	1	5,90%	KPI relations	IT-Business	13	76,50%
EA stakeholders	I(C)T architects	7	41,20%	KPI relations	More generic lower	6	35,30%
EA stakeholders	Information manager	1	5,90%	KPI relations	Number of KPIs	2	11,80%
EA stakeholders	Investors	1	5,90%	KPI relations	On business goals	15	88,20%
EA stakeholders	IT	6	35,30%	KPI relations	On EA framework	1	5,90%
EA stakeholders	IT Maintenance	1	5,90%	KPI relations	On EA goals	7	41,20%

Category	Code	Cases	% Cases
KPI relations	On IT goals	6	35,30%
KPI relations	On maturity levels	4	23,50%
KPI relations	On Operating Model	9	52,90%
KPI relations	On stakeholder interests	15	88,20%
KPI relations	On strategy	12	70,60%
KPI relations	On the enterprise's structural performance	1	5,90%
KPI relations	Per EA Layer	3	17,60%
KPI relations	Reachability	1	5,90%
KPI relations	Roles	6	35,30%
KPI relations	Subjective vs objective	15	88,20%
Measurement approaches	Agility-alignment approach	1	5,90%
Measurement approaches	Architecture effectiveness model	1	5,90%
Measurement approaches	At project level	3	17,60%
Measurement approaches	Based on cases	2	11,80%
Measurement approaches	Baseline not possible	1	5,90%
Measurement approaches	Benchmark in market	1	5,90%
Measurement approaches	Benchmark over time	1	5,90%
Measurement approaches	Benchmarking	3	17,60%
Measurement approaches	Benchmarking against baseline	1	5,90%
Measurement approaches	Bottom-up	1	5,90%
Measurement approaches	Business first	2	11,80%
Measurement approaches	Costs	3	17,60%
Measurement approaches	Decision papers	1	5,90%
Measurement approaches	Deliverables vs effectiveness	2	11,80%
Measurement approaches	EA interviews	3	17,60%
Measurement approaches	EA Realization Index	1	5,90%
Measurement approaches	EA survey	6	35,30%
Measurement approaches	EA value framework	2	11,80%
Measurement approaches	EEAA	1	5,90%
Measurement approaches	Effectiveness part of maturity	5	29,40%
Measurement approaches	Effectiveness vs efficiency	3	17,60%
Measurement approaches	Enterprise Performance Management Planning	1	5,90%
Measurement approaches	Function point analysis	2	11,80%
Measurement approaches	Getting data	1	5,90%
Measurement approaches	Goal-alignment and Maintenance	1	5,90%
Measurement approaches	GQM	2	11,80%
Measurement approaches	Guiding principles network	1	5,90%
Measurement approaches	Improvement programs	1	5,90%
Measurement approaches	Incorporating other disciplines	1	5,90%
Measurement approaches	Isolating EA not necessary	2	11,80%
Measurement approaches	IT costing	1	5,90%
Measurement approaches	IT vs Business metrics	6	35,30%
Measurement approaches	Look at value of IT	1	5,90%
Measurement approaches	Look for existing data	2	11,80%
Measurement approaches	Negative causality	1	5,90%
Measurement approaches	On decision making	4	23,50%
Measurement approaches	On scenarios	2	11,80%
Measurement approaches	Options theory	1	5,90%
Measurement approaches	Percentages	4	23,50%
Measurement approaches	Principle based	2	11,80%
Measurement approaches	Project efficiency	1	5,90%
Measurement approaches	Projects under and not-under architecture	2	11,80%
Measurement approaches	Quint approach	1	5,90%
Measurement approaches	Search for existing accepted	1	5,90%
Measurement approaches	Self-posting	1	5,90%
Measurement approaches	Sell long-term value	1	5,90%
Measurement approaches	Structural guiding ratios	1	5,90%
Measurement approaches	Transition architecture	1	5,90%
Measurement approaches	Translate to business	6	35,30%
Measurement approaches	Use both leading and lagging indicators	1	5,90%
Measurement approaches	Weights	3	17,60%
Measurement challenges	"Braking lead"	1	5,90%
Measurement challenges	Business goals not specific enough	1	5,90%
Measurement challenges	Business IT alignment does not exist	2	11,80%
Measurement challenges	Can't make everyone happy	1	5,90%
Measurement challenges	Causality/traceability	15	88,20%
Measurement challenges	Compare to what?	4	23,50%
Measurement challenges	Comparing initiatives	1	5,90%
Measurement challenges	Decisions don't equal effects	2	11,80%
Measurement challenges	Defining SMART	1	5,90%
Measurement challenges	Different stakeholders	1	5,90%
Measurement challenges	EA not a product	1	5,90%
Measurement challenges	Effect of different decisions	1	5,90%
Measurement challenges	Finding objective metrics for effectiveness	1	5,90%
Measurement challenges	Finding the truth	2	11,80%
Measurement challenges	Focus on measuring	3	17,60%
Measurement challenges	Focusing too much on as-is	1	5,90%
Measurement challenges	Focusing too much on reduced costs	1	5,90%
Measurement challenges	In practice hard to measure complexity	1	5,90%
Measurement challenges	Informal vs formal	8	47,10%
Measurement challenges	Lack of IT costing information	1	5,90%
Measurement challenges	Long-term value	1	5,90%
Measurement challenges	Measurement costs	2	11,80%
Measurement challenges	Measuring the wrong things	1	5,90%
Measurement challenges	Measuring to judge	1	5,90%
Measurement challenges	Measuring too early	1	5,90%
Measurement challenges	Measuring too late	2	11,80%
Measurement challenges	Measuring too low-level	1	5,90%
Measurement challenges	Measuring too often	1	5,90%
Measurement challenges	Missing context	1	5,90%
Measurement challenges	No laboratory experiment	4	23,50%
Measurement challenges	Non linear	2	11,80%
Measurement challenges	Not wanting responsibility	1	5,90%
Measurement challenges	Not wanting to be checked	8	47,10%
Measurement challenges	Playing with numbers	3	17,60%
Measurement challenges	Project vs strategic level	15	88,20%
Measurement challenges	ROI not useful	1	5,90%
Measurement challenges	Satisfaction is not a result	1	5,90%
Measurement challenges	Scenario's still not exact	1	5,90%
Measurement challenges	Setting metrics/KPIs	5	29,40%

Category	Code	Cases	% Cases	Category	Code	Cases	% Cases
Measurement challenges	Shifting future	2	11,80%	Metrics and KPI's	Number of characteristics met	1	5,90%
Measurement challenges	Staying too high-level	2	11,80%	Metrics and KPI's	Number of damages	1	5,90%
Measurement challenges	Timing	1	5,90%	Metrics and KPI's	Number of decision papers	1	5,90%
Metrics and KPI's	Acceptation of deliverables	1	5,90%	Metrics and KPI's	Number of EA Exceptions	1	5,90%
Metrics and KPI's	Agreements met	7	41,20%	Metrics and KPI's	Number of similar projects	1	5,90%
Metrics and KPI's	Application portfolio	2	11,80%	Metrics and KPI's	Number of times EA is involved	4	23,50%
Metrics and KPI's	Better competitivity	1	5,90%	Metrics and KPI's	Participation in change	1	5,90%
Metrics and KPI's	Budgeting	3	17,60%	Metrics and KPI's	Performance	1	5,90%
Metrics and KPI's	Budgets met	1	5,90%	Metrics and KPI's	Planning	1	5,90%
Metrics and KPI's	Business satisfaction with IT	1	5,90%	Metrics and KPI's	Process quality	1	5,90%
Metrics and KPI's	Business-IT alignment	2	11,80%	Metrics and KPI's	Project completion time	4	23,50%
Metrics and KPI's	Capacity	1	5,90%	Metrics and KPI's	Project costs	4	23,50%
Metrics and KPI's	Complexity	2	11,80%	Metrics and KPI's	Project failure	1	5,90%
Metrics and KPI's	Complexity - lines of code	1	5,90%	Metrics and KPI's	Project leader satisfaction	1	5,90%
Metrics and KPI's	Complexity - stakeholders involved	1	5,90%	Metrics and KPI's	Project succes	2	11,80%
Metrics and KPI's	Complexity- Number of applications	1	5,90%	Metrics and KPI's	Project volatility	1	5,90%
Metrics and KPI's	Complexity- Number of interfaces	2	11,80%	Metrics and KPI's	Projects compliant with EA	4	23,50%
Metrics and KPI's	Cost savings	6	35,30%	Metrics and KPI's	Projects initiated under architecture	1	5,90%
Metrics and KPI's	Costs per customer	1	5,90%	Metrics and KPI's	Quality of end product	2	11,80%
Metrics and KPI's	Customer impact	1	5,90%	Metrics and KPI's	Quality of information	2	11,80%
Metrics and KPI's	Customer satisfaction	5	29,40%	Metrics and KPI's	Realization	3	17,60%
Metrics and KPI's	Customization	1	5,90%	Metrics and KPI's	Revenue per customer	1	5,90%
Metrics and KPI's	CxO satisfaction	3	17,60%	Metrics and KPI's	ROI	2	11,80%
Metrics and KPI's	Data safety	1	5,90%	Metrics and KPI's	Run costs	1	5,90%
Metrics and KPI's	Decisions underpinned by EA	3	17,60%	Metrics and KPI's	Scale-complexity ratio	1	5,90%
Metrics and KPI's	Degree of standardization	2	11,80%	Metrics and KPI's	Speed of change	1	5,90%
Metrics and KPI's	Duplication of application functionality, data, interfaces	3	17,60%	Metrics and KPI's	Speed of investments	1	5,90%
Metrics and KPI's	EA information quality	1	5,90%	Metrics and KPI's	Stakeholder satisfaction	6	35,30%
Metrics and KPI's	Enterprise coherence	1	5,90%	Metrics and KPI's	Strategic alignment	1	5,90%
Metrics and KPI's	External customer satisfaction	2	11,80%	Metrics and KPI's	Structural investments realised	1	5,90%
Metrics and KPI's	Financial	6	35,30%	Metrics and KPI's	Structural performance ratios	1	5,90%
Metrics and KPI's	Frameworks delivered	1	5,90%	Metrics and KPI's	Technological diversity	1	5,90%
Metrics and KPI's	FTE's	1	5,90%	Metrics and KPI's	Time to change	3	17,60%
Metrics and KPI's	Generic components	2	11,80%	Metrics and KPI's	Time to establish business change in IT	1	5,90%
Metrics and KPI's	Guiding principles	2	11,80%	Metrics and KPI's	Time To Market	3	17,60%
Metrics and KPI's	Guiding principles used	2	11,80%	Metrics and KPI's	Time until something is acted upon	1	5,90%
Metrics and KPI's	Impact on culture	1	5,90%	Metrics and KPI's	Total cost of ownership	5	29,40%
Metrics and KPI's	Innovation portfolio	2	11,80%	Metrics and KPI's	Uptime	2	11,80%
Metrics and KPI's	Internal customer satisfaction	11	64,70%	Metrics and KPI's	User satisfaction with IT	2	11,80%
Metrics and KPI's	Investments prevented	1	5,90%	Metrics vs KPIs?	Can be acted on	1	5,90%
Metrics and KPI's	IT Budget	1	5,90%	Metrics vs KPIs?	Hygiene	1	5,90%
Metrics and KPI's	IT costs	2	11,80%	Metrics vs KPIs?	Interaction with business	1	5,90%
Metrics and KPI's	Lead time	1	5,90%	Metrics vs KPIs?	KPIs are metrics with scale	3	17,60%
Metrics and KPI's	Maintenance budget	1	5,90%	Metrics vs KPIs?	KPIs easy to see if good or bad	1	5,90%
Metrics and KPI's	Managers satisfaction	3	17,60%	Metrics vs KPIs?	KPIs have goals	1	5,90%
Metrics and KPI's	Metrics wrt personnel	1	5,90%	Metrics vs KPIs?	KPIs more important metrics	1	5,90%
Metrics and KPI's	More efficient or effective investments	4	23,50%	Metrics vs KPIs?	KPIs need metrics	2	11,80%
Metrics and KPI's	More productive investments	1	5,90%	Metrics vs KPIs?	Technical vs enterprise	1	5,90%
Metrics and KPI's	New products	1	5,90%	Metrics vs KPIs?	What are you judged on	2	11,80%
Metrics and KPI's	Number of characteristics agreed on	1	5,90%	Several relations	EA bottom-up	1	5,90%

Category	Code	Cases	% Cases	Category	Code	Cases	% Cases
Several relations	Standardization vs agility	1	5,90%	What is EA	Senior function	1	5,90%
Several relations	Structure follows from strategy	1	5,90%	What is EA	Short-term aspects	10	58,80%
What is EA	About people	2	11,80%	What is EA	Strategic - long term	13	76,50%
What is EA	Agnostic vs specific	1	5,90%	What is EA	Structural innovations	1	5,90%
What is EA	All levels	1	5,90%	What is EA	Structure with a vision	2	11,80%
What is EA	Architecture - IT enables business	13	76,50%	What is EA	Tactic	2	11,80%
What is EA	As-is vs to-be	10	58,80%	What is EA	Translating strategy to scenarios	1	5,90%
What is EA	Assistence	1	5,90%	What is EA	Translator	3	17,60%
What is EA	Blueprint	1	5,90%	When to measure	After each deliverable	1	5,90%
What is EA	Bridge business-IT	8	47,10%	When to measure	After projects	1	5,90%
What is EA	Bridge strategy and execution	4	23,50%	When to measure	At roadmap	1	5,90%
What is EA	Business discipline	1	5,90%	When to measure	Before implementation	1	5,90%
What is EA	City plan	1	5,90%	When to measure	Change management	1	5,90%
What is EA	Coherence	5	29,40%	When to measure	Constantly/continuously	5	29,40%
What is EA	Collaboration	5	29,40%	When to measure	Daily	1	5,90%
What is EA	Communicating	7	41,20%	When to measure	Depending on business dynamics	2	11,80%
What is EA	Connection Business-IT	1	5,90%	When to measure	Depending on level	1	5,90%
What is EA	Cosistent whole for guidance and realisation	1	5,90%	When to measure	Depending on maturity	4	23,50%
What is EA	Covering	4	23,50%	When to measure	Do not raise expectations	2	11,80%
What is EA	Descriptive	2	11,80%	When to measure	Early stages of maturity	9	52,90%
What is EA	Differs per organization	1	5,90%	When to measure	Environmental changes	1	5,90%
What is EA	Direction	1	5,90%	When to measure	Every six months	1	5,90%
What is EA	durable	1	5,90%	When to measure	Every three months	1	5,90%
What is EA	Dynamic vs abstraction	12	70,60%	When to measure	From start of process	1	5,90%
What is EA	EA layers	1	5,90%	When to measure	Ideas turn into investment proposals	1	5,90%
What is EA	EA tools	1	5,90%	When to measure	Latter phases of ADM	1	5,90%
What is EA	Enterprise level	9	52,90%	When to measure	Monthly	1	5,90%
What is EA	Framing	9	52,90%	When to measure	Quarterly	3	17,60%
What is EA	Functional ordering	2	11,80%	When to measure	Strategic changes	1	5,90%
What is EA	Future oriented	1	5,90%	When to measure	Strategy involvement	1	5,90%
What is EA	Governance	6	35,30%	When to measure	Twice a year	1	5,90%
What is EA	High level	8	47,10%	When to measure	When you have governance	1	5,90%
What is EA	Holistic	4	23,50%	When to measure	Yearly	7	41,20%
What is EA	Influencing ideas	1	5,90%	Who should measure	Architects/Individuals themselves	9	52,90%
What is EA	Innovational aspects	3	17,60%	Who should measure	Business responsibility	1	5,90%
What is EA	Instrument	2	11,80%	Who should measure	Depends on structure	1	5,90%
What is EA	Link strategy - operations - IT	1	5,90%	Who should measure	Executing group	1	5,90%
What is EA	Lower management levels	1	5,90%	Who should measure	External help	2	11,80%
What is EA	Mainlines	1	5,90%	Who should measure	Governing entity	1	5,90%
What is EA	Management discipline	2	11,80%	Who should measure	MT	2	11,80%
What is EA	Meddler for architecture team	1	5,90%	Who should measure	Principals	1	5,90%
What is EA	Organizational design	2	11,80%	Who should measure	Program managers	1	5,90%
What is EA	Organizational map	3	17,60%	Who should measure	Representation business-IT	1	5,90%
What is EA	Plan	3	17,60%	Who should measure	Throughout the organization	2	11,80%
What is EA	Political instrument	1	5,90%	Why measure	Achievements	1	5,90%
What is EA	Pragmatic	2	11,80%	Why measure	Cleaning vs innovating	2	11,80%
What is EA	Prescriptive	1	5,90%	Why measure	Depending on EA importance and maturity	1	5,90%
What is EA	Principles for guiding	8	47,10%	Why measure	Doing the right things	2	11,80%
What is EA	Roadmap	4	23,50%	Why measure	EA can be blocker	1	5,90%
What is EA	Scenario planning	3	17,60%	Why measure	Focus on high impact	1	5,90%

Category	Code	Cases	% Cases
Why measure	For improvement	4	23,50%
Why measure	For insights	1	5,90%
Why measure	Get business along	1	5,90%
Why measure	Improved quality of work	2	11,80%
Why measure	Investment vs effectiveness	8	47,10%
Why measure	Monitoring/judging	2	11,80%
Why measure	To know your influence	1	5,90%
Why measure	To manage EA	2	11,80%
Why measure	Translate outcome of EA in financial	1	5,90%

C.2.3   Visualization of Codes

On the next page a visualization of interesting codes is shown, based on the survey and interview codes. It includes the most important concepts and relations for answering the research questions. Note that the model mainly functions as a reference model for the author in order to be able to move on to interpretation. Therefore, completeness, consistency and accuracy of the model are not ensured and it should not be dealt with as such. A legenda for the figures and colors used is shown in figure C.1.
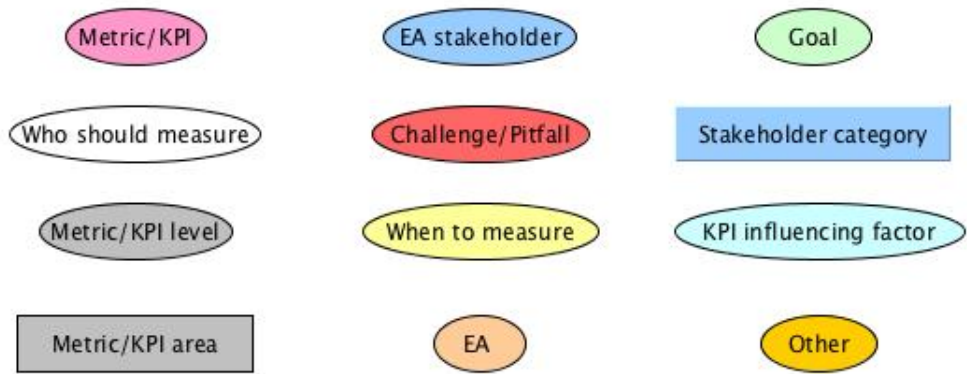
Figure C.1: Legenda for the visual graph.

Visualization Graph

C.2.4 Most Frequent Code Summaries

Table C.1: Summaries of what was found in the the interview transcripts that is related to the code "Enterprise level".

Expert 3	Argues that his organization consists of many domains and implies that EA is about covering everything. Makes a clear distinction between lower-level architects (e.g. project architects and technical architects) and EA, where EA is about translating strategy to IT and therefore resides at enterprise level. Argues that it is not about one bank or one country, but about enterprise level.
Expert 4	Mentions that the board acknowledged the need for a kind of top-down structuring.
Expert 5	Acknowledges that EA exceeds the boundaries of business units and is about the entire company.
Expert 7	Gives reason to believe that EA is about collective interests.
Expert 8	Argues that the term EA may have to do with the fact that it is about the complete picture, which should help the entire organization.
Expert 10	Argues that EA is about connecting IT to operations and operations to business.
Expert 12	Indicates that enterprise architects get involved once it is about the entire enterprise.
Expert 14	Suggests a bottom-up approach for implementing EA, where you eventually end up with EA on enterprise level.
Expert 16	Acknowledges that EA crosses domain boundaries, but that domain-level architecture may be closely connected. Acknowledges that EA has a broad scope.
Expert 18	Gives reason to believe that EA is about the complete view, the total landscape.

Table C.2: Summaries of what was found in the interview transcripts that is related to the code "As-is vs to-be".

Expert 3	Argues that it is not just about influencing decisions on new investments, but that EA may also be responsible for the already existing landscape.
Expert 4	Mentions both dealing with legacy and introducing new technologies
Expert 8	Mentions the "Ist" and "Sol" and argues that the Ist does not need to be described anymore. Argues that it should first be about the Sol, then about the roadmap, and then, if necessary, about the Ist.
Expert 10	Argues that architects should be concerned with both the present and the longer-term future. Argues that decisions about the future are made today.
Expert 11	Argues that it is both about the as-is and the to-be. Argues that the way it is now has to do with the descriptive perspective of EA, but that it gets interesting when it is about the envisioned direction and principles.
Expert 12	Argues that architecture should be about the future (i.e. over 6 months or more).
Expert 13	Argues that you should be aware of the current situation and therefore need an as-is, but that you should also be able to let it go. Argues that the "baseline" may be important when it is about programs and projects.
Expert 14	Is convinced that you need an as-is, a roadmap, and a to-be. Argues that you should first know where you are coming from and then think about a target.
Expert 15	Does not believe in a detailed to-be, but does mention that it is about setting a horizon. Argues that a future cannot exist without insight into the current situation. Emphasizes the importance of the as-is as a starting point.
Expert 16	Mentions how at his company they look at both the as-is and the to-be, but that this was not always the case. Mentions how they used to only look at the future and relates this to "ivory tower models".

Expert 18	Argues that it is not only about describing the current situation, but that it is about directing as well. Argues that the classic as-is to-be thinking may be changing.

Table C.3: Summaries of what was found in the interview transcripts that is related to the code "Framing".

Expert 3	Argues that EA is about setting long-term frames that allow the organization to actually execute a strategy using IT.
Expert 4	Focuses on the ability to identify the "pivot points" of the organization.
Expert 5	Acknowledges that EA can be used to assess the fit of lower level initiatives.
Expert 6	Seems to argue that EA can be used as an assessment framework for operational decisions, but that it is meant to steer longer-term developments.
Expert 8	Seems to agree that decisions on project level should be linked to the frames set, and relates this to principles.
Expert 9	Makes the comparison with buildings architecture and argues that "builders" need to comply to the criteria set. Argues that they cannot just build something else.
Expert 12	Actually has to work within the frames set by EA. Argues that everyone should be able to justify what they are doing within those frames, but that this could still give room for innovation.
Expert 16	Mentions both frames to operate in, and guidelines.
Expert 17	Focuses on "EA controls" for portfolio planning.
Expert 18	Argues that EA is shifting from a structural focus to actual framing. Argues that projects and solutions are framed by EA.

Table C.4: Summaries of what was found in the interview transcripts that is related to the code "Dynamic vs abstraction".

Expert 1	Gives reason to believe that if you do architecture right, with proper interfaces, you change technologies when needed.
Expert 3	Argues that EA is no longer just about describing several views and that it has become much more dynamic.
Expert 4	Argues that EA is not an "art", nor an "abstract science".
Expert 5	Argues that you still have to deal with a fast-changing environment and that you should be aware of short-term changes.
Expert 6	Acknowledges that startup organizations that are still subject to a lot of movement may not want to practice architecture yet as there is no stability yet.
Expert 7	Refers to a combination of architecture levels where higher level architecture is more "vague" and lower level architecture is more tangible.
Expert 8	Seems to argue that the more EA is about long-term, the more it should just give directions
Expert 10	Acknowledges that actual plans are continuously changed and that it is about setting a course.
Expert 12	Argues that a more abstract architecture has a bigger chance of being stable over time and that a future state architecture should be stable.
Expert 14	Seems to argue that situations change and that it is a kind of continuous and endless process.
Expert 15	Acknowledges the importance of dynamics and argues that architecture is about setting a horizon instead of completely figuring out the to-be architecture.
Expert 16	Acknowledges that the longer-term view may be more global. Also argues that EA may be more global compared to domains.

Expert 18	Argues that making long-term plans may not work anymore as the world changes too quickly.

Table C.5: Summaries of what was found in the interview transcripts that is related to the code "Strategic-long term".

Expert 1	Argues that EA forces you into long-term thinking.
Expert 2	Argues that EA is about the future and that it is in principle long-term.
Expert 3	Seems to argue that EA should support long-term decisions.
Expert 5	Argues that images for over 10 years may be too long, but that one may consider a time period of 5 years.
Expert 6	Argues that EA is, in principle, focused on the longer-term.
Expert 7	Acknowledges that EA is partly about strategy. Mentions a time span of 2 to 5 years.
Expert 8	Argues that EA could be involved in strategy formation.
Expert 10	Seems to argue that EA is about longer-term thinking and limiting erroneous short-term decisions.
Expert 12	Mentions that their future state architecture covers a time period of 5 years and argues that enterprise architects should be concerned with the future (a half year from now or further).
Expert 13	Argues that EA should be connected to longer-term strategy.
Expert 15	Argues that EA should not be seen in isolation and that it is about making decisions linked to strategy.
Expert 16	Mentions that they look 5 years ahead.
Expert 18	Acknowledges that EA may be about longer-term plans, whereas a CIO may be more concerned with operations.

Table C.6: Summaries of what was found in the interview transcripts that is related to the code "Short-term aspects".

Expert 2	Argues that although EA is long-term in principle, the architecture may need to be revised (once a year) to look at, for example, new technologies.
Expert 3	Indicates that sometimes, EA is also involved in short-term decision making.
Expert 5	Argues that you could follow a long-term vision, but that you should also accept short-term changes if your organization's environment changes quickly.
Expert 6	Acknowledges that architecture can be used to assess operational decisions against as well.
Expert 7	Argues that EA is partly about tactics, i.e. the next 2 years.
Expert 12	Acknowledges that the roadmap leading towards the future vision is not stable.
Expert 14	Acknowledges that sometimes, you have to accept shorter-term priorities and try to limit the damage.
Expert 15	Argues that EA is concerned with smaller steps directed towards the longer-term horizon.
Expert 16	Describes how more concrete, operational plans are made for the upcoming year.
Expert 18	Acknowledges that EA should not only be about long-term plans, but that you should show shorter-term value as well.

Table C.7: Summaries of what was found in the interview transcripts that is related to the code "Help during decision making".

Expert 2	Argues that before implementing actual projects, enterprise architecture provides value in that it could be used for discussions.
Expert 3	Acknowledged EA as an important source of information for decision making.
Expert 4	Argues that you cannot be valuable if you do not impact decision makers and the decision-making process.
Expert 5	Compares the architecture function to an advisory club and argues that EA should lead to "sensible" decision making.
Expert 6	Agrees that EA is mainly about supporting management's decisions and business transformations.
Expert 10	Puts emphasis on how EA helps by informing decision makers and argues that some decisions (e.g. organization's strategy direction) are still just left to business.
Expert 11	Seems to acknowledge that architects do not always make decisions themselves, but influences decision makers. Argues that architects that know how to influence decision makers are much appreciated.
Expert 13	Agrees that decisions do not equal effects, but that enterprise architecture should aim at better decision making.
Expert 14	Argues that enterprise architects influence decisions as well and that you should in fact be concerned with several levels, i.e. project level, middle management, and higher management. Moreover, acknowledges that at their organization, architects do not make decisions themselves, but provide advice.
Expert 15	Argues that you should focus on information that is actually going to help during decision making.
Expert 16	Acknowledges the "strategic dialogue" by translating strategy into impact and communicating this in order for decision makers to be able to make well informed decisions.
Expert 17	Describes a situation where enterprise architects were expected to come up with alternatives such that decision makers could make decisions. Warns that this could still lead to fragmented decision making.

Table C.8: Summaries of what was found in the interview transcripts that is related to the code "Enterprise Architect".

Expert 3	Seems to argue that architects should be able to tell how the business can use IT.
Expert 4	Argues that enterprise architects may eventually get on the same level as the CIO and that the risk is then that they may not add anything.
Expert 7	Argues that you have one enterprise architect at a CIO level and derivatives at other levels.
Expert 8	Gives the impression that the enterprise architect controls and governs the architecture team.
Expert 10	Argues that true enterprise architects should have a lot of experience.
Expert 11	Acknowledges that an architect as a person can be very effective, depending on his or her role in the organization, understanding of and ability to link business and IT, and personal traits.
Expert 12	Argues that enterprise architects should eventually serve strategic goals.
Expert 14	Does not explicitly mention the (enterprise) architect, but does acknowledge that less than 50% is about content and the rest is about skills.
Expert 16	Acknowledges that the formal role of enterprise architect exists, but argues that the distinction is not that clear in reality.

Expert 18	Mentions an example organization where attempts are made to position the chief architect directly under the board. Argues that the CIO would then be concerned with daily operations, whereas the architect would be concerned with longer-term focus aspects.

Table C.9: Summaries of what was found in the interview transcripts that is related to the code "CxO/senior management/board".

Expert 1	Mainly gives the impression that this level of the organization sets the targets and goals.
Expert 2	Mentions the CIO as the one who is ultimately responsible for EA in the survey.
Expert 3	Argues that CIOs are also concerned with operations.
Expert 4	Explains that the chief architect more or less functions as the "conscience" of the CIO. He notes, though, that this is still a step away from the CEO.
Expert 5	Mentions that their architecture group is part of the environment under the CIO.
Expert 6	Argues that, although there are some layers in between, eventually, the C-level is the most important stakeholder as enterprise architecture is about supporting business transformations.
Expert 7	Argues that there is typically one enterprise architect near the CIO.
Expert 8	Mentions senior management and the board as being the most important stakeholders for enterprise architecture (in the survey).
Expert 10	Argues that the CIO is the one who decides what should happen, whereas the architect is more about how. Argues that, even if you do not report directly to him, the CIO still provides input.
Expert 13	Argues that the C-level gains most from the fact that enterprise architecture is really broad and is about the entire organization.
Expert 15	Argues that the C-level is concerned about about risks and impacts.
Expert 16	Mentions "senior management in business and IT" as the major EA stakeholders in the survey
Expert 17	Indicates that the most important stakeholders are senior management, because enterprise architecture is about organizational coherence and big transformations that they initiate.
Expert 18	Argues that in most organizations, architects are situated under the CIO. The CIO may be more concerned with daily operations.

Table C.10: Summaries of what was found in the interview transcripts that is related to the code "Solution architects".

Expert 2	Clearly makes the distinction between enterprise and solution architecture. Argues that solutions architects are more involved with development, where it gets much more concrete, and actually realizing the plans made by enterprise architects (reference to lecture).
Expert 5	Regrets the absence of solution architects at his organization as those have knowledge of both IT and business.
Expert 6	Argues that solution architecture is more concrete, focused on a project or system.
Expert 7	Agrees that solution architects are more concerned with details and that enterprise architects steer them.
Expert 8	Acknowledges that, once a direction has been set, solution architects should take care of the implementation.

Expert 9	Argues that solution architecture is "still designing something that needs to work".
Expert 10	Admits that he sometimes functions as a solution architect by taking responsibility for project results.
Expert 12	Generally agrees that solution architects reside on a different level.
Expert 13	Implies that solution architecture is about specific changes and that the bigger those changes are, the closer it may get to domain architecture.
Expert 15	Implies that solution architects should execute ideas and are thus more concerned with details.
Expert 18	Mentions solution architects as some of the most important stakeholders of EA. Argues that solution architects are more focused on projects, but that they are framed by enterprise architecture. Describes a so-called staircase structure.

Table C.11: Summaries of what was found in the interview transcripts that is related to the code "Insight and oversight".

Expert 4	Argues that it is important to point out what the "pivot points" of an organization are.
Expert 5	Argues that providing insight and oversight may be the core of architecture. Argues that architecture provides insight into the impact of certain business and IT decisions.
Expert 6	Acknowledges that EA provides insight and oversight in the way things are connected. Thinks that most organizations want architecture to provide insight into, for example, the current landscape.
Expert 7	Mentions insight as one of the reasons for adopting and implementing EA in the survey.
Expert 10	Argues that one can function as a bridge between business and IT by providing insight into complex situations and making stakeholders understand.
Expert 11	Argues that principles also provide insight and that they should make IT understand how technology contributes to business goals.
Expert 13	Seems to argue that oversight allows for greater speed in advising and helping projects.
Expert 15	Gives the impression that insight and oversight is needed for judging requests.
Expert 16	Seems to argue that architects are needed to provide insight into where you can change things and what the impact would be.
Expert 17	Acknowledges that it is more important to provide insight than to have beautiful models.

Table C.12: Summaries of what was found in the interview transcripts that is related to the code "On business goals".

Expert 1	Argues that it is actually dangerous to express enterprise architecture using IT terminology and that goals should always be expressed in business terminology.
Expert 2	Argues that it starts with enterprise-wide business goals that should then be translated to several other lines, e.g. enterprise architecture goals and IT goals.
Expert 3	Survey.
Expert 4	Survey.
Expert 5	Agrees that business should be leading and that IT is an enabler.
Expert 6	Survey
Expert 7	Warns that a business itself can still be fragmented.
Expert 8	Explains that the choice of KPIs is similar to a tree like structure with the business goals and strategy on top.

Expert 9	Survey
Expert 10	Survey
Expert 12	Explains that enterprise architects are supposed to support the achievement of business goals.
Expert 14	Argues that goals are translated from strategy, but that they provide a better foundation.
Expert 15	Argues that you are in trouble if you cannot relate EA and IT goals to business goals as these are decomposed from business goals.
Expert 16	Argues that you should not focus on internal, but on external aspects and that it is about bridging business and IT.
Expert 17	Survey.
Expert 18	Argues that KPIs are really business-specific and that personal goals should always be linked to business goals.

Table C.13: Summaries of what was found in the interview transcripts that is related to the code "On strategy".

Expert 1	Gives examples of cost-reducing or power-reducing strategies.
Expert 2	Survey.
Expert 3	Survey.
Expert 4	Survey.
Expert 5	Survey.
Expert 6	Survey.
Expert 7	Survey.
Expert 8	Argues that strategy also resides at the top of the tree-like goal structure.
Expert 9	Survey.
Expert 12	Argues that you cannot have goals without strategy and acknowledges that he should have answered that on the survey.
Expert 13	Argues that architecture should look further than specific business or IT goals and thinks that strategy may be more steady than goals.
Expert 15	Survey.
Expert 16	Survey.

Table C.14: Summaries of what was found in the interview transcripts that is related to the code "On stakeholder interests".

Expert 1	Survey.
Expert 2	Seems to argue that you should identify your "club".
Expert 4	Survey.
Expert 5	Links metrics for measuring enterprise architecture effectiveness to interests of top-level stakeholders with certain responsibilities.
Expert 6	Survey.
Expert 7	Survey.
Expert 9	Argues that metrics should be translated into some form that the stakeholders architects impact, care about.
Expert 10	Argues that, as an architect, you should be able to explain to your boss what it is you are doing in order for him to be able to base decisions on it.
Expert 11	Acknowledges that complexity metrics are of interest for IT, whereas agility and flexibility metrics are interesting for demanding parties.
Expert 12	Agrees that the ones who pay for EA and decide on it should be able to understand the KPIs used.
Expert 13	Argues you should think about who you are doing things for.

Expert 14	Argues that architects should look at people and their concerns in order to win them over. Actually argues that individual goals are more important than collective goals, due to internal politics.
Expert 15	Acknowledges that stakeholders should really be seen as partners.
Expert 17	Argues that whenever a stakeholder wants to know something about EA, that is what you have to report on.
Expert 18	Argues that you should take the satisfaction levels of all stakeholders, including customers, into account.

Table C.15: Summaries of what was found in the interview transcripts that is related to the code "On Operating Model".

Expert 1	Survey.
Expert 2	Survey.
Expert 3	Survey.
Expert 6	Implies that organizations with different operating models have different needs and that KPIs for the business are closely related to the adopted business model.
Expert 8	Acknowledges that using the operating model for choosing KPIs is interesting, but that this is very difficult.
Expert 12	Agrees to a great extent with the kinds of operating models by Ross et al [5].
Expert 13	Acknowledges that the operating model is already closely related to architecture as it is a translation of the strategy.
Expert 14	Argues that the operating model is about the way the enterprise works right now and that you need KPIs based on that in order to be able to influence it.
Expert 16	Interprets the term as the way the company is steered and argues that EA adds value in this regard.

Table C.16: Summaries of what was found in the interview transcripts that is related to the code "Subjective vs objective".

Expert 2	Argues that if you want hard numbers, your enterprise architecture may need to be defined, in terms of maturity.
Expert 3	Acknowledges the difficulty of expressing impact in numbers, but that there is a certain risk associated with keeping it subjective as you may be too late when things go wrong.
Expert 4	Argues that impact on decision making level is subjective. Claims that measuring satisfaction by means of a survey makes it more quantitative. Argues that you may not want to objectify enterprise architecture too much as it is something subjective.
Expert 6	Argues that you should not just focus on quantitative metrics, but should combine it with qualitative metrics.
Expert 7	Seems to argue that on a mature level, you would look at both subjective metrics and numbers such as costs.
Expert 8	Indicates that you could form a more objective view through certain survey questions, but acknowledges that subjectivity is inevitable.
Expert 9	Distinguishes between observation and calculation.
Expert 10	Argues that in order to measure anything, IT Costing should be in place. Acknowledges that you should strive to be objective, but that you should not be fixated on it. Argues that attributing revenue to the CEO is also hardly possible.

Expert 11	Is skeptical about trying to objectify metrics, but argues that you should use both qualitative and quantitative metrics.
Expert 12	Questions whether you should want to measure enterprise architecture to a great extent or that you should look at qualitative aspects and grey areas.
Expert 13	Argues that numbers may be important, but that you cannot realize these without subjective aspects. Argues that architects should be effective towards stakeholders.
Expert 14	Argues that it is difficult to make enterprise architecture effectiveness concrete. Also, argues that it is more important to have satisfied EA customers than to be able to claim revenue. Acknowledges that eventually customers may want to see hard results and that you should then look at Total Cost of Ownership.
Expert 15	Argues that it matters less whether people like you or not and that you should look at financial metrics and (measurable) quality metrics of processes or products.
Expert 16	Acknowledges that it is hard to express the value of enterprise architecture in numbers. Acknowledges that although EA customer satisfaction is subjective, it does tell you something about added value. Questions whether you want to make things really explicit.
Expert 17	Argues that you should try to make your contribution explicit and is a proponent of hard numbers.
Expert 18	Seems to argue that although organizations aim for financial numbers, this could be very difficult to quantify. Acknowledges the importance of soft metrics.

Table C.17: Summaries of what was found in the interview transcripts that is related to the code "Causality/traceability".

Expert 1	Argues that it is hard to determine whether something is better or more efficient thanks to enterprise architecture, as you may not be able to compare it to anything.
Expert 2	Argues that actual effectiveness becomes visible after implementation, but that once something has been implemented, it gained many fathers.
Expert 5	Acknowledges the difficulty of setting up business cases and argues that even costs are difficult to determine.
Expert 6	Acknowledges the causality issue and suggests looking at what constitutes a good architecture.
Expert 7	Points out that you cannot try the same thing once with architecture and once without architecture.
Expert 8	Acknowledges the importance of traceability, but argues that it is difficult to link results to earlier contributions. Argues that results could have been subject to anything and that ideas may even have come from anyone.
Expert 9	Argues that you cannot impact things such as revenue directly and that you should therefore look at "interim metrics".
Expert 10	Compares it to measuring the value of marketing and argues that it is hard to make tangible. Argues that this is also the case at decision making level: how do you measure whether better decisions were made thanks to enterprise architecture.
Expert 11	Seems to argue that some effects of EA are really indirect.
Expert 12	Argues that it is extremely complex to link enterprise architecture to, for example, external customer satisfaction.
Expert 13	Argues that even when you reason from the perspective of enterprise architecture, you cannot fully account for other influences contributing to the same outcomes as enterprise architecture. Argues that you should then consider the situation.

Expert 14	Argues that many steps exist between architecture and organizational results.
Expert 16	Acknowledges that you can never know what would have happened if the organization did not have architecture.
Expert 17	Acknowledges that the "cause and effect chain" of enterprise architecture is rather large and that you need additional measurements to be able to grasp EA's contribution during the process.
Expert 18	Suggests measuring a large number of project results in order to be able to say something about causality. Acknowledges the difficulty of translating measurements such as revenue back to enterprise architecture, but argues that you should try to make it credible. Argues that it is not a linear relation and acknowledges that projects have many fathers.

Table C.18: Summaries of what was found in the interview transcripts that is related to the code "Project vs strategic level".

Expert 3	Argues that the enterprise architecture function (the chief architect) resides at a managerial level. Acknowledges that there is a difference in layering between enterprise architecture and lower level architectures, and that EA is not really about projects.
Expert 4	Mentions how architects used to be evaluated on quality aspects or contribution on project level.
Expert 5	Describes how at lower levels, enterprise architecture is used to see if requests fit with the domain portfolio, whereas at the higher levels the architecture board verifies whether they fit with principles.
Expert 6	Argues that as architecture is about the entire enterprise as opposed to just concrete projects, you should not focus too much on what is measurable.
Expert 7	Argues that enterprise architecture at a higher level is rather vague and that it becomes tangible only at lower levels. Moreover, he argues that every now and then architects have to step down and get involved with lower levels.
Expert 8	Agrees that enterprise architects should not be concerned with, for example, the choice of hardware, but that they should provide guiding principles.
Expert 9	Argues that architects provide the designs for builders to build.
Expert 10	Argues that enterprise architecture resides on strategic level and that it is no longer enterprise architecture if you go deeper.
Expert 11	Argues that enterprise architects reside on strategic level, as an ambassador, and agrees that measuring such things as function points may be the area of software architecture.
Expert 12	Questions whether enterprise architects should be concerned with implementation forms such as cloud solutions.
Expert 13	Distinguishes between tactical and operational levels by arguing that actual projects reside on operational level as it is about a concrete implementation of architecture. Acknowledges the existence of solution architecture at a tactical level.
Expert 14	Argues that you should be concerned with both project leaders and middle management and that it is about a combination of decision making and project implementation. Acknowledges however, that you should not get into too much technical project details.
Expert 15	Seems to describe a bottom-up approach for implementing an EA measurement program and argues that you should start small before letting it grow to an enterprise level.

Expert 16	Argues that enterprise architecture is rather high-level and global and that roadmaps are used as a basis for domain architecture. Argues that enterprise architecture is more about "width", whereas projects are more about "depth". Agrees that effectiveness should be measured at implementation, but that enterprise architecture is then much less involved.
Expert 17	Describes how EA controls reside at a portfolio planning level.
Expert 18	Argues that enterprise architects can still be responsible for actual performance aspects, depending on the level at which decisions are made.

Table C.19: Summaries of what was found in the interview transcripts that is related to the code "Internal customer satisfaction".

Expert 4	Indicates that he is mainly judged on whether his CIO is happy with what he does.
Expert 6	Suggests having interviews with stakeholders to get opinions on how good they think architecture is.
Expert 8	Suggests asking business stakeholders.
Expert 10	Argues that you are not useful if your principal or EA customer does not think you are.
Expert 11	Suggests asking business managers about EA effectiveness.
Expert 12	Argues that those who work under EA may be the ones most capable of judging its effectiveness.
Expert 13	Seems to argue that it should be fine as long as your principals are satisfied and they know what you are doing.
Expert 14	Even though he seems to argue that project leaders are not eventually the EA customers, mentions that they do measure the extent to which expectations are fulfilled. Focuses on satisfaction of EA customers and argues that EA customers say they are satisfied when they actually benefit from EA.
Expert 16	Argues that whenever you are asked by the CIO to help think about future directions, you are doing well.
Expert 17	Suggests doing interviews with EA customers, on their expectations.
Expert 18	Acknowledges that if many people inside the organization think EA is valuable, this may actually be the case.

Table C.20: Summaries of what was found in the interview transcripts that is related to the code "Early stages of maturity".

Expert 1	Argues that you should measure effectiveness from the start as that is where you could gain the most efficiency.
Expert 2	Argues that you can measure effectiveness and value from the start, but that if you want hard data, you should be at defined.
Expert 5	Does not think maturity and effectiveness have much to do with each other and argues you could start measuring from the very beginning.
Expert 6	Agrees that even if you are not mature, you could be able to measure effectiveness. Argues that an organization with a hardly matured architecture could still be very effective.
Expert 8	Argues that maturity is not a requirement for EA success. Argues that even if you are not be mature, you could still have, for example, a really effective architect.
Expert 11	Seems to imply that from the moment you have a form of governance, you could start measuring effectiveness. Argues that even when architecture is really small, you start taking initiatives that could be measured.

Expert 12	Argues that starting from level 1, you should be able to describe value. Measurability then, though, is the responsibility of the individual.
Expert 13	Argues that you should show how effective you are from the beginning, at least informally. You should at least determine it for yourself.
Expert 16	Argues that you should have insight into progress, thus implying that you need to measure from the start.

Table C.21: Summaries of what was found in the interview transcripts that is related to the code "Architects/individuals themselves".

Expert 1	Argues that architects should measure themselves and should report to business.
Expert 2	Argues that architects should judge their own work, but that there should be some kind of check.
Expert 5	Argues that the architecture team should be able to determine whether it fulfilled its role. Acknowledges however, that it should be measured throughout the entire organization, at all levels. Suggests making a balanced scorecard
Expert 7	Argues that you can expect professionalism and that therefore architects should measure themselves.
Expert 9	Argues that there is always some "self-measurement" involved, but that you have to compare it with stakeholder views.
Expert 10	Argues that you yourself, being an architect, should be able to show value and promote yourself.
Expert 12	Argues that nowadays people are responsible for their own added value.
Expert 13	Argues that both the architect and the EA customer have a form of responsibility when it comes to measuring EA effectiveness. The architect should be able to show that he or she does a good job.
Expert 16	Mentions that architects get their own "report mark".

C.2.5 Metrics from Survey and Interviews

Table C.22: Metrics categorized under Decision making process with relevance 2, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Managers' satisfaction." *10, 11, 14*	DP	2	Although managers in general may be broad, it is about those involved with decision making.	EA Customer
"CxO satisfaction." *34, 10, 16*	DP	2	Really important at decision making level.	EA Customer

Table C.23: Metrics categorized under Decision making results with relevance 2, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Investments prevented." *10*	DR	2	About "wrong" investments prevented and therefore the cost savings that can be claimed.	Investments
"More efficient or effective investments: Cheaper, faster, better ideas (Or more productive)." *34, 8, 9, 18*	DR	2	In some cases, it can be claimed, although it should be really clear.	Investments
"Time until something is acted upon: Time between identification and subsequent steps." *7*	DR	2	Also an indication of whether something is done with EA plans.	Speed and agility

Table C.24: Metrics categorized under Program implementation with relevance 2, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Number of similar projects: doing the same things." *14*	PI	2	EA should step in here.	Duplication
"Project completion time. (Speed of investments)" *6, 13, 14, 17, 9*	PI	2	Whether EA is a bottleneck or not.	Project completion
"Project costs: within budget." *13, 14, 17, 18*	PI	2	EA could play a big role in this.	Project completion
"Project failure." *17*	PI	2	EA could play a big role in this.	Project completion
"Project leader satisfaction: Did EA help?" *14*	PI	2	Project leaders' view on effectiveness.	EA Customer
"Project volatility: Number of unexpected architecture changes in large projects." *10*	PI	2	It is not as much about the architecture, but about large unforeseen changes.	Planning
"Time to establish business change in IT." *11*	PI	2	This is about IT-related business changes, which is the area of EA.	Speed and agility

Table C.25: Metrics categorized under Program results with relevance 2, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Complexity - number of applications: About the number of applications and connections." *11*	PR	2	EA could play a big role in this.	Complexity
"Complexity - number of interfaces: Number of connections and interfaces." *11,13*	PR	2	EA could play a big role in this.	Complexity
"Number of generic components." *1, 11*	PR	2	On a high level, yes, not in coding though.	Complexity
"IT costs: reduction of costs thanks to standardization and reduction of costs of programs." *1,17*	PR	2	As derived from the interviews, the experts meant this on a low level, making it hard to link to EA. However, EA could play a big role in reducing IT costs through standardization.	IT costs
"Project success: deadlines and results." *5, 11*	PR	2	Whether the actual claimed results are met.	Claims met
"Realization: what is actually realized." *7, 8, 9*	PR	2	Metric a bit high level, but it is about meeting claims and seeing whether something is actually done with EA plans.	Claims met
"Duplication of application functionality, data, interfaces" *10, 11, 18*	PR	2	Duplication and reuse are definitely areas of EA.	Complexity
"Structural investments realised." *9*	PR	2	Whether investments are actually realized.	Claims met
"User satisfaction with IT." *11, 16*	PR	2	On a high level, EA has responsibility here.	User satisfaction with IT
"Scale-complexity ratio" *12*	PR	2	Interesting as a metric for standardization on an enterprise level.	Complexity
"Business satisfaction with IT" *14*	PR	2	Whether business is content with IT.	User satisfaction with IT

Table C.26: Metrics categorized under Program implementation with relevance 1, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Budgets met" *9*	PI	1	The meeting of budgets was deemed important in the context of governments, but meeting general budgets is hard to link to EA.	Budget
"Capacity: When architecture leads to less number of people or days of project work." *5*	PI	1	It is hard to link an improvement in this field to enterprise architecture.	Resources
"Process quality." *15*	PI	1	Hard to link to EA as it is subject to multiple influences.	Project completion
"Speed of change(time to change)." *11, 13, 17*	PI	1	Metric a bit high level and maybe hard to link to EA as it is subject to multiple influences.	Speed and agility
"Lead time." *5*	PI	1	Hard to link to EA as it is subject to multiple influences.	Speed and agility
"Time to market" *1, 5, 17*	PI	1	Hard to link to EA as it is subject to multiple influences.	Speed and agility

Table C.27: Metrics categorized under Program results with relevance 1, shown by name, focus area, relevance, reason, and category.

Name	FA.	Rv.	Reason	Cat.
"Complexity - lines of code"*5*	PR	1	Complexity should be visible by lines of code, but it is really hard to link to EA's influence as it may be too low level.	Complexity
"Complexity - stakeholders involved"*5*	PR	1	Hard to link to EA's influence.	Complexity
"Costs per customer."*1*	PR	1	Really hard to link to EA as it is subject to many influences.	Costs
"External customer satisfaction."*1,7*	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Financial: The use of financial metrics."*2,5,9,15,16,18*	PR	1	Some experts value this more than others, even among the ones who mentioned it. Either way, it could be hard to link to EA and may be more interesting as appraisal methods.	Appraisal methods
"FTE's: reduction."*18*	PR	1	Hard to link to EA as it is subject to multiple influences.	Resources
"Impact on culture."*9*	PR	1	Although interesting, hard to link to EA.	Culture
"Metrics wrt personnel: less personnel, higher productivity."*1*	PR	1	Hard to link to EA as it is subject to multiple influences.	Resources
"Number of damages."*5*	PR	1	Hard to link to EA as it is subject to multiple influences.	Performance
"Quality of end product."*14, 15*	PR	1	Hard to link to EA as it is subject to multiple influences.	Product quality
"Revenue per customer."*1*	PR	1	Really hard to link to EA as it is subject to many influences.	Revenue
"ROI."*1, 10*	PR	1	Interesting as appraisal method.	Appraisal methods
"Run costs."*17*	PR	1	Hard to link to EA as it is subject to multiple influences.	Costs
"Total Cost of Ownership (TCO)"*1, 11, 14, 15, 17*	PR	1	Interesting as appraisal method.	Appraisal methods
"Better competitivity."*1*	PR	1	Really hard to link to EA as it is subject to many influences.	Business
"Cost savings."*1, 34, 15, 16, 17, 18*	PR	1	Metric a bit high level and maybe hard to link total cost savings.	Costs
"Customer impact."*7*	PR	1	Really hard to link to EA as it is subject to many influences.	Customer
"Customization."*7*	PR	1	According to expert, hard to measure and discussable.	Customization
"Data safety: availability of data."*6*	PR	1	EA could have a stake in this, but it is difficult to measure and link to EA.	Performance
"New products: new products to webshop"*6*	PR	1	Hard to link to EA as it is subject to multiple influences.	Speed and agility
"Performance"*18*	PR	1	Hard to link to EA as it is subject to multiple influences. Although EA could be responsible for bad performance.	Performance
"Uptime"*1, 6*	PR	1	Although in some industries really important, may be hard to link to EA.	Performance

Table C.28: Metrics that were categorized otherwise, shown by name, focus area, relevance, and reason.

Name	FA.	Rv.	Reason
"Budgeting: Whether budget is made available for architectural initiatives."*7, 8,11*	EA involvement	NA	More about EA involvement and use as it is about whether something is done with EA.
"Degree of standardization"*12, 16*	None	NA	Metric a bit high level.
"EA information quality."*10*	Architecture	NA	More about EA quality.
"Frameworks delivered."*10*	Architecture	NA	Not about EA effectiveness.
"Guiding principles used."*7,8*	EA Use and compliance	NA	Not about EA effectiveness.
"Internal customer satisfaction."*34, 6, 8, 10, 11, 13, 14, 12, 16, 17, 18*	None	NA	Too high level, this concept was linked to EA customer satisfaction at all levels.
"IT Budget"*10*	Maturity and Governance	NA	Not about EA effectiveness.
"(Number of characteristics agreed on and) Number of characteristics met."*9*	None	NA	Metric a bit high level.
"Number of decision papers."*7*	Maturity and Governance	NA	Not about EA effectiveness.
"Number of EA exceptions."*17*	EA Use and compliance	NA	More about compliance.
"Participation in change."*34*	EA involvement	NA	More about participation of EA.
"Planning: whether proposed EA ideas are planned."*7*	EA involvement	NA	More about actual use of EA.
"Projects compliant with EA."*7,9,11,17*	EA Use and compliance	NA	More about compliance.

"Projects initiated under architecture." *11*	EA Use and compliance	NA	More about compliance and use.
"Quality of information." *10, 11*	Architecture	NA	May be more about the Architecture quality.
"Stakeholder satisfaction." *34, 6, 10, 11, 14,18*	None	NA	More specific concepts exist.
"Strategic alignment" *34*	None	NA	Metric a bit high level.
"Technological diversity." *17*	None	NA	Metric a bit high level.
"Acceptation of deliverables." *18*	EA Use and compliance	NA	More about EA's use and acceptation.
"Agreements met." *34, 7, 10, 14, 16, 17, 18*	None	NA	Metric category instead of metric. Moreover, about both effectiveness related claims and things such as deliverables.
"Application portfolio." *7, 11*	None	NA	Metric a bit high level.
"Business-IT alignment: Business understanding, steering committees, budgeting, business value of software." *7, 16*	None	NA	Metric a bit high level and actually a category in itself.
"Complexity." *11, 13*	None	NA	Metric a bit high level and actually a category in itself.
"Customer satisfaction." *10, 14, 12, 16, 18*	None	NA	Concept includes multiple customers.
"Decisions underpinned by EA." *34, 6, 11*	EA involvement	NA	Experts seem to use it more in the context of involvement or compliance.
"Enterprise coherence." *17*	None	NA	Although interesting, a bit high level.
"Guiding principles." *7, 8*	EA Use and compliance	NA	Seems to be more about architecture or compliance.
"Innovation portfolio." *7, 12*	None	NA	Metric a bit high level.
"Maintenance budget." *5*	Maturity and Governance	NA	Not about EA effectiveness.
"Number of times EA is involved." *6, 8, 12, 16*	EA involvement	NA	More about EA involvement.

Appendix D

Evaluation Setup and Products

D.1 Evaluation Session Presentation

Note that the entire presentation contained more slides, including for example a definition of EA. On the next two pages however, those slides that are relevant for evaluating the design are shown, i.e. the initial framework and the initial KPIs shown during the evaluation session.

Enterprise Architecture Effectiveness Measurement Framework
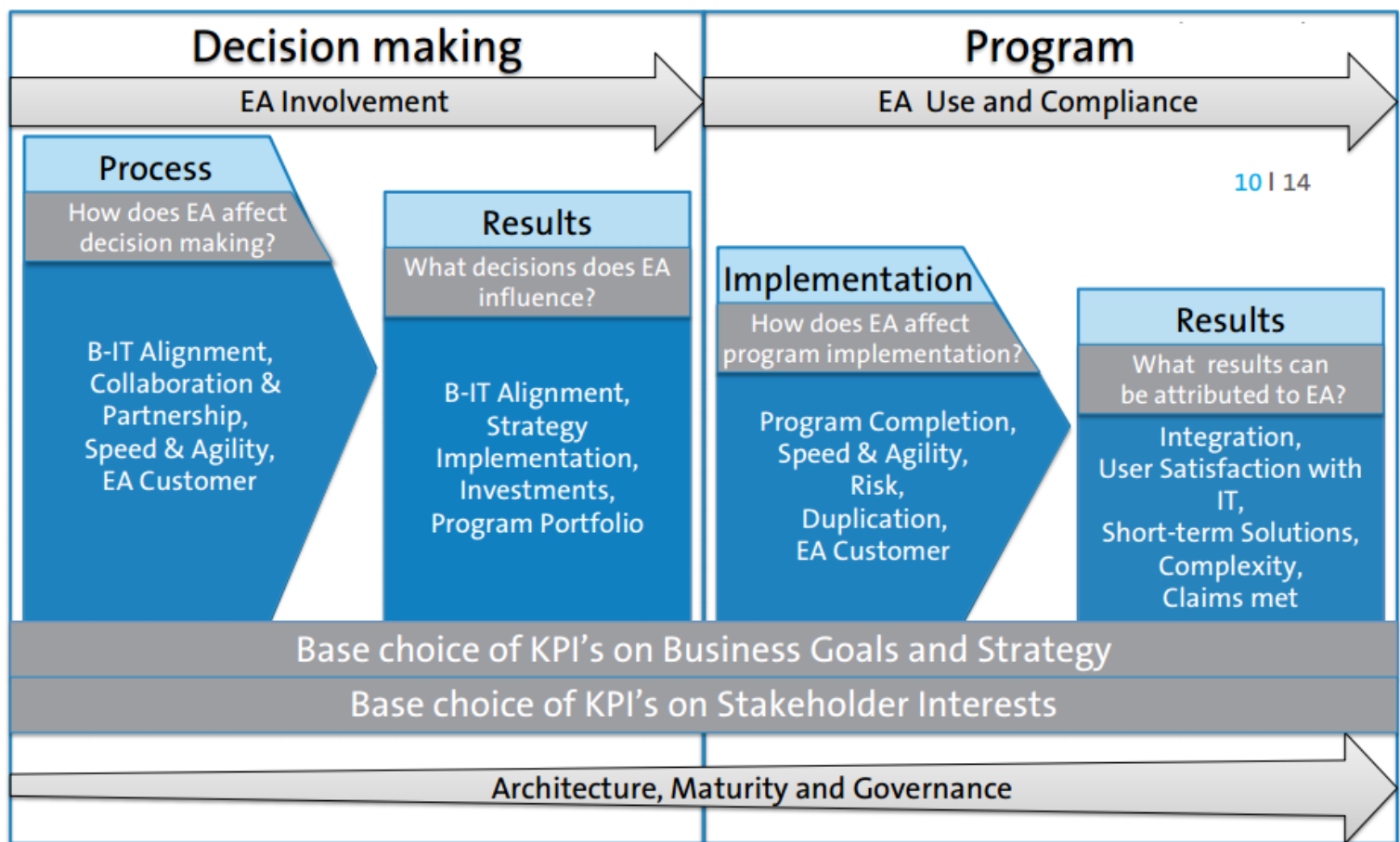
EA should **make sure business and IT stakeholders are conceptually aligned.**

KPI 1: EA's influence on IT stakeholders' understanding of the business direction.

Question: How much does EA [not at all 1 2 3 4 5 much] increase the understanding of (1) the business goals and strategy, (2) IT linkage to business, and (3) business impact and risk of IT-related decisions.

Ask of: Key IT stakeholders involved with decision making on enterprise level.

KPI operationalization: The percentage of IT stakeholders that give negative ratings.

EA should **increase the alignment between business and IT decisions.**

KPI 7: Mapping between IT strategic goals and business strategic goals.

Mapping between: (1) IT strategic goals, and (2) business strategic goals.

KPI operationalization: The percentages of (1) business strategic goals not adequately supported by IT strategic goals, and (2) IT strategic goals not mapped to business strategic goals.

EA can be used to **improve integration**.

Critical system : Distinct combination of information, application and infrastructure providing a certain critical service

KPI 17: Integration of critical systems with other critical systems.

Situation: Critical systems insufficiently linked to other critical systems.

KPI operationalization: Percentage of the total number of critical systems.

D.2   Final Mapping of Metrics to Draft KPIs

Mapping for Decision Making Process

KPI	Relation	Metrics
EA's influence on IT stakeholders' understanding of the business direction.	$\xrightarrow{Includes}$	"(Improved) understanding of business by IT." [46, 69]
	$\xrightarrow{Relates}$	"Level of business user understanding of how technology solutions support their process." [80]
	$\xrightarrow{Uses}$	"Relationship (Degree to which customers enjoy working with EA). (Architecture customer feedback)." [79, 80]
	$\xrightarrow{Relates}$	"Perceived complexity (reference information and insight)." [52]
	$\xrightarrow{Uses}$	"Managers' satisfaction." *10, 11, 14*
	$\xrightarrow{Uses}$	"CxO satisfaction." *34, 10, 16*

KPI	Relation	Metrics
EA's influence on business stakeholders' understanding of the IT landscape.	$\xrightarrow{Includes}$	"(Improved) understanding of IT by business." [46, 69]
	$\xrightarrow{Includes}$	"Satisfaction survey of key stakeholders regarding the transparency, understanding and accuracy of IT financial information." [80]
	$\xrightarrow{Includes}$	"Level of business user understanding of how technology solutions support their process." [80]
	$\xrightarrow{Includes}$	"Level of business executive awareness and understanding of IT innovation possibilities." [80]
	$\xrightarrow{Relates}$	"Perceived complexity (reference information and insight)." [52]
	$\xrightarrow{Uses}$	"Relationship (Degree to which customers enjoy working with EA). (Architecture customer feedback)" [79, 80]
	$\xrightarrow{Uses}$	"Managers' satisfaction." *10, 11, 14*
	$\xrightarrow{Uses}$	"CxO satisfaction." *34, 10, 16*

KPI	Relation	Metrics
EA's influence on stakeholders' understanding of risks and impacts.	$\xrightarrow{Includes}$	"Identifies and mitigates risk" [65]
	$\xrightarrow{Relates}$	"Percentage critical to business processes, IT services and IT-enabled business programmes covered by risk assessment." [80]
	$\xrightarrow{Relates}$	"Due to architecture analyses and/or scenarios of the impact on the market are made." [50]
	$\xrightarrow{Relates}$	"Due to architecture analyses and/or scenarios of the impact on the customer are made." [50]

KPI	Relation	Metrics
EA's influence on the ability of business and IT stakeholders to cooperate.	$\xrightarrow{Includes}$	"Business perception of IT value (Business perceive IT as a partner in creating value) (IT is seen as a cost and profit center)." [46,69]
	$\xrightarrow{Includes}$	"Relationship/trust style (Business and IT are trusted partners)." [46,69]
	$\xrightarrow{Includes}$	"Traditional, enabler/driver, external (IT has an external scope and is driver and enabler for the business strategy)." [46,69]
	$\xrightarrow{Includes}$	"Partnership Ratio: IT function involvement with strategic business initiatives and percentage business stakeholders viewing IT as trusted advisor and strategic partner." [61]
	$\xrightarrow{Relates}$	"Role of IT in strategic business planning (Business and IT develop the strategic plan together)." [46,69]
	$\xrightarrow{Relates}$	"Number of times IT is on the board agenda in proactive manner." [80]
	$\xrightarrow{Relates}$	"Common language (improved communication to reduce misunderstandings). (Provides a shared frame of reference to communicate effectively)." [52,65]
	$\xrightarrow{Relates}$	"Perceived complexity (reference information and insight)." [52]
	$\xrightarrow{Uses}$	"Relationship (Degree to which customers enjoy working with EA). (Architecture customer feedback)" [79,80]
	$\xrightarrow{Uses}$	"Managers' satisfaction." *10, 11, 14*
	$\xrightarrow{Uses}$	"CxO satisfaction." *34, 10, 16*

KPI	Relation	Metrics
EA's influence on stakeholders' ability to cooperate with external business partners.	$\xrightarrow{Includes}$	"Organization's ability to work with external suppliers to leverage shared IT capabilities to create high-value resources." [48]
	$\xrightarrow{Includes}$	"Organization's ability to manage relationships with outsourcing partners." [48]
	$\xrightarrow{Includes}$	"Facilitates co-operation with other organizations" [65]
	$\xrightarrow{Relates}$	"Common language (improved communication to reduce misunderstandings). (Provides a shared frame of reference to communicate effectively)." [52,65]
	$\xrightarrow{Relates}$	"Perceived complexity (reference information and insight)." [52]
	$\xrightarrow{Uses}$	"Relationship (Degree to which customers enjoy working with EA). (Architecture customer feedback)" [79,80]
	$\xrightarrow{Uses}$	"Managers' satisfaction." *10, 11, 14*
	$\xrightarrow{Uses}$	"CxO satisfaction." *34, 10, 16*

KPI	Relation	Metrics
EA's influence on the speed of decision making.	$\xrightarrow{Relates}$	"Time from strategy announcement until a prioritized project pipeline is presented to review and funding bodies." [61]
	$\xrightarrow{Relates}$	"Average time to turn strategic IT objectives into an agreed and approved initiative." [80]
	$\xrightarrow{Uses}$	"Relationship (Degree to which customers enjoy working with EA). (Architecture customer feedback)" [79, 80]
	$\xrightarrow{Relates}$	"Time until something is acted upon: Time between identification and subsequent steps." 7
	$\xrightarrow{Uses}$	"Managers' satisfaction." 10, 11, 14
	$\xrightarrow{Uses}$	"CxO satisfaction." 34, 10, 16

KPI	Relation	Metrics
EA's contribution during decision making.	$\xrightarrow{Includes}$	"Relationship (Degree to which customers enjoy working with EA). (Architecture customer feedback)" [79, 80]
	$\xrightarrow{Includes}$	"Perceived complexity (reference information and insight)." [52]
	$\xrightarrow{Includes}$	"Common language (improved communication to reduce misunderstandings). (Provides a shared frame of reference to communicate effectively)." [52, 65]
	$\xrightarrow{Includes}$	"Provides a consistent and coherent overview." [65]
	$\xrightarrow{Relates}$	"Provides insight into complex projects." [65]
	$\xrightarrow{Relates}$	"Enables identification of integration possibilities." [65]
	$\xrightarrow{Relates}$	"Percentage of EA ideas relevant to business objectives, relevant to innovation focus." [61]
	$\xrightarrow{Includes}$	"Managers' satisfaction." 10, 11, 14
	$\xrightarrow{Includes}$	"CxO satisfaction." 34, 10, 16

Mapping for Decision Making Results

KPI	Relation	Metrics
Mapping between IT strategic goals and business strategic goals.	$\xrightarrow{Includes}$	"Percentage of IT initiatives that are aligned, as identified through the EA process." [61]
	$\xrightarrow{Includes}$	"Consistency of business and IT strategies (Percentage enterprise strategic goals and requirements supported by IT strategic goals)." [48, 80]
	$\xrightarrow{Relates}$	"Percentage IT value drivers mapped to business value drivers." [80]

KPI	Relation	Metrics
Mapping between enterprise-wide programs and business strategic goals.	$\xrightarrow{Includes}$	"Number of business strategies that do not map to a funded initiative." [61]

	$\xrightarrow{Includes}$	"Number of business strategies that map to multiple funded initiatives." [61]
	$\xrightarrow{Relates}$	"Ratio of opportunities to support a strategy adopted versus not adopted (Ratio opportunities taken versus those not taken)." [61, 79]

KPI	Relation	Metrics
Erroneous decisions where EA was a key originator.	$\xrightarrow{Includes}$	"Ratio and extent of erroneous business decisions where erroneous or unavailable information was key factor." [80]

KPI	Relation	Metrics
Erroneous decisions prevented thanks to EA.	$\xrightarrow{Includes}$	"'Investments prevented." *10*
	$\xrightarrow{Includes}$	"More efficient or effective investments: Cheaper, faster, better ideas (Or more productive)." *34, 8, 9, 18*

KPI	Relation	Metrics
Stakeholder satisfaction with the scope of the enterprise-wide program portfolio.	$\xrightarrow{Includes}$	"Stakeholder satisfaction with the scope of the planned portfolio of programmes and services." [80]
	$\xrightarrow{Relates}$	"Perceived value (User satisfaction with EA decisions)." [79]

Mapping for Program Implementation

KPI	Relation	Metrics
Enterprise-wide programs suffering due to EA-related issues.	$\xrightarrow{Includes}$	"Number of business process changes that need to be delayed or reworked because of technology integration issues." [80]
	$\xrightarrow{Includes}$	"Number of IT-enabled business programmes delayed or incurring additional cost due to technology integration issues." [80]
	$\xrightarrow{Relates}$	"Comparing project completion times and performance improvement (in terms of deliverable success) of architecture-aligned and non-compliant projects. (Timeliness (Staying within project time))(Reduce time to deliver IT projects)(saves project time) (duration of procurement projects)." [61, 64, 65, 74, 79]
	$\xrightarrow{Relates}$	"Project performance index (Measurement of the success of the project delivery in the 3 dimensions time, budget and quality). Calculation: Sum of achieved project goals divided by the number of goals. (expected and variance of budget, expected and variance of time)(Results in project quality) (successful execution of IT projects)." [64, 65, 68, 71]
	$\xrightarrow{Relates}$	"Number of new IT-enabled business capabilities (or features or services) within a given budget time and the revenue generated." [61, 74]

	$\xrightarrow{Relates}$	"Rate of execution of executive IT-related decisions." [80]
	$\xrightarrow{Relates}$	"Project failure." *17*
	$\xrightarrow{Relates}$	"Project volatility: Number of unexpected architecture changes in large projects." *10*
	$\xrightarrow{Relates}$	"Project completion time. (Speed of investments)" *6, 13, 14, 17, 9*
	$\xrightarrow{Relates}$	"Project costs: within budget." *13, 14, 17, 18*
	$\xrightarrow{Relates}$	"Project success: deadlines and results." *5, 11*

KPI	Relation	Metrics
Business stakeholder satisfaction with IT's responsiveness to new requirements.	$\xrightarrow{Includes}$	"Level of satisfaction of business executives with IT's responsiveness to new requirements (IT responsiveness satisfaction index, Calculation: Number of satisfied stakeholders divided by the total number of stakeholders)." [71, 80]
	$\xrightarrow{Relates}$	"Time to establish business change in IT." *11*

KPI	Relation	Metrics
Occurrence of critical to business EA-related incidents during enterprise-wide program implementation.	$\xrightarrow{Includes}$	"Number of significant IT-related incidents not identified in risk assessment (Not previously identified risks occurred, Calculation: Number of occurred but not previously identified risks divided by the total number of occurred risks)." [71, 80]
	$\xrightarrow{Includes}$	"Previously identified risks occurred (A measure of the efficacy of IT risk management). Calculation: Number of occurred and previously identified risks divided by the total number of occurred risks." [71]

KPI	Relation	Metrics
Duplication within the enterprise-wide program portfolio.	$\xrightarrow{Includes}$	"Number of similar projects: doing the same things." *14*

KPI	Relation	Metrics
EA's contribution during enterprise-wide program implementation.	$\xrightarrow{Includes}$	"Extent to which projects have been able to leverage EA information (determined through survey)" [61]
	$\xrightarrow{Includes}$	"Customer satisfaction with execution and result." [68]
	$\xrightarrow{Relates}$	"Enables working with project complexity." [65]
	$\xrightarrow{Includes}$	"Project leader satisfaction: Did EA help?" *14*

Mapping for Program Results

KPI	Relation	Metrics
Integration of critical systems with other critical systems.	$\xrightarrow{Includes}$	"Number of applications or critical infrastructures operating in silos and not integrated." [80]
	$\xrightarrow{Relates}$	"Improvement in "anytime, anywhere, anyway" access to information." [61, 73]
	$\xrightarrow{Relates}$	"Integration (combined functionalities into one or at least less applications. Consolidation of data and systems, easy interconnectivity, interfaces, data e.g. by standardization)." [52]
	$\xrightarrow{Relates}$	"Complexity - number of interfaces: Number of connections and interfaces." *11,13*

KPI	Relation	Metrics
Critical to business processing incidents caused by EA-related errors.	$\xrightarrow{Includes}$	"Number of business process incidents caused by non-availability of information." [80]
	$\xrightarrow{Includes}$	"Number of business processing incidents caused by technology integration errors." [80]
	$\xrightarrow{Relates}$	"Number of business disruptions due to IT service incidents." [80]

KPI	Relation	Metrics
Business stakeholder satisfaction with IT-enabled business capabilities.	$\xrightarrow{Includes}$	"Percentage of business process owners satisfied with supporting IT products and services. " [80]
	$\xrightarrow{Includes}$	"Satisfaction levels of business and IT executives with IT-related costs and capabilities." [80]
	$\xrightarrow{Includes}$	"Operational departments' satisfied with IT." [64]
	$\xrightarrow{Relates}$	"Percentage business stakeholders satisfied that IT service delivery meets agreed-upon service levels." [80]
	$\xrightarrow{Relates}$	"Percentage users satisfied with quality of IT service delivery." [80]
	$\xrightarrow{Includes}$	"User satisfaction with IT." *11, 16*
	$\xrightarrow{Includes}$	"Business satisfaction with IT" *14*

KPI	Relation	Metrics
Existence of short-term focused critical systems.	$\xrightarrow{Includes}$	"Reduction in the rate of urgent infrastructure projects and number of support products (Occurrence of short-lived products)." [61, 74]

KPI	Relation	Metrics
Critical systems with similar or closely related functionalities.	$\xrightarrow{Relates}$	"Integration (combined functionalities into one or at least less applications. Consolidation of data and systems, easy interconnectivity, interfaces, data e.g. by standardization)." [52]
	$\xrightarrow{Relates}$	"Physical complexity (Amounts and amount of sorts of systems)" [52]

	$\xrightarrow{Includes}$	"Duplication of application functionality, data, interfaces" *10, 11, 18*
	$\xrightarrow{Relates}$	"Scale-complexity ratio" *12*
	$\xrightarrow{Relates}$	"Complexity - number of applications: About the number of applications and connections." *11*
	$\xrightarrow{Relates}$	"Complexity - number of interfaces: Number of connections and interfaces." *11,13*

KPI	Relation	Metrics
Critical systems used by more than one domain.	$\xrightarrow{Includes}$	"Percentage re-use of architectural components including services." [61]
	$\xrightarrow{Includes}$	"Percentage of applications used by more than one business." [61]
	$\xrightarrow{Relates}$	"Cost savings through re-use of software components, standardized purchase agreements, and common product sets. " [56, 61, 78]
	$\xrightarrow{Relates}$	"IT costs: reduction of costs thanks to standardization and reduction of costs of programs." *1,17*
	$\xrightarrow{Relates}$	"Physical complexity (Amounts and amount of sorts of systems)" [52]
	$\xrightarrow{Includes}$	"Number of generic components." *1, 11*
	$\xrightarrow{Relates}$	"Complexity - number of applications: About the number of applications and connections." *11*
	$\xrightarrow{Relates}$	"Complexity - number of interfaces: Number of connections and interfaces." *11,13*

KPI	Relation	Metrics
Diversity among critical systems.	$\xrightarrow{Includes}$	"Reduced number of vendors of the same technology over time. " [63]
	$\xrightarrow{Includes}$	"Reduced version released diversity." [63]
	$\xrightarrow{Relates}$	"Synthesis of diverse technologies." [69]
	$\xrightarrow{Relates}$	"Physical complexity (Amounts and amount of sorts of systems)" [52]

KPI	Relation	Metrics
Enterprise-wide programs meeting EA-related claimed benefits.	$\xrightarrow{Includes}$	"Percentage IT-enabled investments where claimed benefits met or exceeded." [80]
	$\xrightarrow{Includes}$	"Total and targeted cost savings achieved." [76]
	$\xrightarrow{Includes}$	"Percentage IT services where expected benefits realised (IT investment delivering predefined benefits)." [71, 80]
	$\xrightarrow{Includes}$	"Project benefits realised that can be traced back to architecture involvement(e.g. cost reduction through reuse)" [80]
	$\xrightarrow{Includes}$	"Percentage delivered of intended results." [68]

$\xrightarrow{Includes}$	"Functional fit (match between planned and delivered functionality) (Results in project functionality)." [65, 68]
$\xrightarrow{Includes}$	"Technical fit (Match between planned and delivered non-functional characteristics)." [68]
$\xrightarrow{Includes}$	"Alignment (with management intentions)." [52]
$\xrightarrow{Includes}$	"Cost savings through re-use of software components, standardized purchase agreements, and common product sets (savings from reuse). " " [56, 61, 78, 79]
$\xrightarrow{Relates}$	"Percentage of EA ideas implemented, trends and patterns." [61]
$\xrightarrow{Relates}$	"Number of critical business processes supported by up-to-date infrastructure and applications. " [80]
$\xrightarrow{Relates}$	"Number of new processes identified and improved (number of processes improved) (number of new business processes identified and improved)." [61, 73, 76]
$\xrightarrow{Includes}$	"Realization: what is actually realized." *7, 8, 9*
$\xrightarrow{Includes}$	"IT costs: reduction of costs thanks to standardization and reduction of costs of programs." *1,17*
$\xrightarrow{Includes}$	"Structural investments realised." *9*

D.3   Evaluation Survey Setup and Products

D.3.1   Evaluation Survey Questions Asked

Note: Page numbers are not visible when filling in the survey. Also, the tool does allow for remembering where respondents left off by allowing only for one answer per computer. However, this option was not used.

Measuring EA effectiveness: Key Performance Indicators

Page 1

Q1: DESCRIPTIVE TEXT

Dear Participant,

Thank you for your help and feedback during our interactive evaluation session.

This survey builds on our interactive evaluation session. The goal of my research is to arrive at a clear overview of Key Performance Indicators (KPIs) that can be used to measure enterprise architecture (EA) effectiveness. In this survey, 25 KPIs are included. They have been divided into four focus areas:

- Decision Making Process (page 1)
- Decision Making Results (page 2)
- Program Implementation (page 3)
- Program Results (page 4)

Per focus area, KPIs and questions are structured as follows:

Category (e.g. B-IT Alignment)
KPI 1
Questions regarding KPI 1
Room for comments on KPI 1
KPI 2
Questions regarding KPI 2
Room for comments on KPI 2
Category (e.g. Risk & Impact)
KPI 3
Questions regarding KPI 3
Room for comments on KPI 3
...

Finally, page 5 gives room for suggestions and general feedback.

The survey will take about 20 minutes.
Please note: Unfortunately, the tool does not remember where you left off in case of an interruption.

Page 2

Q2: DESCRIPTIVE TEXT

Decision Making Process: How does EA affect decision making?

Q3: DESCRIPTIVE TEXT

Category: B-IT Alignment

Q4: DESCRIPTIVE TEXT

KPI 1: EA's influence on IT stakeholders' understanding of the business direction.
Question: Does EA [Not at all 1 2 3 4 5 Very much] lead to an increased understanding of (1) the business goals and strategy, and (2) IT linkage to business?
Ask of: Key IT stakeholders involved in decision making at enterprise level.
KPI operationalization: The percentage of key IT stakeholders giving negative ratings.

Q5: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 1 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 1 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q6: COMMENT BOX
Comments on KPI 1?

Q7: DESCRIPTIVE TEXT

KPI 2: EA's influence on business stakeholders' understanding of the IT landscape.

Question: Does EA [Not at all 1 2 3 4 5 Very much] lead to an increased understanding of (1) IT financial information, (2) IT innovation possibilities, and (3) IT linkage to business?
Ask of: Key business stakeholders involved in decision making at enterprise level.
KPI operationalization: The percentage of key business stakeholders giving negative ratings.

Q8: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 2 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 2 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q9: COMMENT BOX

Comments on KPI 2?

Q10: DESCRIPTIVE TEXT

Category: Risk & Impact

Q11: DESCRIPTIVE TEXT

KPI 3: EA's influence on stakeholders' understanding of risks and impacts.
Question: Does EA [Not at all 1 2 3 4 5 Very much] lead to an increased understanding of the (1) risks, and (2) impacts of certain scenarios and decisions?
Ask of: Key stakeholders involved in decision making at enterprise level.
KPI operationalization: The percentage of key stakeholders giving negative ratings.

Q12: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1	2	3	4	5

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
KPI 3 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 3 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q13: COMMENT BOX

Comments on KPI 3?

Q14: DESCRIPTIVE TEXT

Category: Collaboration & Partnership

Q15: DESCRIPTIVE TEXT

KPI 4: EA's influence on the ability of business and IT stakeholders to cooperate.
Question: Does EA [Not at all 1 2 3 4 5 Very much] (1) facilitate the strategic dialogue between business and IT, (2) promote IT as a driver or as "co-adaptive", and (3) promote IT as a partner in creating value?
Ask of: Key business and IT stakeholders involved in decision making at enterprise level.
KPI operationalization: The percentage of key business and IT stakeholders giving negative ratings.

Q16: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 4 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 4 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q17: COMMENT BOX

Comments on KPI 4?

Q18: DESCRIPTIVE TEXT

KPI 5: EA's influence on stakeholders' ability to cooperate with external business partners.

Question: Does EA [Not at all 1 2 3 4 5 Very much] (1) lead to an increased understanding of the way external business partners are related to the enterprise, and (2) facilitate cooperation with external business partners?

Ask of: Key stakeholders involved in decision making at enterprise level.

KPI operationalization: The percentage of key stakeholders giving negative ratings.

Q19: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 5 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 5 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q20: COMMENT BOX

Comments on KPI 5?

Q21: DESCRIPTIVE TEXT

Category: Speed & Agility

Q22: DESCRIPTIVE TEXT

KPI 6: EA's influence on the speed of decision making.

Question: Does EA affect [Slows down 1 2 3 4 5 Speeds up] the speed of the decision making process?

Ask of: Key stakeholders involved in decision making at enterprise level.

KPI operationalization: The percentage of key stakeholders giving negative ratings.

Q23: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 6 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 6 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q24: COMMENT BOX

Comments on KPI 6?

Q25: DESCRIPTIVE TEXT

Category: EA Customer

Q26: DESCRIPTIVE TEXT

KPI 7: EA's contribution during decision making.

Question: Does EA [Not at all 1 2 3 4 5 Very much] help the EA customer during the decision making process by (1) facilitating communication, (2) providing insight and oversight, and (3) providing input and advice?

Ask of: Key stakeholders involved in decision making at enterprise level.

KPI operationalization: The percentage of key stakeholders giving negative ratings.

Q27: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 7 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 7 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q28: COMMENT BOX

Comments on KPI 7?

Page 3

Q29: DESCRIPTIVE TEXT

Decision Making Results: What decisions does EA influence?

Q30: DESCRIPTIVE TEXT

Category: B-IT Alignment

Q31: DESCRIPTIVE TEXT

KPI 8: Mapping between IT strategic goals and business strategic goals.
Mapping between: (1) IT strategic goals, and (2) business strategic goals.
KPI operationalization: The percentages of (1) IT strategic goals not mapped to or competing with business strategic goals, and (2) business strategic goals not adequately supported by IT strategic goals.

Q32: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 8 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 8 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q33: COMMENT BOX

Comments on KPI 8?

Q34: DESCRIPTIVE TEXT

Category: Strategy Implementation

Q35: DESCRIPTIVE TEXT

KPI 9: Mapping between enterprise-wide programs and business strategic goals.
Mapping between: (1) Enterprise-wide programs, both adopted (i.e. budgeted and planned for) and ongoing, and (2) business strategic goals.
KPI operationalization: The percentages of (1) enterprise-wide programs not mapped to or competing with business strategic goals, and (2) business strategic goals not adequately supported by enterprise-wide programs.

Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.

Q36: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 9 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 9 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q37: COMMENT BOX

Comments on KPI 9?

Q38: DESCRIPTIVE TEXT

Category: Investments

Q39: DESCRIPTIVE TEXT

KPI 10: Erroneous decisions where EA was a key originator.
Cases: Erroneous decisions largely caused by (1) erroneous or (2) unavailable EA

information.
KPI operationalization: (1) The number of cases, and (2) their impact.

Q40: SINGLE-SELECT MATRIX
To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 10 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 10 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q41: COMMENT BOX
Comments on KPI 10?

Q42: DESCRIPTIVE TEXT

KPI 11: Erroneous decisions prevented thanks to EA.
Cases: (1) Inefficient or (2) ineffective decisions clearly prevented by EA (e.g. by suggesting better alternatives).
KPI operationalization: (1) The number of cases, and (2) their impact.

Q43: SINGLE-SELECT MATRIX
To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 11 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 11 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q44: COMMENT BOX

Comments on KPI 11?

Q45: DESCRIPTIVE TEXT

Category: Program Portfolio

Q46: DESCRIPTIVE TEXT

KPI 12: Stakeholder satisfaction with the scope of the enterprise-wide program portfolio.
Question: Does the scope of the enterprise-wide program portfolio [Not at all 1 2 3 4 5 Fully] sufficiently cover stakeholder interests?
Ask of: Key stakeholders affected by enterprise-wide programs at enterprise and domain levels.
KPI operationalization: The percentage of key stakeholders giving negative ratings.

Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.

Q47: SINGLE-SELECT MATRIX
To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 12 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 12 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q48: COMMENT BOX
Comments on KPI 12?

Page 4

Q49: DESCRIPTIVE TEXT

Program Implementation: How does EA affect

program implementation?

Q50: DESCRIPTIVE TEXT

Category: Program Completion

Q51: DESCRIPTIVE TEXT

KPI 13: Enterprise-wide programs suffering due to EA-related issues.
Cases: Enterprise-wide programs (1) failed, (2) delayed, (3) reworked, or (4) incurring additional costs due to EA-related issues (e.g. integration issues).
KPI operationalization: (1) The number of cases, and (2) their impact.

Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.

Q52: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 13 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 13 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q53: COMMENT BOX

Comments on KPI 13?

Q54: DESCRIPTIVE TEXT

Category: Speed & Agility

Q55: DESCRIPTIVE TEXT

KPI 14: Business stakeholder satisfaction with IT's

responsiveness to new requirements.
Question: Level of satisfaction [Very dissatisfied 1 2 3 4 5 Very satisfied] with IT's responsiveness to new business demands?
Ask of: Key business stakeholders involved in decision making at enterprise level.
KPI operationalization: The percentage of key business stakeholders giving negative ratings.

Q56: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 14 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 14 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q57: COMMENT BOX

Comments on KPI 14?

Q58: DESCRIPTIVE TEXT

Category: Risk & Impact

Q59: DESCRIPTIVE TEXT

KPI 15: Occurrence of critical to business EA-related incidents during enterprise-wide program implementation.
Cases: EA-related incidents that prevent the business from operating during enterprise-wide program implementation.
KPI operationalization: (1) The number of cases, and (2) their impact.

Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.

Q60: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 15 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 15 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q61: COMMENT BOX

Comments on KPI 15?

Q62: DESCRIPTIVE TEXT

Category: Duplication

Q63: DESCRIPTIVE TEXT

KPI 16: Duplication within the enterprise-wide program portfolio.

Determine: Number of programs or projects within the enterprise-wide program portfolio aiming for something very similar to other programs, projects, or already existing solutions.
KPI operationalization: As a percentage of the total number of programs or projects within the enterprise-wide program portfolio.

Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.

Q64: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 16 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 16 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q65: COMMENT BOX

Comments on KPI 16?

Q66: DESCRIPTIVE TEXT

Category: EA Customer

Q67: DESCRIPTIVE TEXT

KPI 17: EA's contribution during enterprise-wide program implementation.

Question: Does EA [Not at all 1 2 3 4 5 Very much] help the EA customer during enterprise-wide program implementation by (1) facilitating communication, (2) providing insight and oversight, (3) providing input and advice, and (4) providing directions?
Ask of: Key stakeholders involved in enterprise-wide program implementation.
KPI operationalization: The percentage of key stakeholders giving negative ratings.

Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.

Q68: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 17 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 17 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q69: COMMENT BOX

Comments on KPI 17?

Page 5

Q70: DESCRIPTIVE TEXT

Program Results: What results can be attributed to EA?

Q71: DESCRIPTIVE TEXT

Category: Integration

Q72: DESCRIPTIVE TEXT

KPI 18: Integration of critical systems with other critical systems.
Determine: Number of critical systems insufficiently linked to other critical systems.
KPI operationalization: As a percentage of the total number of critical systems.

Critical system = Distinct combination of business, information, applications and infrastructure providing a certain critical service.

Q73: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 18 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 18 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q74: COMMENT BOX
Comments on KPI 18?

Q75: DESCRIPTIVE TEXT

KPI 19: Critical to business processing incidents caused by EA-related errors.
Cases: Critical to business processing incidents caused by EA-related errors (e.g. integration errors).

KPI operationalization: (1) The number of cases, and (2) their impact.

Q76: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 19 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 19 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q77: COMMENT BOX
Comments on KPI 19?

Q78: DESCRIPTIVE TEXT

Category: User Satisfaction with IT

Q79: DESCRIPTIVE TEXT

KPI 20: Business stakeholder satisfaction with IT-enabled business capabilities.
Question: Level of satisfaction [Very dissatisfied 1 2 3 4 5 Very satisfied] with IT-enabled business capabilities?
Ask of: Key business stakeholders at enterprise and domain levels.
KPI operationalization: The percentage of key business stakeholders giving negative ratings.

Q80: SINGLE-SELECT MATRIX
To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 20 is clear enough for use in practice.	☐	☐	☐	☐	☐

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 20 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q81: COMMENT BOX

Comments on KPI 20?

Q82: DESCRIPTIVE TEXT

Category: Short-term Solutions

Q83: DESCRIPTIVE TEXT

KPI 21: Existence of short-term focused critical systems.

Determine: Number of critical systems that are short-term focused (i.e. not in line with longer-term strategic goals).
KPI operationalization: As a percentage of the total number of critical systems.

Critical system = Distinct combination of business, information, applications and infrastructure providing a certain critical service.

Q84: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 21 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 21 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q85: COMMENT BOX

Comments on KPI 21?

Q86: DESCRIPTIVE TEXT

Category: Complexity

Q87: DESCRIPTIVE TEXT

KPI 22: Critical systems with similar or closely related functionalities.

Determine: Number of critical systems providing services similar or closely related to one or more other critical systems.
KPI operationalization: As a percentage of the total number of critical systems.

Critical system = Distinct combination of business, information, applications and infrastructure providing a certain critical service.

Q88: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 22 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 22 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q89: COMMENT BOX

Comments on KPI 22?

Q90: DESCRIPTIVE TEXT

KPI 23: Critical systems used by more than one domain.

Determine: Number of critical systems used by more than one domain.
KPI operationalization: As a percentage of the total number of critical systems.

Critical system = Distinct combination of business, information, applications and infrastructure providing a certain critical service.

Q91: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 23 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 23 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q92: COMMENT BOX

Comments on KPI 23?

Q93: DESCRIPTIVE TEXT

KPI 24: Diversity among critical systems.
Determine: Number of critical systems suffering (1) from version released diversity, or (2) due to the number of vendors.
KPI operationalization: As a percentage of the total number of critical systems.

Critical system = Distinct combination of business, information, applications and infrastructure providing a certain critical service.

Q94: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 24 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 24 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q95: COMMENT BOX

Comments on KPI 24?

Q96: DESCRIPTIVE TEXT

Category: Claims met

Q97: DESCRIPTIVE TEXT

KPI 25: Enterprise-wide programs meeting EA-related claimed benefits.
Cases: Enterprise-wide programs where EA-related claimed benefits (e.g. reduced IT costs thanks to reuse, delivered functionalities to business) are (1) met, or (2) not met.
KPI operationalization: (1) The number of cases, and (2) their impact.

Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.

Q98: SINGLE-SELECT MATRIX

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree
KPI 25 is clear enough for use in practice.	☐	☐	☐	☐	☐
KPI 25 is useful for measuring EA effectiveness.	☐	☐	☐	☐	☐

Q99: COMMENT BOX

Comments on KPI 25?

Page 6

Q100: COMMENT BOX

Are there any KPIs you are missing in one of the focus areas?

Q101: COMMENT BOX

Do you have any general comments?

Thank You Page

Thank you very much for your participation! I will of course share with you the results of my research. For more information, see http://www.sig.eu/en/study_gunther.

D.3.2   Evaluation Survey Summary Report

The following pages show the summary report of the survey results as retrieved from Instant.ly [38] after 6 respondents had answered the questions completely.

My Summary Report

Source	Started Survey	Currently in Survey	Completed Survey	Were Terminated	Did not Finish	Average Survey Length
Survey Link	6	0	6	0	0	00:35:07
Totals	**6**	**0**	**6**	**0**	**0**	**00:35:07**

Question #1

Dear Participant, Thank you for your help and feedback during our interactive evaluation session. This survey builds on our interactive evaluation session. The goal of my research is to arrive at a clear overview of Key Performance Indicators (KPIs) that can be used to measure enterprise architecture (EA) effectiveness. In this survey, 25 KPIs are included. They have been divided into four focus areas: - Decision Making Process (page 1) - Decision Making Results (page 2) - Program Implementation (page 3) - Program Results (page 4) Per focus area, KPIs and questions are structured as follows:

Category (e.g. B-IT Alignment) KPI 1 Questions regarding KPI 1 Room for comments on KPI 1 KPI 2 Questions regarding KPI 2 Room for comments on KPI 2 Category (e.g. Risk & Impact) KPI 3 Questions regarding KPI 3 Room for comments on KPI 3 ...

Finally, page 5 gives room for suggestions and general feedback. The survey will take about 20 minutes. Please note: Unfortunately, the tool does not remember where you left off in case of an interruption.

Decision Making Process: How does EA affect decision making?

Category: B-IT Alignment

KPI 1: EA's influence on IT stakeholders' understanding of the business direction.

Question: Does EA [Not at all 1 2 3 4 5 Very much] lead to an increased understanding of (1) the business goals and strategy, and (2) IT linkage to business? Ask of: Key IT stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key IT stakeholders giving negative ratings.

Question #5

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 1 is clear enough for use in practice.	1 17%	1 17%	1 17%	2 33%	1 17%	6
KPI 1 is useful for measuring EA effectiveness.	0 0%	0 0%	1 17%	4 67%	1 17%	6
Total	**1**	**1**	**2**	**6**	**2**	

Comments on KPI 1?

Order	Answer	Responses	Percent
1		5	100%
	Enterprise Architecture guides changes in the right direction, as the EA principles describe the road to the corporate vision and strategy.		
	Difficult to quantify		
	Two goals in one question :) Very difficult to give the right answer to the KPI-questions		
	KPI 1 adresses two different topics: 1. EA being part of clarifying business goals and strategy, which is input to EA 2. EA translating the new strategy into IT Solutions supporting this strategy It's better to split the KPI into these two topics.		
	Confusion might exist about wheather this question addresses the EA process (organization) or the EA products (or both)		
	Total	**5**	**100%**

KPI 2: EA's influence on business stakeholders' understanding of the IT landscape.

Question: Does EA [Not at all 1 2 3 4 5 Very much] lead to an increased understanding of (1) IT financial information, (2) IT innovation possibilities, and (3) IT linkage to business? Ask of: Key business stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key business stakeholders giving negative ratings.

Comments on KPI 1?

Order	Answer	Responses	Percent
1		5	100%
	Enterprise Architecture guides changes in the right direction, as the EA principles describe the road to the corporate vision and strategy.		

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 2 is clear enough for use in practice.	1 17%	2 33%	0 0%	3 50%	0 0%	6
KPI 2 is useful for measuring EA effectiveness.	0 0%	0 0%	0 0%	5 83%	1 17%	6
Total	**1**	**2**	**0**	**8**	**1**	

Comments on KPI 2?

Order	Answer	Responses	Percent
1		3	100%
	I think EA leads to increased understanding of the IT landscape, but not to financial information or innovation. If you change the KPI accordingly, I think the KPI is useful.		
	Again two topics are being addressed: 1. IT Financials, like TCO of alternative solutions can be used to support business decisions 2. IT Innovation, how can new technologies be leveraged by the business Splitting the KPI into the two areas makes it more clear where the benefit of EA lies.		
	see comment above		
	Total	**3**	**100%**

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 2 is clear enough for use in practice.	1 17%	2 33%	0 0%	3 50%	0 0%	6
KPI 2 is useful for measuring EA effectiveness.	0 0%	0 0%	0 0%	5 83%	1 17%	6

Category: Risk & Impact

KPI 3: EA's influence on stakeholders' understanding of risks and impacts. Question: Does EA [Not at all 1 2 3 4 5 Very much] lead to an increased understanding of the (1) risks, and (2) impacts of certain scenarios and decisions? Ask of: Key stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key stakeholders giving negative ratings.

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 3 is clear enough for use in practice.	0 0%	0 0%	1 17%	3 50%	2 33%	6
KPI 3 is useful for measuring EA effectiveness.	0 0%	1 17%	0 0%	4 67%	1 17%	6
Total	**0**	**1**	**1**	**7**	**3**	

Comments on KPI 3?

Order	Answer	Responses	Percent
1		3	100%
	If proposed changes deviate from the EA principles, this is a risk. EA helps mitigating the risks and can propose another scenario.		
	Ok, when you only look at the KPI and forget the rest it is easier to answer the KPI-questions		
	see above		
	Total	**3**	**100%**

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total

Category: Collaboration & Partnership

KPI 4: EA's influence on the ability of business and IT stakeholders to cooperate.

Question: Does EA [Not at all 1 2 3 4 5 Very much] (1) facilitate the strategic dialogue between business and IT, (2) promote IT as a driver or as "co-adaptive", and (3) promote IT as a partner in creating value? Ask of: Key business and IT stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key business and IT stakeholders giving negative ratings.

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 4 is clear enough for use in practice.	0 0%	0 0%	1 17%	4 67%	1 17%	6
KPI 4 is useful for measuring EA effectiveness.	0 0%	0 0%	1 17%	4 67%	1 17%	6
Total	**0**	**0**	**2**	**8**	**2**	

Comments on KPI 4?

Order	Answer	Responses	Percent
1		2	100%
	I hope this KPI always is green!		
	see above		
	Total	**2**	**100%**

KPI 5: EA's influence on stakeholders' ability to cooperate with external business partners. Question: Does EA [Not at all 1 2 3 4 5 Very much] (1) lead to an increased understanding of the way external business partners are related to the enterprise, and (2) facilitate cooperation with external business partners? Ask of: Key stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key stakeholders giving negative ratings.

Question #19

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 5 is clear enough for use in practice.	0 0%	1 17%	2 33%	3 50%	0 0%	6
KPI 5 is useful for measuring EA effectiveness.	0 0%	1 17%	3 50%	2 33%	0 0%	6
Total	**0**	**2**	**5**	**5**	**0**	

Comments on KPI 5?

Order	Answer	Responses	Percent
1		3	100%
	EA principles will say something about sourcing. EA views will give a clear picture on how business processes work e.g. with external business partners. But I don't think the value of this KPI will help in measuring EA effectiveness.		
	It should be mentioned how EA can support easy partnering with external business partners, like definition and governance of selected standards and interfaces.		
	see above		
	Total	**3**	**100%**

Category: Speed & Agility

EA principles will say something about sourcing. EA views will give a clear picture on how business processes work e.g. with external business partners. But I don't think the value of this KPI will help in measuring EA effectiveness.

It should be mentioned how EA can support easy partnering with external business partners, like

KPI 6: EA's influence on the speed of decision making. Question: Does EA affect [Slows down 1 2 3 4 5 Speeds up] the speed of the decision making process? Ask of: Key stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key stakeholders giving negative ratings.

Question #23

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 6 is clear enough for use in practice.	0 0%	0 0%	3 50%	2 33%	1 17%	6
KPI 6 is useful for measuring EA effectiveness.	1 17%	0 0%	2 33%	2 33%	1 17%	6
Total	**1**	**0**	**5**	**4**	**2**	

Comments on KPI 6?

Order	Answer	Responses	Percent
1		2	100%
	If changes comply to the EA principles (and have a valid business case), no discussion is necessary. If changes do not comply to the EA principles, the EA deviation process speeds the decision making process: either (1) accept the deviation and do nothing, or (2) accept the deviation and propose a rework project, or (3) stop the project.		
	see above		
	Total	**2**	**100%**

Category: EA Customer

KPI 7: EA's contribution during decision making. Question: Does EA [Not at all 1 2 3 4 5 Very much] help the EA customer during the decision making process by (1) facilitating communication, (2) providing insight and oversight, and (3) providing input and advice? Ask of: Key stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key stakeholders giving negative ratings.

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 7 is clear enough for use in practice.	1 17%	0 0%	0 0%	3 50%	2 33%	6
KPI 7 is useful for measuring EA effectiveness.	0 0%	0 0%	0 0%	4 67%	2 33%	6
Total	**1**	**0**	**0**	**7**	**4**	

KPI 7: EA's contribution during decision making. Question: Does EA [Not at all 1 2 3 4 5 Very much] help the EA customer during the decision making process by (1) facilitating communication, (2) providing insight and oversight, and (3) providing input and advice? Ask of: Key stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key stakeholders giving negative ratings.

Comments on KPI 7?

Order	Answer	Responses	Percent
1		1	100%
	I hope this KPI always is green!		
	Total	**1**	**100%**

Question #29

Decision Making Results: What decisions does EA influence?

Comments on KPI 7?

Order	Answer	Responses	Percent
1			
	I hope this KPI always is green!		
	Total	**1**	**100%**

Category: B-IT Alignment

KPI 8: Mapping between IT strategic goals and business strategic goals. Mapping between: (1) IT strategic goals, and (2) business strategic goals. KPI operationalization: The percentages of (1) IT strategic goals not mapped to or competing with business strategic goals, and (2) business strategic goals not adequately supported by IT strategic goals.

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 8 is clear enough for use in practice.	0 0%	0 0%	2 33%	3 50%	1 17%	6
KPI 8 is useful for measuring EA effectiveness.	0 0%	0 0%	1 17%	4 67%	1 17%	6
Total	**0**	**0**	**3**	**7**	**2**	

Comments on KPI 8?

Order	Answer	Responses	Percent
1		1	100%
	I think every IT strategic goal should somehow map to a business strategic goal. Great KPI.		
	Total	**1**	**100%**

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 8 is clear enough for use in practice.	0 0%	0 0%	2 33%	3 50%	1 17%	6
KPI 8 is useful for measuring EA effectiveness.	0 0%	0 0%	1 17%	4 67%	1 17%	6

Category: Strategy Implementation

KPI 9: Mapping between enterprise-wide programs and business strategic goals.

Mapping between: (1) Enterprise-wide programs, both adopted (i.e. budgeted and planned for) and ongoing, and (2) business strategic goals. KPI operationalization: The percentages of (1) enterprise-wide programs not mapped to or competing with business strategic goals, and (2) business strategic goals not adequately supported by enterprise-wide programs. *Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.*

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 9 is clear enough for use in practice.	0 0%	0 0%	1 17%	4 67%	1 17%	6
KPI 9 is useful for measuring EA effectiveness.	0 0%	0 0%	0 0%	4 67%	2 33%	6
Total	**0**	**0**	**1**	**8**	**3**	

Comments on KPI 9?

Order	Answer	Responses	Percent
1		1	100%
	Outcomes of every program should somehow support strategic goals.		
	Total	**1**	**100%**

Category: Investments

KPI 10: Erroneous decisions where EA was a key originator. Cases: Erroneous decisions largely caused by (1) erroneous or (2) unavailable EA information. KPI operationalization: (1) The number of cases, and (2) their impact.

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 10 is clear enough for use in practice.	0 0%	4 67%	2 33%	0 0%	0 0%	6
KPI 10 is useful for measuring EA effectiveness.	1 17%	3 50%	2 33%	0 0%	0 0%	6
Total	**1**	**7**	**4**	**0**	**0**	

Comments on KPI 10?

Order	Answer	Responses	Percent
1		3	100%
	EA principles always guide changes in the right direction. EA principles can be wrong, or can be mis-interpreted. Same can happen in e.g. Infrastructure Management (IM) or Application Management (AM) processes. Is IM or AM less effective if an error occurs?		
	You first need to establish a clear definition of EA Information. Since this is not clear in many organizations it's impossible to ask for the impact of not having it.		
	Not sure if erroneous dicisions can always be traced back to their cause (be it EA or otherwise)		
	Total	**3**	**100%**

KPI 11: Erroneous decisions prevented thanks to EA. Cases: (1) Inefficient or (2) ineffective decisions clearly prevented by EA (e.g. by suggesting better alternatives). KPI operationalization: (1) The number of cases, and (2) their impact.

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 11 is clear enough for use in practice.	1 17%	2 33%	1 17%	2 33%	0 0%	6
KPI 11 is useful for measuring EA effectiveness.	1 17%	2 33%	1 17%	2 33%	0 0%	6
Total	**2**	**4**	**2**	**4**	**0**	

Comments on KPI 11?

Order	Answer	Responses	Percent
1		3	100%
	Same as KPI 10, but inversed.		
	Not measurable and not wise to measure		
	see above		
	Total	**3**	**100%**

Question #45

Category: Program Portfolio

Question #44

Order	Answer	Responses	Percent
	Same as KPI 10, but inversed.		
	Not measurable and not wise to measure		
	see above		
	Total	**3**	**100%**

KPI 12: Stakeholder satisfaction with the scope of the enterprise-wide program portfolio. Question: Does the scope of the enterprise-wide program portfolio [Not at all 1 2 3 4 5 Fully] sufficiently cover stakeholder interests? Ask of: Key stakeholders affected by enterprise-wide programs at enterprise and domain levels. KPI operationalization: The percentage of key stakeholders giving negative ratings. *Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.*

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 12 is clear enough for use in practice.	2 33%	0 0%	1 17%	2 33%	1 17%	6
KPI 12 is useful for measuring EA effectiveness.	0 0%	0 0%	2 33%	4 67%	0 0%	6
Total	**2**	**0**	**3**	**6**	**1**	

KPI 12: Stakeholder satisfaction with the scope of the enterprise-wide program portfolio. Question: Does the scope of the enterprise-wide program portfolio [Not at all 1 2 3 4 5 Fully] sufficiently cover stakeholder interests? Ask of: Key stakeholders affected by enterprise-wide programs at enterprise and domain levels. KPI operationalization: The percentage of key stakeholders giving negative ratings. *Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.*

Comments on KPI 12?

Order	Answer	Responses	Percent
1		1	100%
	The KPI must be clarified.		
	Total	**1**	**100%**

Program Implementation: How does EA affect program implementation?

Comments on KPI 12?

Order	Answer	Responses	Percent
1		1	100%
	The KPI must be clarified.		
	Total	**1**	**100%**

Category: Program Completion

KPI 13: Enterprise-wide programs suffering due to EA-related issues. Cases: Enterprise-wide programs (1) failed, (2) delayed, (3) reworked, or (4) incurring additional costs due to EA-related issues (e.g. integration issues). KPI operationalization: (1) The number of cases, and (2) their impact. *Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.*

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 13 is clear enough for use in practice.	0 0%	1 17%	3 50%	2 33%	0 0%	6
KPI 13 is useful for measuring EA effectiveness.	2 33%	0 0%	3 50%	1 17%	0 0%	6
Total	**2**	**1**	**6**	**3**	**0**	

Comments on KPI 13?

Order	Answer	Responses	Percent
1		3	100%
	EA is there to help Enterprise-wide programs. If programs fail, delay, or ... due to an EA issue, this is always to help the entire organization. So that particular program might have an issue with the delay, but in the end the enterprise has a better result!		
	EA related issues is not concise enough		
	see comment above		
	Total	**3**	**100%**

Category: Speed & Agility

KPI 14: Business stakeholder satisfaction with IT's responsiveness to new requirements. Question: Level of satisfaction [Very dissatisfied 1 2 3 4 5 Very satisfied] with IT's responsiveness to new business demands? Ask of: Key business stakeholders involved in decision making at enterprise level. KPI operationalization: The percentage of key business stakeholders giving negative ratings.

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 14 is clear enough for use in practice.	0 0%	1 17%	2 33%	3 50%	0 0%	6
KPI 14 is useful for measuring EA effectiveness.	0 0%	1 17%	3 50%	2 33%	0 0%	6
Total	**0**	**2**	**5**	**5**	**0**	

Comments on KPI 14?

Order	Answer	Responses	Percent
1		3	100%
	The level of satisfaction will not only be defined by EA but more by the ability to execute (time to market) the change by the IT department.		
	focus and level of interaction of IT organisation itself is not suitable as a measure for effectiveness of EA. IT management is responsible for focus		
	Property of EA only?		
	Total	**3**	**100%**

Category: Risk & Impact

KPI 15: Occurrence of critical to business EA-related incidents during enterprise-wide program implementation. Cases: EA-related incidents that prevent the business from operating during enterprise-wide program implementation. KPI operationalization: (1) The number of cases, and (2) their impact.

Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 15 is clear enough for use in practice.	1 17%	0 0%	3 50%	2 33%	0 0%	6
KPI 15 is useful for measuring EA effectiveness.	2 33%	0 0%	2 33%	2 33%	0 0%	6
Total	**3**	**0**	**5**	**4**	**0**	

Comments on KPI 15?

Order	Answer	Responses	Percent
1		2	100%
	These kind of issues may not occur. During implementation a failure has occured, not during the EA processes.		
	interesting measure but needs to be more concise to work		
	Total	**2**	**100%**

Category: Duplication

KPI 16: Duplication within the enterprise-wide program portfolio. Determine: Number of programs or projects within the enterprise-wide program portfolio aiming for something very similar to other programs, projects, or already existing solutions. KPI operationalization: As a percentage of the total number of programs or projects within the enterprise-wide program portfolio. *Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.*

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 16 is clear enough for use in practice.	0 0%	1 17%	2 33%	3 50%	0 0%	6
KPI 16 is useful for measuring EA effectiveness.	1 17%	1 17%	1 17%	3 50%	0 0%	6
Total	**1**	**2**	**3**	**6**	**0**	

Comments on KPI 16?

Order	Answer	Responses	Percent
1		3	100%
	This one is difficult. As the result of a deviation process, it might be possible projects have some overlap. If there is a valid business case and the EA process has worked (deviation!) this can occur and will not result in ineffective EA.		
	Duplication can be intended. So it's not wise to measure just duplication and make EA accountable for that		
	Pre-condition: Portfolio process should be aligned with EA		
	Total	**3**	**100%**

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 16 is clear enough for use in practice.	0 0%	1 17%	2 33%	3 50%	0 0%	6
KPI 16 is useful for measuring EA effectiveness.	1 17%	1 17%	1 17%	3 50%	0 0%	6

Category: EA Customer

KPI 17: EA's contribution during enterprise-wide program implementation. Question: Does EA [Not at all 1 2 3 4 5 Very much] help the EA customer during enterprise-wide program implementation by (1) facilitating communication, (2) providing insight and oversight, (3) providing input and advice, and (4) providing directions? Ask of: Key stakeholders involved in enterprise-wide program implementation. KPI operationalization: The percentage of key stakeholders giving negative ratings. *Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.*

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 17 is clear enough for use in practice.	0 0%	0 0%	2 33%	3 50%	1 17%	6
KPI 17 is useful for measuring EA effectiveness.	0 0%	0 0%	0 0%	4 67%	2 33%	6
Total	**0**	**0**	**2**	**7**	**3**	

Comments on KPI 17?

Order	Answer	Responses	Percent
1		3	100%
	Almost same as KPI 7?		
	Isn't this 4 questions in stead of 1		
	There's a lot of similarity with an earlier KPI		
	Total	**3**	**100%**

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total

Program Results: What results can be attributed to EA?

Category: Integration

KPI 18: Integration of critical systems with other critical systems. Determine: Number of critical systems insufficiently linked to other critical systems. KPI operationalization: As a percentage of the total number of critical systems. *Critical system = Distinct combination of business, information, applications and infrastructure providing a certain critical service.*

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 18 is clear enough for use in practice.	1 17%	1 17%	0 0%	3 50%	1 17%	6
KPI 18 is useful for measuring EA effectiveness.	1 17%	2 33%	0 0%	3 50%	0 0%	6
Total	**2**	**3**	**0**	**6**	**1**	

Comments on KPI 18?

Order	Answer	Responses	Percent
1		4	100%
	KPI is more risk related		
	More connections would be better? I Would beg to differ. This would hold a strong case against a service bus for example		
	What do you mean by insufficiently linked???		
	Not clear because of lack of definition of critical systems; I fail to see the EA involvement in a lack of connecting critical systems		
	Total	**4**	**100%**

KPI 19: Critical to business processing incidents caused by EA-related errors. Cases:
Critical to business processing incidents caused by EA-related errors (e.g. integration errors). KPI operationalization:
(1) The number of cases, and (2) their impact.

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 19 is clear enough for use in practice.	2 33%	1 17%	3 50%	0 0%	0 0%	6
KPI 19 is useful for measuring EA effectiveness.	2 33%	1 17%	3 50%	0 0%	0 0%	6
Total	**4**	**2**	**6**	**0**	**0**	

Comments on KPI 19?

Order	Answer	Responses	Percent
1		4	100%
	These kind of errors may not occur due to EA.		
	Not concise at all. Also not clear what is meant		
	I think it is hardly possible to create such a link (between business process errors and EA)		
	Maybe not always easy to trace incidents back to EA		
	Total	**4**	**100%**

Category: User Satisfaction with IT

KPI 20: Business stakeholder satisfaction with IT-enabled business capabilities.

Question: Level of satisfaction [Very dissatisfied 1 2 3 4 5 Very satisfied] with IT-enabled business capabilities? Ask of: Key business stakeholders at enterprise and domain levels. KPI operationalization: The percentage of key business stakeholders giving negative ratings.

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 20 is clear enough for use in practice.	1 17%	1 17%	0 0%	4 67%	0 0%	6
KPI 20 is useful for measuring EA effectiveness.	1 17%	3 50%	0 0%	2 33%	0 0%	6
Total	**2**	**4**	**0**	**6**	**0**	

Comments on KPI 20?

Order	Answer	Responses	Percent
1		3	100%
	Is more an IT Service Management related KPI.		
	Outcome is not Always defined by EA		
	Seems more like an overall IT KPI		
	Total	**3**	**100%**

Category: Short-term Solutions

KPI 21: Existence of short-term focused critical systems. Determine: Number of critical systems that are short-term focused (i.e. not in line with longer-term strategic goals). KPI operationalization: As a percentage of the total number of critical systems. *Critical system = Distinct combination of business, information, applications and infrastructure providing a certain critical service.*

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 21 is clear enough for use in practice.	1 17%	1 17%	2 33%	2 33%	0 0%	6
KPI 21 is useful for measuring EA effectiveness.	0 0%	3 50%	2 33%	1 17%	0 0%	6
Total	**1**	**4**	**4**	**3**	**0**	

Comments on KPI 21?

Order	Answer	Responses	Percent
1		3	100%
	This can occur due to the deviation process. If a short-term solution is delivered and implementation of the long term solution is proposed on the portfolio, EA has been very effective.		
	EA can advise to do a short term sollution. Simply because the business value of the solution is short lived as well.		
	If an EA program has just started this may be the case. It does not necessarilly mean the EA fails. Somehow it has to be taken in account since when EA programs exist. If not this would be a KPI/ assessment of the as-is IT landscape		
	Total	**3**	**100%**

Category: Complexity

KPI 22: Critical systems with similar or closely related functionalities. Determine: Number of critical systems providing services similar or closely related to one or more other critical systems. KPI operationalization: As a percentage of the total number of critical systems. *Critical system = Distinct combination of business, information, applications and infrastructure providing a certain critical service.*

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 22 is clear enough for use in practice.	1 17%	1 17%	1 17%	3 50%	0 0%	6
KPI 22 is useful for measuring EA effectiveness.	1 17%	1 17%	1 17%	3 50%	0 0%	6
Total	**2**	**2**	**2**	**6**	**0**	

Comments on KPI 22?

Order	Answer	Responses	Percent
1		3	100%
	Is both an EA and ALM (Application Life cycle Management) KPI.		
	Complexity is something an EA can help to overcome, but he cannot be held accountable for complexity		
	See above		
	Total	**3**	**100%**

KPI 23: Critical systems used by more than one domain. Determine: Number of critical systems used by more than one domain. KPI operationalization: As a percentage of the total number of critical systems.

Critical system = Distinct combination of business, information, applications and infrastructure providing a certain critical service.

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 23 is clear enough for use in practice.	1 17%	1 17%	2 33%	1 17%	1 17%	6
KPI 23 is useful for measuring EA effectiveness.	0 0%	3 50%	2 33%	1 17%	0 0%	6
Total	**1**	**4**	**4**	**2**	**1**	

Comments on KPI 23?

Order	Answer	Responses	Percent
1		4	100%
	Why could a critical system not be used by more than one domain? e.g. ERP (Finance, Logistics) and HR systems will be used by more than one domain.		
	this would render ERP solutions as a bad thing?		
	Why is this bad?		
	See above		
	Total	**4**	**100%**

KPI 24: Diversity among critical systems. Determine: Number of critical systems suffering (1) from version released diversity, or (2) due to the number of vendors. KPI operationalization: As a percentage of the total number of critical systems. *Critical system = Distinct combination of business, information, applications and infrastructure providing a certain critical service.*

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 24 is clear enough for use in practice.	0 0%	1 17%	4 67%	1 17%	0 0%	6
KPI 24 is useful for measuring EA effectiveness.	0 0%	2 33%	2 33%	2 33%	0 0%	6
Total	**0**	**3**	**6**	**3**	**0**	

Comments on KPI 24?

Order	Answer	Responses	Percent
1		3	100%
	Various versions is more an ALM (Application Life cycle Management) issue and I don't see the number of vendors is an EA issue.		
	IT management and ITIL are not EA		
	See above		
	Total	**3**	**100%**

Category: Claims met

KPI 25: Enterprise-wide programs meeting EA-related claimed benefits. Cases: Enterprise-wide programs where EA-related claimed benefits (e.g. reduced IT costs thanks to reuse, delivered functionalities to business) are (1) met, or (2) not met. KPI operationalization: (1) The number of cases, and (2) their impact.

Enterprise-wide program = Program in the interest of the enterprise-wide structures, processes, systems and procedures.

To what extent do you agree or disagree with the following statements?

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 25 is clear enough for use in practice.	1 17%	1 17%	0 0%	4 67%	0 0%	6
KPI 25 is useful for measuring EA effectiveness.	0 0%	0 0%	1 17%	5 83%	0 0%	6
Total	**1**	**1**	**1**	**9**	**0**	

Comments on KPI 25?

Order	Answer	Responses	Percent
1		1	100%
	I think this KPI is difficult to operationalize, but it might help in measuring the EA effectiveness.		
	Total	**1**	**100%**

	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total
KPI 25 is clear enough for use in practice.						
KPI 25 is useful for measuring EA effectiveness.			1 17%	5 83%	0 0%	6

Are there any KPIs you are missing in one of the focus areas?

Order	Answer	Responses	Percent
1		4	100%
	-		
	Contribution to company strategy, external customer satisfaction,		
	More positive KPI's, most of the KPI's have a negative connotation. So what are the goals/ objectives that need the contribution of an EA?		
	No		
	Total	**4**	**100%**

Do you have any general comments?

Order	Answer	Responses	Percent
1		3	100%
	-		
	The number of KPIs should be brought down to a maximum of 10, to enable focussed follow-up. Look at some of the KPIs, if they are really Key, or just supportive of others.		
	I like the areas/topics that are measured by the KPI's. These seem to me the relevant topics for EA.		
	Total	**3**	**100%**

Are there any KPIs you are missing in one of the focus areas?

Order	Answer	Responses	Percent
1		3	100%
	-		
	Contribution to company strategy, external customer satisfaction,		
	More positive KPI's, most of the KPI's have a negative connotation. So what are the goals/ objectives that need the contribution of an EA?		

D.3.3 KPI Modifications

Table D.26: Draft KPIs and their judgement based on the evaluation survey. Transition describes what transformation was applied for the final set of KPIs.

KPI	Reject	Modifications	Explanation
Draft KPI 1	No	Separation of KPIs	Draft KPI 1 was split into two seperate KPIs, one on IT stakeholders' understanding of the business goals and strategy, one on their understanding of IT linkage to business.
Draft KPI 2	No	Separation of KPIs and account for IT landscape	Draft KPI 2 was split into two seperate KPIs (one of them merged with one of the the resulting KPIs from the previous split of KPI 1). Moreover, the KPI needed to account for a general understanding of the IT landscape.
Draft KPI 3	No	-	Only renumbered to KPI 4.
Draft KPI 4	No	-	Only renumbered to KPI 5.
Draft KPI 5	No	Linkage and how EA supports partnerships	How EA supports partnerships with external business partners during the decision-making process was elaborated on. The focus needed to be on providing insight and facilitating communication. Moreover, it is about the way external stakeholders are and can be linked to the enterprise. Also, renumbered to KPI 6
Draft KPI 6	No	-	Only renumbered to KPI 7.
Draft KPI 7	No	-	Only renumbered to KPI 8.
Draft KPI 8	No	-	Only renumbered to KPI 9.
Draft KPI 9	No	-	Only renumbered to KPI 10.
Draft KPI 10	Yes	Taken out	-
Draft KPI 11	No	Theoretical impact	Needed to be about the theoretical impact of decisions.
Draft KPI 12	No	Elaborate on cover and portfolio	Needed to be about whether stakeholder interests are supported, not just covered. Moreover, a very brief elaboration on the programs that are included in the program portfolio was needed.
Draft KPI 13	No	Focus on EA's help	The focus was shifted to the way EA helps complete enterprise-wide programs.
Draft KPI 14	No	Taken out	Not in line with the definition of KPIs for EA effectiveness used in this research.
Draft KPI 15	No	Elaborate on EA related incidents, limit	"Incidents" was changed to issues. An example of an EA-related issue that limits (instead of prevents) ongoing business operations was given. Also, renumbered to KPI 14.
Draft KPI 16	No	Unintentional duplication	Focus needed to be on unintentional duplication as opposed to general duplication within the enterprise-wide program portfolio. Also, renumbered to KPI 15.
Draft KPI 17	No	None	Only renumbered to KPI 16.

Draft KPI 18	No	Elaborate on linkage	Needed to be about whether critical systems are able to adequately communicate. Also, renumbered to KPI 17.
Draft KPI 19	Yes	Taken out	-
Draft KPI 20	No	IT functionality	Needed to be about IT functionality delivered by enterprise-wide programs. Note that the category of which this draft KPI is part also needed to be renamed. Also, renumbered to KPI 18.
Draft KPI 21	No	Emphasize seriousness	EA is about framing and guiding the organization towards achieving longer-term strategic goals. Focus needed to be on short-term solutions posing a serious threat to the achievement of longer-term strategic goals. Also, renumbered to KPI 19.
Draft KPI 22	No	Unintentional duplication and similarity	Although stakeholders did not mention it, it was recognized that it needed to be about unintentional duplication or similarities. Also, renumbered to KPI 20.
Draft KPI 23	No	Change structure	Was renamed to "Reuse of critical systems". Moreover, the operationalization needed to focus on the number of critical systems that are not used by more than one domain. Also, renumbered to KPI 21.
Draft KPI 24	No	Taken out	EA may not need to be concerned with the actual implementation or version numbers.
Draft KPI 25	No	Elaborate on EA-related claimed benefits	A general example of an EA-related claimed benefit was needed. Also, renumbered to KPI 22.

Appendix E

Raw Interview Transcriptions

This part of the appendix is delivered separately.