Measuring the Effectiveness of Enterprise Architecture Implementation

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Thesis submitted in partial fulfillment of the requirement
for the degree of Master of Science in Systems Engineering,
Policy Analysis and Management – Information Architecture

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Executive summary

Enterprise Architecture (EA) is popular as a means among large industrial and governmental organizations to manage IT complexity and deal with the continuous change imposed by their dynamic environments. Despite the large, long-term, investments these EA initiatives bring along, organizations fail in demonstrating the effectiveness of EA. Although several models are available to assess efficiency aspects of EA (e.g. comprehensiveness of the EA and maturity of EA development processes), little guidance in measuring EA on its effectiveness is provided. Effectiveness in this regard is defined as the degree to which the objectives (i.e. the purpose of organizational performance improvement) that organizations have set with EA are being attained. To measure the effectiveness of EA, organizations require to (1) isolate the effect of EA, (2) operationalize (qualitatively or quantitatively) the objectives of EA, and (3) assign weights to stakeholder groups when aggregating perceptions among different organizational levels. Unfortunately organizations often fail to fulfill these requirements. This thesis provides a foundation to measure the effectiveness of EA, by operationalizing its typical main objectives, business-IT alignment and enterprise agility. Based on a case study at a large financial services provider, the operationalization seems promising as a starting point for measuring, and providing recommendations concerning, the effectiveness of EA.

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This thesis has been submitted in partial fulfillment of the requirement for the degree of Master of Science in Systems Engineering, Policy Analysis and Management, with Information Architecture as specialization profile. This is an interfaculty master combining courses from both the faculty of Technology, Policy and Management and the faculty of Computer Science, both of the Delft University of Technology. The research has been commissioned by Capgemini The Netherlands B.V., due to Capgemini's interest in demonstrating the value architecture to its clients.

Based on this thesis, a scientific article has been written in collaboration with Bas van der Raadt, my supervisor at Capgemini. This paper has been submitted to the 21st International Conference on Advanced Information Systems, to be held in Amsterdam, June 2009. Acceptance notification is due in February 2009.

This graduation research has been a joyful and valuable experience for me. I would like to thank my graduation committee at the TU Delft: Harry Bouwman, Mark de Bruijn en Jan van den Berg. The insights and expertise of Harry Bouwman concerning architecture, business-IT alignment, and research methodologies proved very valuable. Jan van den Berg and Mark de Bruijne frequently provided great tips on improving both the research and thesis. Their positive attitude really helped me forward. I would also like to thank my supervisor at Capgemini, Bas van der Raadt. Bas van der Raadt has always been closely involved during the entire research. The frequent meetings and interesting conversations, on top of his efforts to arrange meetings and provide contact information, have been indispensable for this research. It has been a pleasant collaboration.

I would like to thank Johan Hoorn, who helped in providing a foundation for defining and splitting the alignment and agility constructs. I thank all interviewees for their participation, both from Capgemini and the financial services company at which I performed the case study. I am grateful for the facilities Capgemini has provided. The working environment was very pleasant and I appreciate the support I received from all fellow graduates at Capgemini FS. All in all it was a great experience with a steep learning curve. Finally, I would like to thank my parents who enabled, supported and stimulated my education. And of course my friends who definitely helped me take my mind off things once in a while.

The Hague, February 2009

Marc Bonnet

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List of abbreviations

BITA	-	Business and IT Alignment
BO	-	Back Office
LoB	-	Line of Business
CAO	-	Chief Architecture Officer
CEO	-	Chief Executive Officer
CFO	-	Chief Financial Officer
CIO	-	Chief Information Officer
CTO	-	Chief Technology Officer
EA	-	Enterprise Architecture
EAF	-	Enterprise Architecture Framework
EITA	-	Enterprise IT Architecture
FO	-	Front Office
IT	-	Information Technology
KPI	-	Key Performance Indicator
MO	-	Mid Office
MTTR	-	Mean Time To Repair
MTBF	-	Mean Time Between Failures
NAOMI	-	Normalized Architecture Organization Maturity Index
PID	-	Project Initiation Document
QA	-	Quality Assurance
RfC	-	Request for Change
SOA	-	Service Oriented Architecture
STP	-	Straight Through Processing

1. Introduction

1.1 Background

Many large organizations, industrial and governmental, operate in highly dynamic environments driven by regulatory changes, technical innovations, demanding customers, and aggressive competitors within a globalizing market place. In order to adapt to these external changes, these organizations require to swiftly change their business strategy and stay agile. However, these strategic changes have to be implemented in the business model, operational processes, and IT systems accordingly for an organization to become effective, with which many organizations have great difficulties (Bouwman and Versteeg, 2006).

Enterprise Architecture (EA) can be used as a means to design the required organizational changes based on its business strategy, and to implement these changes across the operational structures, processes and systems of the organization's business and IT domains (Ross et al., 2006). Architecture can be defined as the fundamental organization of a system embodied by its components, their relationships to each other and the environment, and the principles guiding its design and evolution (Maier et al., 2001). EA, in turn, can therefore be defined as the fundamental organization of *the enterprise* embodied by its components, their relationships to each other and the environment, and the principles guiding its design and evolution.

Despite the need EA promises to fulfill, an Infosys survey (Infosys, 2007) held among Infosys customers in 2007 showed that industrial organizations have difficulty collecting measurement data to prove the value of EA: only 24% of 262 respondents (IT-decision-makers and Enterprise Architects of mainly large end-user organizations with 1000 to 50,000 employees) claimed to measure the benefit generated for business and IT by means of value-oriented metrics, while 44% claimed not to have any metrics in place at all. Furthermore, a 2006 survey (Christiansen and Gøtze, 2006) among representatives of governmental agencies of 16 countries showed that only 55% of these governmental agencies was able to report achieved goals (e.g. the number of platforms and systems has been reduced) as a result of EA. Moreover, 70% of the respondents indicated not to have operationalized (i.e. in terms of measurement unit and target value) goals in place (e.g. 65% of the public services channeled via the internet). Apparently large industrial and governmental organizations have great difficulty to measure the effectiveness of their EA, while evaluating results is a seemingly common activity of any major project requiring a significant amount of time and money, of which an EA initiative is an example (Morganwalp and Sage, 2004).

In this context, EA effectiveness can be defined as the degree to which the objectives of EA are being attained (Morganwalp and Sage, 2004); a common perspective on the effectiveness of organizations (Cameron, 1986). However, organizations must be able to demonstrate that the objectives are being attained by means of EA (i.e. trace outcomes back to EA). A better definition of EA effectiveness would therefore be: the degree to which the objectives of EA are being attained *by means of EA.*

We expect having knowledge about the effectiveness of EA will help organizations to refrain from their EA suffering from a possible 'ivory tower syndrome' (Wagter et al., 2005) by providing input for EA improvement (e.g. when the EA is not effective, organizations may acknowledge principles need to be updated according to new developments). This way, EA becoming shelf-ware (Boster et al., 2000) can be prohibited. Furthermore, knowledge on effectiveness may facilitate an iterative development approach, which is considered key to architecting by (Amour et al., 1999).

1.2 Problem definition

1.2.1 Problem definition

The problem is twofold. First, it is a general problem for organizations not being able to measure the effectiveness of EA. Second, there is very little guidance on the measurement of EA effectiveness available (Kaisler et al., 2005), since most models available focus on efficiency elements (e.g. comprehensiveness of the EA and maturity of EA development processes) of EA as a discipline (Campbell et al., 2007, Schekkerman, 2006, van der Loo, 2007, Slot, 2000, METAgroup, 2000, Hite et al., 2003, NASCIO, 2003, van den Bent, 2006, Veltman - Van Reekum, 2006).

1.2.2 Further problem exploration

To further investigate the context of the problem, six interviews have been held with experienced Capgemini architects (4) and assessors (2) to further explore the problem[1]. In total, 6 interviews varying in duration from one hour to one hour and a half were held. See Table 1 for interviewee details. The interviewees have been selected based on certification (3) or by recommendation (3). More information on Capgemini's criteria of different architect certification levels is provided in Appendix H.

Table 1. Capgemini interviewees

Certification or other selection criterion	Date	Time
Level 4 certified architect	23-04-2008	12:00 – 13:00
Business/Information architect; Business Analyst	20-05-2008	13:30 – 15:00
Level 4 certified architect	21-05-2008	11:00 – 12:00
Level 1 certified architect; Assessor	23-05-2008	09:00 – 10:00
Author of thesis on stakeholder perception of architecture	04-06-2008	09:00 – 10:30
SOA architect & expert group leader (SOA)	29-05-2008	11:00 – 12:00

The interviews were semi-structured, meaning some main questions where formulated up-front, guiding the direction of the interview but not restricting it. The questions generally addressed the following topics: (1) typical objectives of EA as encountered at client organizations, and (2) measurement of those objectives and corresponding problems. A short introduction on this research had been e-mailed to the interviewee in advance. To check for reliability, interview reports have been sent to the interviewees after the interview to provide the interviewees the possibility of making alterations to their answers and/or confirm the content of the report (data triangulation (Denzin, 1978)).

From the interviews with experienced Capgemini assessors and architects, several general issues concerning the measurement of the effectiveness of EA, as encountered at various clients of Capgemini, were identified: (1) the effectiveness of EA is rarely assessed, (2) various types of organizations have different objectives, (3) EA has both tangible and intangible value, (4) measurement data concerning EA often does not exist within the organization, or it is very time-consuming to extract, (5) Different stakeholders have different perceptions of EA, (6) assessing the effectiveness based on perceptions is a multi-level problem (i.e. perceptions of different organizational levels should be weighted preceding aggregation), (7) most organizations do not have clear objectives for EA formulated up-front, (8) organizations have difficulty to isolate the effect of EA, (9) objectives of EA change during the implementation path, (10) most employees do not know about architecture, (11) several initiatives contribute to the attainment of strategic goals, of which EA is only one, and (12) current research on objectives is too abstract. This

[1] Findings have also been used in a later stage of this research to provide an early indication of the broader meaning of case study findings.

research takes the issues into account. The most relevant quotes to support these issues are included in Appendix D.

1.3 Research objective

The objective of the research depicted in this thesis is to provide a foundation, in the form of an initial conceptual model and an initial measurement model, for measuring the effectiveness of EA.

1.4 Research scope

This research focuses on the effectiveness (i.e. goal-attainment) of implementing the EA (see Section 1.4.1), financial services providers (see Section 1.4.2). Furthermore, this research only provides an early foundation for the development of a generically applicable instrument to measure the effectiveness of EA (see Section 1.4.3).

1.4.1 Effectiveness of implementing EA

In section 1.1 we defined EA as the fundamental organization of *the enterprise* embodied by its components, their relationships to each other and the environment (i.e. the AS-IS EA; current description of the enterprise), and the principles guiding its design and evolution (leading to the TO-BE architecture; the desired future state of the enterprise). However, EA as a management discipline (van den Berg and Van Steenbergen, 2004) comprises more than delivering architectural products (i.e. the EA, and corresponding EA governance policy and EA roadmap). Van der Raadt and Van Vliet (van der Raadt and van Vliet, 2008) therefore speak of an EA function, which they define as "the organizational functions, roles and bodies involved with creating, maintaining, ratifying, enforcing, and observing Enterprise Architecture decision-making – established in EA products – interacting through formal (governance) and informal (collaboration) processes at enterprise, domain, project, and operational levels" (van der Raadt and van Vliet, 2008). EA thus involves people (e.g. architects and system developers (Amour et al., 1999)) who operate according to specific processes (i.e. architecting and implementation processes (Amour and Kaisler, 2001)) to create, maintain and implement EA products (e.g. the EA document, EA governance policy and EA implementation roadmap (Amour and Kaisler, 2001, van der Raadt and van Vliet, 2008)), with the purpose of delivering the intended results (Boster et al., 2000, van den Berg and Van Steenbergen, 2004). A simplified visual representation of EA aspects and how it contributes to the attainment of its objectives is depicted in Figure 1. A more detailed description of EA, its aspects and how it contributes to the attainment of objectives is provided in Chapter 3.

!	**IMPORTANT:** In this thesis we speak of '*the* EA' when indicating the AS-IS and TO-BE enterprise architecture document (including the principles guiding the transition between them) as defined in Section 1.1, while we speak of 'EA' to indicate all aspects of EA within an organization (i.e. EA as a management discipline). More information on these aspects is depicted in Chapter 3.

This research focuses on the effectiveness (i.e. goal-attainment) of the EA implementation (see Figure 1). In other words, the focus is on the effectiveness of working under architecture (i.e. whether EA compliant projects yield the intended results). The effectiveness of architecting (i.e. whether architects deliver comprehensive products) or the efficiency of the implementation process (i.e. whether project designs are conform the EA; the effectiveness of the EA governance policy) are beyond the scope of this research, since several assessment models already address those, what we consider EA efficiency areas, as discussed in Section 1.2. A detailed conceptualization of the research scope is depicted in Chapter 3.

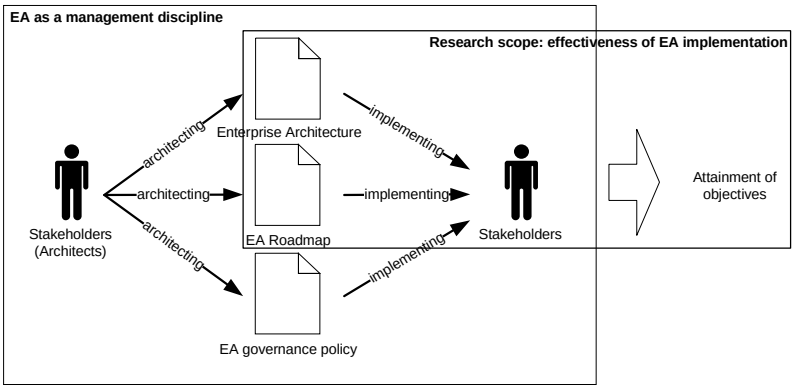

Figure 1. Simplified representation of EA and research scope

1.4.2 Financial services industry

Despite the potential general relevance, this research focuses on large (>1000 employees) financial services organizations, due to the case study context (i.e. a large financial services provider).

1.4.3 Non-financial evaluation

This research does not focus on the financial benefits of EA, since we have reason to believe EA cannot be cost-justified (Zachman, 2001). Furthermore, there are quite some disadvantages to traditional financial methods to evaluate EA (Hoffmann, 2007).

1.4.4 Foundation

This research provides an early foundation (i.e. initial conceptual and measurement model) for the development of an instrument to measure the effectiveness of the EA function, based on qualitative research at a single company. An indication of relevant objectives at financial services providers is provided. Furthermore, several challenges have been identified for this company to overcome, in order to measure the effectiveness of the EA function. However, the purpose of this research is not to provide a generically applicable, validated instrument; to accomplish that, more case studies have to be performed and statistical analysis of a much larger sample is necessary.

1.5 Research questions

The main research question and corresponding sub-questions, following from the problem definition and research objective, can be formulated as:

Main research question
How to measure the effectiveness of EA implementation?

Sub questions
1. What does EA, as a management discipline, entail?
A detailed description of the typical EA processes and products, is provided.

2. How does EA contribute to the attainment of its objectives?
A detailed description of how typical EA processes and products contribute to the attainment of EA objectives is provided, in order to come to a conceptual model.

3. What are the main objectives of EA implementation?
An overview of the typical objectives of EA is provided.

4. How can the main objectives be measured (i.e. operationalized)?
The objectives are decomposed into dimensions and potential indicators.

5. To what extent does the operationalization match (case-specific) reality?
An indication of the relevance of indicators and dimensions is provided by conducting a case-study at a large financial services provider.

6. How do these findings lead to recommendations for the case-study organization?
The operationalization is assessed for its usefulness in guiding the organization in question to measure the effectiveness of its EA implementation.

1.6 Research methodology & thesis structure

This thesis consists of four main parts, each describing a crucial research phase depicted in several chapters. The main research phases are illustrated in Figure 2. The conceptualization phase is essential to gain an understanding of the main concepts discussed and investigated in this research. A measurement model/instrument is designed based on these concepts and applied in a case study to come to a scientifically sound (i.e. in terms of validity and reliability) conclusion. Figure 3 depicts which research questions are addressed per chapter

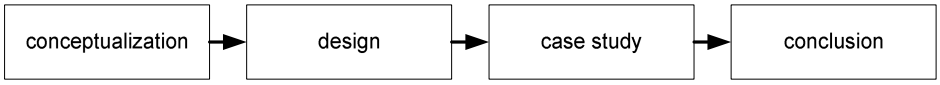

Figure 2. Main research phases

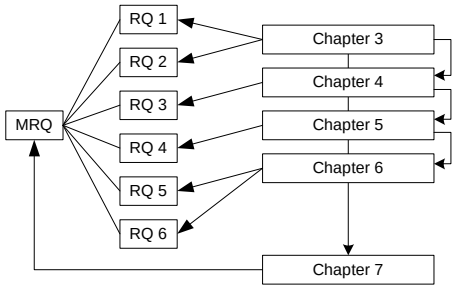

Figure 3. Link between research questions and chapters

1.6.1 Conceptualization of EA effectiveness

Based on a literature study, addressing established and relevant sources in the field of EA, the main concepts used in this research are described. First the value-creation process of EA is described (Chapter 3). Subsequently, the main objectives of EA are identified and defined, leading to the conceptual model of EA effectiveness (Chapter 4).

1.6.2 Design of measurement model

Based on the conceptualization depicted in part I, a measurement model has been designed (Chapter 5). The model combines the operationalizations of both agility and alignment in terms of dimensions and corresponding indicators. The operationalizations are based upon the widely

accepted business-IT alignment model of Luftman (Luftman, 2000) and a review of agility attributes by Sherehiy et al. (Sherehiy et al., 2007).

1.6.3 Case study

A case study has been performed to determine the fit of the conceptual and measurement model with the organization-specific context (Chapter 6). Interviews have been conducted with respondents, which are responsible for the EA program (i.e. the design of EA products and EA implementation). Based on their functional roles concerning EA, the respondents are considered representative for the authorized decision-makers of the EA program within the organization. Furthermore, the interviews were semi-structured (only certain themes were put forward by the interviewer, and the interview was prohibited from getting off-track), minimizing the influence of the interviewer. Interview reports have been sent afterwards to the interviewees for confirmation. Therefore the findings are assumed to be reliable. Furthermore, external (Capgemini) consultants involved with the development and implementation of the EA products have been interviewed. To test the validity of the interview findings, the triangulation approach has been applied; additional documents concerning EA within the organization have been analyzed. To test for possible external validity of case study findings, external consultants *not* involved with the development and implementation of EA at FinaCom, but experienced with other EA implementations, have been interviewed. The latter group may not be considered representative considering the consultants were all Capgemini employees and may employ a common frame of reference, but may provide an indication for external validity nonetheless (among Capgemini clients at least). Interview findings have been cross-validated with internal Capgemini documents.

This research approach thus only provides an exploration of the potential validity of the model. The usefulness (i.e. does the model help in formulating recommendations) is evaluated by the author subjectively.

1.6.4 Conclusion

In Chapter 7, based on the findings in chapters 3 to 6, a general conclusion is drawn, answering the main research question. Furthermore the limitations of this research and recommendations for future research are described.

1.7 Related work

Morganwalp and Sage (2004) summarized several author's perspectives on how to measure the effectiveness of EA (in terms of objectives or metrics). Based on the three measurement dimensions and corresponding benefits of (Buchanan, 2001), Morganwalp and Sage formulated 12 qualitative objectives, with 58 corresponding indicators, to be attained by any EA framework and architecture development process. 11 of 12 objectives (47 of 58 indicators) appeared to be positively influenced by the EA framework (EAF) and development process. Our research focuses on the effect of EA implementation, instead of the EA framework (EAF) and development process (although Morganwalp and Sage argue that a high quality EAF leads to a high quality EA).

2. Reading guide

Based on the structure of this thesis (Figure 4) and the research approach…

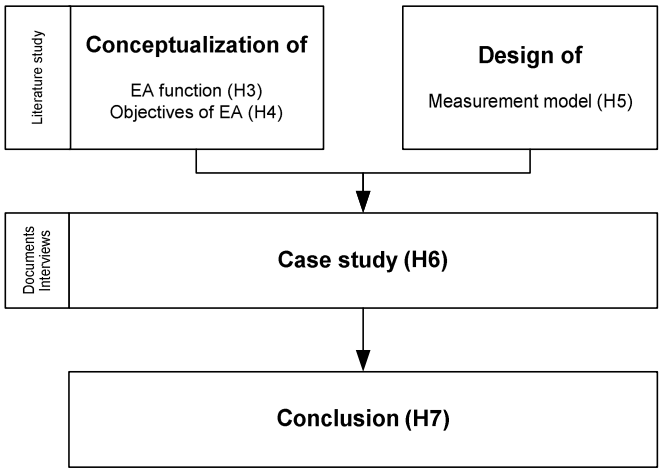

Figure 4. Thesis structure

you should read…

… Summary if you are interested in a short summary of the research and its outcomes.
… Chapter 1, if you are interested in the research background and approach.
… Chapter 2, if you are interested in knowing what to read according to your interests.
… Chapter 3, if you are interested in what EA entails.
… Chapter 4, if you are interested in the main objectives of EA.
… Chapter 5, if you are interested in the design of the measurement model.
… Chapter 6, if you are interested in the case study, testing the models.
… Chapter 7, if you are interested in the general conclusion.

PART I: CONCEPTUALIZATION

3. EA as a management discipline

EA promises to fulfill the growing need to manage increasing complexity and deal with continuous change by providing a holistic view on the enterprise. EA is often viewed as a management practice that aims at improving the performance of enterprises (de Vries and van Rensburg, 2008).

A large variety of EA definitions exists (Bharosa, 2006), showing both differences and similarities. An overview of EA definitions is provided in Appendix A. Consensus on the definition of EA is still lacking (Schekkerman, 2004). Rood (Rood, 1994) already pointed out this issue in 1994. Apparently, after more than a decade, the EA community still has not reached agreement on a single definition (and description) of EA. It is not the purpose of this research to redefine EA or specifically choose or reformulate an existing definition. However, EA encompasses more than most definitions are able to clarify; EA is more than just a documentation method, although it is often perceived as such (Bernard, 2005). Therefore this chapter describes the typical aspects of EA as a management discipline.

Van der Raadt and van Vliet (van der Raadt and van Vliet, 2008) provide a detailed description of what they call the EA function and define it as: *"The organizational functions, roles and bodies involved with creating, maintaining, ratifying, enforcing, and observing Enterprise Architecture decision-making – established in EA products – interacting through formal (governance) and informal (collaboration) processes at enterprise, domain, project, and operational levels"* (van der Raadt and van Vliet, 2008). (Boster et al., 2000) and (van den Berg and Van Steenbergen, 2004) acknowledge similar components – people, processes, products – of the EA discipline. See Figure 5.

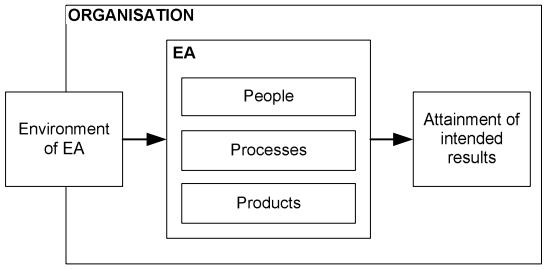

Figure 5. EA embedded in an organization

This chapter explains what EA, as a management discipline, typically encompasses in detail and what processes are generally being employed to achieve the intended results of EA. Section 3.1 describes the typical EA products. Section 3.2 describes the processes and corresponding stakeholder responsibilities of EA, adapted from (van der Raadt and van Vliet, 2008). Section 3.3 describes the environment of EA. Section 3.4 concludes with a conceptual model of EA.

3.1 EA Products

The key EA products are: (1) architectures (e.g., the EA), (2) the EA governance policy and (3) the EA roadmap (Ross et al., 1996, Amour et al., 1999). They typically describe the architectural decisions taken, and provide a means for communicating and enforcing these decisions throughout the organization respectively (van der Raadt et al., 2004). An *architecture* document typically describes a blueprint (Smolander and Päivärinta, 2002) for the fundamental organization of a system (i.e., enterprise, domain, or solution) embodied by its components, their relationships to each other and the environment, and the principles guiding its design and evolution (Maier, 2001). The EA thus consists of a description of the current (AS-IS) and desired future state (TO-BE) of the organization. Principles, as discussed earlier, consist of standards, rules, patterns and/or guidelines (Rijsenbrij et al., 2002). An architecture document may cover one or a combination of 6 areas of concern: Business, Information, Information Systems, Technical Infrastructure, Security and Governance (Capgemini, 2007). In the EA all these areas are represented, preferably. However, another decomposition of areas of concern may be attained. An *EA policy* prescribes the procedures which enable the enforcement of architectural compliance (Leganza, 2003). Enforcing projects to work under architecture allows organizations to centrally control the change activities of subunits without dictating exactly how they handle the details (Boh and Yellin, 2001). EA products may also include a *transition plan* or *roadmap* (Kaisler et al., 2005, Amour et al., 1999) to guide the organization in addressing specific aspects and specifying targets during the transition patch from the AS-IS to the TO-BE architecture

3.2 EA processes & stakeholder responsibilities

EA comprises three different types of interrelated processes: (1) EA decision-making processes, (2) architecting processes, and (3) EA implementation processes; adapted from (van der Raadt and van Vliet, 2008), who speak of the decision-making, delivery and conformance sub-functions respectively. Quality EA decision-making is assumed to lead to high quality EA implementation (e.g. formally approved EA products gain EA stakeholder commitment) and EA architecting (e.g. EA decision-making resolves EA development conflicts), and high quality EA products (e.g. new EA products are approved by the EA decision-making authority). High quality EA architecting is assumed to lead to high quality EA products (e.g. architecting skills concerning standard selection), EA implementation processes (e.g. support of architects increases understandability of EA products), and decision-making (e.g. architects have an advisory role towards the decision-making authority). High quality EA products are assumed to lead to high quality EA implementation processes (e.g. the EA governance policy enables enforcement of EA compliancy), and to organizational performance improvement (e.g. performance improvement depends on the quality of principles). High quality EA implementation is assumed to lead to organizational performance improvement (e.g. when all projects are compliant with the EA, the effect of EA is maximized) and architecting. Sections 3.2.1, 3.2.2 and 3.2.3 describe these types of process in more detail. See Figure 7 for the conceptual model and Figure 8 for the conceptual model with the EA products decomposed, according to the description of Section 3.1.

3.2.1 EA decision-making

EA decision-making comprises *the people and processes responsible for the formal approval of new EA products, changes to existing EA products and handling issues of projects that are not compliant with the EA.* According to (van der Raadt and van Vliet, 2008) the accountability of EA decision making is typically assigned to senior management on enterprise level, but may be delegated to a decision-making body (e.g., EA council) with representatives from the Lines of Business (LoBs) – or business segments/domains – within the organization (see Table 2). EA decision-making also includes resolving conflicts between the various functions, bodies and roles involved with EA, and handling issues of non-conformance (van der Raadt and van Vliet, 2008).

3.2.2 Architecting

Architecting entails *the people and processes responsible for creating and maintaining EA products, and providing advice to guide EA decision making and implementation* (van der Raadt and van Vliet, 2008). These people are typically architects, which are often organized in an EA department or community within the organization (van der Raadt et al., 2007, Wagter et al., 2005, van der Raadt and van Vliet, 2008). However, architects are also responsible for checking projects and operational changes on their conformance to the EA, and providing support to EA stakeholders (see Table 2) in applying EA products. This also involves communicating the value of EA to the sponsor and stakeholders of the EA function (Strano and Rehmani, 2007).

Architects can be operating within a specific area of concern (e.g. business, information, application, technology, security or governance areas) or enterprise architects, aggregating architectures focusing on a specific area of concern to form the holistic EA. Architects of the first category operate on various organizational levels: enterprise, domain/segment or project/solution level (Federal Enterprise Architecture Program Management Office, 2006). Architects on all levels need to collaborate formally and informally to come to the EA products. The enterprise architect thus has to communicate with architects on all levels and EA stakeholders like upper management (e.g. CIO or CEO) and project management (Handler, 2008).

Architects operate according to certain *architecting* processes. Most of these processes are best practices and methodologies according to which either the organization itself and/or a third party whishes to operate in order to develop comprehensive EA products. Often, the architectural development is supported by Enterprise Architecture Frameworks (EAFs). EAFs delineate the decomposition of areas of concern, views on those areas, artifacts, etc. Some EAFs even delineate a specific methodology, like TOGAF 8[2] for instance. Organizations may also create and use their own framework.

The EA products may be created from a top-down approach – the EA is created first, based directly on the organizational strategy, from which segment and solution architectures are derived – or a bottom-up approach – organizational outcomes are traced back to business and IT issues, which are in turn traced back to the business or IT design (reverse engineering); solutions for the design problems are incorporated in the new solution architectures, then providing input for segment architectures, which are aggregated into the EA. It is common to have a combination of both approaches (Federal Enterprise Architecture Program Management Office, 2006, van der Raadt and van Vliet, 2008). See Figure 6.

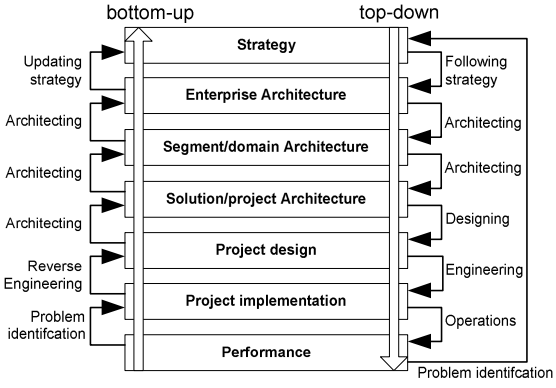

Figure 6. Bottom-up and top-down approach of architecting

[2] http://www.opengroup.com/togaf

3.2.3 EA implementation

The EA stakeholders responsible for running change projects and implementing operational changes carry out the *EA implementation*¸ which entails the *people and processes responsible for implementing the EA products.* The EA stakeholders involved with EA implementation are responsible for implementing organizational changes conform the enforced EA products. EA implementation also includes providing feedback on the practical applicability of the EA products to the architects by suggesting changes and improvements (van der Raadt and van Vliet, 2008). Employees are considered stakeholders of EA when they are actively involved with realizing intended outcomes of EA (either by providing input or by working under architecture, directly or indirectly). However, which EA stakeholder groups are relevant depends on the scope of the EA function (i.e. which elements of the organization the EA products address). An overview of typical stakeholder roles is provided in Table 2, in which the rows represent the organizational level and columns represent the areas of concern. Architects are omitted in this overview, because they have multiple responsibilities on multiple domains and organizational levels. Architects also have the responsibility during the implementation process to pro-actively support the EA stakeholders in dealing with change.

Table 2. Possible EA stakeholder roles (van der Raadt et al., 2008)

	Business	Information	Application	Technology
Enterprise	- CEO - CFO - COO	- CIO - CAO	- CIO - CAO	- CTO - CAO
Segment/domain	- Head of BU - Business change manager	- DIO - IT change manager	- DIO - IT change manager	- Platform manager - Platform subject matter expert
Solution/project	- Business project manager - Business process designer	- Information analyst	- Software development project manager - Software designer	- Infrastructure project manager - Infrastructure engineer
Operational	- Operational business manager - Business process engineer	- Data administrator	- Application management - Application administrator	- Data center management - Infrastructure administrator

3.3 EA environment

The EA *environment* consists of an environment within organizational boundaries (e.g. the organizational processes) and beyond organizational boundaries (e.g. competitors), providing input for the architects to develop the EA products (Lankhorst, 2005). Change can be initiated by internal issues within the organization (process improvement) or by external developments outside the organization, such as market changes, regulatory changes (e.g. US Clinger-Cohen Act of 1996) and/or technological innovations (van der Raadt and van Vliet, 2008, Lankhorst, 2005). The internal environment may impose specific requirements of the EA in terms of existing governance structures, best practices and methodologies; the architect has to decide on referring to these existing elements in the EA or devising new ones.

3.4 Conclusion

EA comprises architecting processes, implementation processes, decision-making processes, architects and other stakeholders, and EA products in terms of the EA, the EA governance policy and the EA roadmap. This research focuses on the effect of EA on the organizational performance and by analyzing the aspects of EA, only the EA products and implementation processes are assumed to ultimately determine the influence on the organizational performance and thus the attainment of the objectives of EA. An initial conceptual model of EA effectiveness is provided in Figure 9.

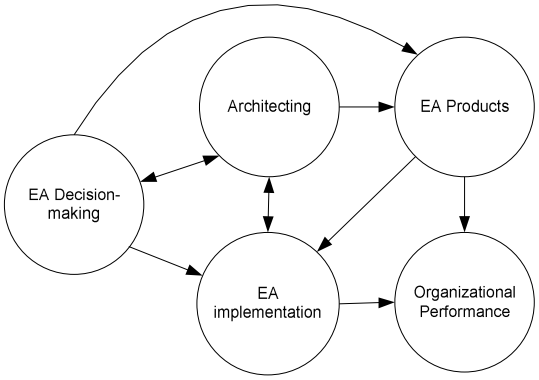

Figure 7. Conceptual model EA value creation

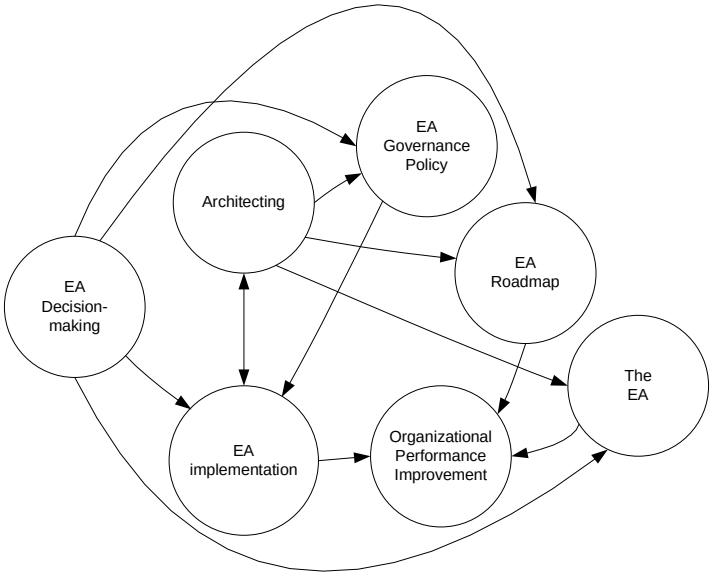

Figure 8. Conceptual model EA value creation with EA products decomposed

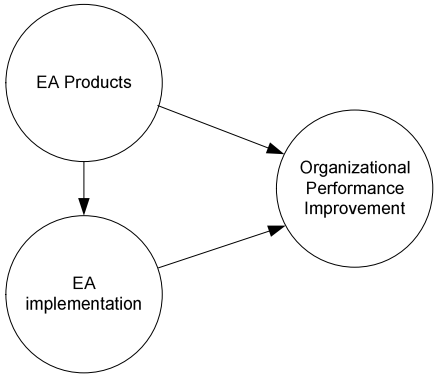

Figure 9. First conceptual model of EA effectiveness

4. Objectives of EA

This chapter describes the main objectives of EA (i.e. the impact of the EA), based on a literature study. The purpose is to come to a refined conceptual model, with organizational performance improvement (see Figure 9) decomposed into the main objectives to be attained.

4.1 Listing typical objectives

4.1.1 Sources

Objectives have been extracted from scientific articles and books (Veasy, 2001, Johnson et al., 2004, Zachman, 2001, Wegmann, 2002, Hoogervorst, 2004, van den Berg and Hoogervorst, 2004, Ross et al., 2006), surveys (Schekkerman, 2005, Christiansen and Gøtze, 2006, Infosys, 2005, Infosys, 2007), whitepapers from three consultancy agencies (Capgemini, 2007, Metastorm, 2007, Sullivan, 2004, Ryan et al., 2005, IBM, 2004) and one governmental architecture advisory committee (Ryan et al., 2005), and several reports from specific EA engagements (Pichereau and Larimer, 2003, van den Berg and Hoogervorst, 2004, Hain, 2002). The objectives have been included in a Long List of (131) possible EA objectives (see Appendix B).

4.1.2 Observations

Three observations have been made while analyzing these objectives: 1) mostly, objectives are not defined or elaborated on, 2) if they are, a lot of inconsistencies exist between definitions among authors (e.g. alignment and integration are often considered the same concepts), and 3) objectives are not structured in any way; it is unclear whether there is any hierarchy in the objectives (i.e. the attainment of one objective will increase the attainment of another).

4.2 Grouping of objectives

Because of these observations, the potential objectives have been grouped into a smaller number of objectives (which are based on the occurrence and terminology of the objectives in the Long List) by interpretation of the author, to create order in the objectives. However, some objectives could not be grouped without providing clear definitions of the objectives. These objectives and definitions are provided in Table 3. The grouping resulted in 14 objectives (see Table 4 for the objectives ranked on number of occurrences in the sources mentioned in section 4.1.1). Apparently some objectives (as defined in Table 3) are mentioned in terms of various similar objectives in the same source, leading to a higher occurrence score (e.g. alignment is mentioned 41 times in 20 sources; an average of being mentioned twice in every source). We did not correct the occurrence scores for this phenomenon, since we believe it still reflects the importance of the objective.

4.3 Overview of EA objectives

An overview of the goals and their relationships to each other is provided in Figure 10 on page 25. The arrows in the diagram indicate a means-end relationship, based on the analysis described in Sections 4.3.1, 4.3.2 and 4.3.3. The number left to the comma indicates the number of times the objective has been mentioned in the sources discussed in the previous sections. The number to the right of the comma indicates the number of incoming arrows (i.e. the extent to which the objective is an end-objective, relative to the other objectives). The diagram is completely based on the objectives mentioned in the sources analyzed. However, it could be drastically extended with a large variety of other objectives (e.g. componentization could be a means for re-use), when

individual goal concepts would be analyzed to their full extent. This is beyond the purpose of this overview though and would lead to a chaotic and cluttered diagram.

Table 3. Definitions of objectives

Objective	Definition
Alignment	The strategic fit between strategy and operations, and functional integration of business and IT (Henderson and Venkatraman, 1999), extended to partners (e.g. external suppliers or other lines of business within the organization) (Luftman et al., 1993).
Agility	The ability to sense environmental change and respond appriopriately (Overby et al., 2005)
Improved understanding	Grasping what the relevant elements of the enterprise are, how they interrelate and what potential consequences are in a specific context. Risk reduction is considered a part of understanding since understanding increases the certainty about the hazard and probability (Chicken and Posner, 1999) and can therefore be avoided.
Quality	Degree to which a set of inherent characteristics (of products, services and IT systems) fulfills requirements (TC 176/SC, 2005).
Integration	Enterprise Application Integration: The unrestricted sharing of data and business processes among any connected application or data sources in the enterprise (Gartner, 2001).
Interoperability	The capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units (ISO, 2003).
Corporate governance	Corporate governance refers to that blend of law, regulation and appropriate voluntary private sector practices which enable the corporation to attract financial and human capital, perform efficiently, and thereby perpetuate itself by generating long-term economic value for its shareholders, while respecting the interests of stakeholders and society as a whole (Worldbank.org)
Efficiency	Input/output (e.g. costs versus revenue) ratio
Complexity reduction	Reduction of the complication of a system or system component, determined by such factors as the number and intricacy of interfaces, the number and intricacy of conditional branches, the degree of nesting, and the types of data structures (Evans and Marciniak, 1987).

Table 4. Objectives and number of occurrences in 20 sources

Objective	Number of occurrences	Objective	Number of occurrences
Alignment	41	Knowledge sharing	10
Agility	27	Re-use	4
Improved understanding	27	Complexity reduction	4
Quality	21	Corporate governance	3
Integration	19	Operational efficiency	3
Cost reduction	10	Resource management	2
Reduction of TTM	10	Prioritization	2

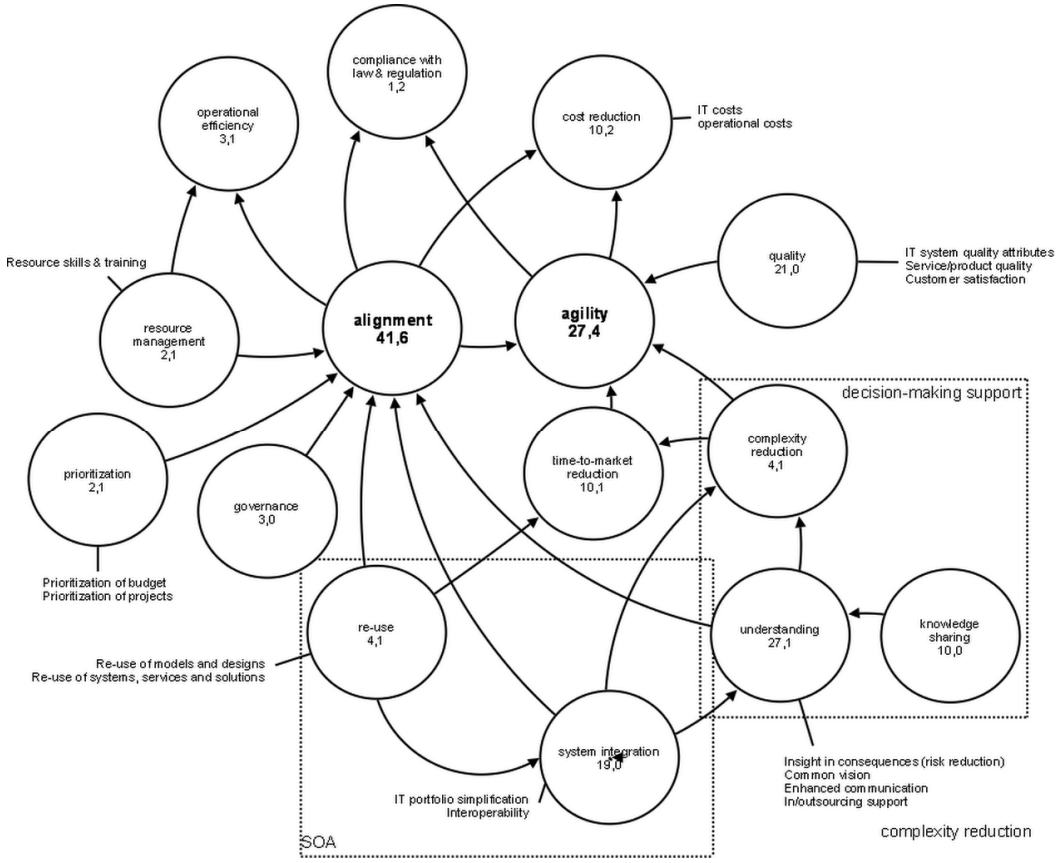

Figure 10. Overview of objectives and relationships

Dotted-line rectangles clarify several concepts, not included as specific objectives, but as a combination of objectives. Decision-making support is described in Section 4.3.1 and Service Oriented Architecture (SOA) is described in Section 4.3.2. The relationship between alignment and agility is described in Section 4.3.3. All other relationships between the objectives in this overview are described in Section 4.3.4.

4.3.1 Decision-making support

Many sources mention decision-making support as a goal of EA. However, decision-making support is a fairly abstract notion. According to Hubbard (Hubbard, 2007), information (knowledge sharing) reduces uncertainty and consequently uncertainty reduction improves decision-making. In turn, improved decision-making will lead to risk reduction. Risk can generally be defined as hazard multiplied by exposure, in which hazard is the negative consequence and exposure the extent or probability to which the recipient of the hazard can be influenced by the hazard (Chicken and Posner, 1999). However, if information leads to certainty (understanding) about those hazards and probabilities, solutions with high risk will be avoided through better decision-making.

Complexity can be expressed in terms of system integration and re-use on the physical side and understanding and knowledge sharing on the perception side. Complexity reduction may thus involve perceived and physical complexity. However, in this research complexity is defined as physical complexity (see Table 3). Physical complexity reduction will therefore increase the degree to which the organization is understandable (perceived complexity) and thus improve decision-making.

In short, decision-making is a goal expressed in understanding, knowledge sharing and complexity reduction. Risk reduction in this regard is considered the degree of certainty that negative consequences are being avoided and incorporated in understanding.

4.3.2 Service Oriented Architecture

System integration and re-use imply the possibility of implementing a Service Oriented Architecture (SOA). SOA is a type of EA focusing on loose coupling of services. Addressing the SOA concept in more detail is beyond the scope of this research though[3].

4.3.3 Alignment and agility

The distinction is made by *assuming* alignment has an internal focus, while agility has an external focus. An organization needs to be aligned internally in order to be agile externally and vice versa. An external event (e.g. development of a new technology, or new customer demand) may trigger the need for change. This responsive behavior of the organization (i.e. recognizing that need) is an aspect of agility. The need for change may result in either alteration of business or IT strategy. Changing business and/or IT strategy based on external events is another attribute of the agile organization. Agility provides input for alignment: a change in strategy (according to which the EA thus has to be updated) may lead to an internally misaligned organization.

According to Henderson and Venkatraman (Henderson and Venkatraman, 1999) there are four perspectives how re-alignment takes place in such a case, depending on whether the agile organization is changing its business or IT strategy based on external developments. If the *IT strategy is leading*, the business strategy may be adapted to new developments in the IT market. The organizational infrastructure is consequently affected by new business objectives, linked to IT competencies. This is the *competitive potential perspective*. Another perspective is that of *service level alignment*, in which the IT strategy is directly translated to the IT infrastructure, leveraging the organization's processes to be able to cope with the demand of end-customers appropriately. If the *business strategy is leading*, the IT infrastructure can be based upon the IT strategy supporting the business strategy directly; *the technology transformation persective*. IT is then not constrained by the organizational infrastructure. The more classical *strategy execution perspective* is that of the translation of business strategy to processes, in which the IT systems are purely supportive of those processes. These perspectives are not included explicitly in the model, but it should be clear that alignment can take place in multiple ways, depending on both the degree of agility, as well as the nature of the external event.

During the alignment process, quality of the service/product offering must be guaranteed. Furthermore, time-to-market and other timely aspects (e.g. quickly recognized necessary strategy changes) must be guaranteed. In other words, the alignment must take place as soon as possible, ensuring quality (Dove, 2001), which in turn are aspects of agility (implied by the word *appropriately* in the definition of (Overby et al., 2005)).

So in short, EA should ensure swift internal alignment, based on the strategy changes triggered by external events, while ensuring high quality and timely product/service delivery. Agility aspects are thus emphasized on an interface level between the organization's external and internal environment.

!	**IMPORTANT:** The extent to which agility and alignment aspects are relevant (also in relation to each other) depends on the strategy of the organization, and thus the EA (e.g. an organization may pursue stability of its core activities, but not pursue quick response to environmental changes). Objectives should thus be determined per organization individiually (Schelp and Stutz, 2007).

[3] Please refer to the book "Service Oriented Architecture: Concepts, Technology and Design" of Thomas Erl, if you would like more information on this type of architecture.

4.3.4 Other relationships

Governance – i.e. the specification of processes, policies, roles and customs affecting the people operating within the organization – is considered a means for alignment; governance provides organizational order in relation to avoid conflicts and realize mutual gains (Williamson, 1996).

Prioritization of projects and budgets based on the corporate strategy, realizes alignment (e.g. projects with a strong link with a strategic objective receives higher priority and more budget).

Re-use of enterprise models and systems, ensures business units utilize the same applications and unification of processes and data. That strengthens the alignment and the extent to which systems are integrated. Re-use also makes faster time-to-market of solutions possible, since solutions do not have to be built from scratch. Naturally, this makes the organization more agile (i.e. agility requires quick response, when a quick response is needed).

Based on the definition of agility high quality products and services lead to higher agility; appropriateness implies quality (Dove, 2001), as discussed in Section 4.3.3. Quality concerns both internal IT system quality (e.g. security, responsiveness, throughput, reliability, etc.) (Barbacci et al., 1995) and external customer satisfaction (e.g., ISO 10002:2004 addresses customer satisfaction as part of quality management).

Complexity reduction (physical complexity reduction that is; see Section 4.3.1 and Table 3) enables agile response due to a lower amount of systems which are subject to change. It may also realize faster Time-To-Market (e.g. less interoperability issues have to be solved and one system may be updated faster than several systems).

System integration (i.e. consolidating systems) is the means for complexity reduction, but also for understanding (e.g. it is easier to comprehend a smaller set of systems, because there are less interdependencies) and alignment directly (e.g. systems are integrated according to business functionality).

Resource management (e.g. training employees) will lead to better alignment (e.g. trained employees are more capable to ‘think outside the box’ and thus better able to relate business with IT, or subdivisions with eachother). Resource management is also considered to lead to increased operational efficiency.

Alignment and agility in turn are expected to lead to increased operational efficiency, cost reduction and increased compliance with law and regulation.

4.4 Conclusion

Based on the number of occurrences[4] (>10), alignment, agility, understanding, quality and integration seem to be the main objectives of the EA function. However, when the relationships between the 14 objectives are made explicit (see Figure 10), it seems alignment and agility are the main goals based on the amount of incoming arrows; alignment and agility can be perceived as the main objectives the EA function contributes to. Based on this analysis, the conceptual model designed in Section 3.4, is refined. Figure 11 shows the refined conceptual model with organizational performance improvement decomposed into the main objectives to be attained: alignment and agility. The concepts of alignment and agility have been operationalized in Chapter 5 in order to be able to measure their attainment. Furthermore, the other grouped objectives should be incorporated in that operationalization (or incorporated as separate objectives) so that they are not overlooked. Section 5.4 provides the additional theoretical foundation for the conceptual model of Figure 11: how EA products and EA implementation contribute to the attainment of alignment and agility.

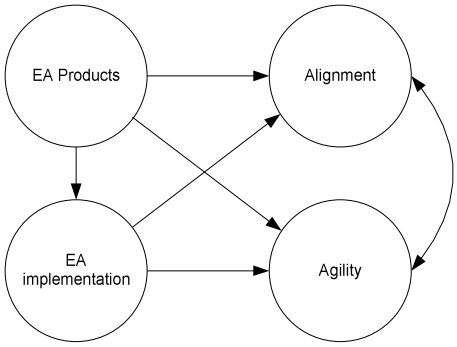

Figure 11. Refined conceptual model of EA effectiveness

[4] Please note that an objective may be mentioned in a single source more than one time, if multiple objectives mentioned fall within the definition of a grouping objective.

PART II: DESIGN

5. Design of the measurement model

The EA effectiveness measurement model is designed based on the conceptualization of the main objectives of EA (Chapter 4): alignment and agility. The model consists of the operationalized concepts alignment and agility, in terms of dimensions and corresponding indicators. The purpose of this model is to be able to qualitatively and quantitatively measure the attainment of the main objectives of EA (i.e. the effectiveness of EA implementation).

Literature (Luftman, 2003, Sherehiy et al., 2007) on the measurement and attributes of the main EA objectives, alignment and agility, is consulted to decompose alignment and agility into several dimensions with corresponding, presumably measurable, (non-quantified) indicators. Based on the indicators of the dimensions of both concepts, some dimensions have been partly integrated and renamed to eliminate dimension and indicator redundancy (see Section 5.3), in order to come to a consistent and coherent operationalization. During the design process several suggestions of six experienced and knowledgeable consultants in the area of EA have been taken into consideration.

Section 5.1 describes the dimensions and corresponding indicators of agility, as defined in Table 3. Section 5.2 describes the dimensions and corresponding indicators of alignment, as defined in Table 3. Section 5.3 describes how the operationalization has been refined based on the integration and renaming of dimensions (and indicators). Section 5.4 describes how EA is expected to contribute to the attainment of the dimensions of agility and alignment. Section 5.5 presents the measurement model. And finally, Section 5.6 describes the mapping of the objectives derived in Section 4.2 on the operationalization.

!	**IMPORTANT:** The hypotheses of how EA contributes to the attainment of agility and alignment dimensions also provide an additional foundation for the conceptual models presented in Section 3.4. Nonetheless, we included these propositions in Section 5.4, due to the relationship with the dimensions.

5.1 Dimensions and indicators of agility

Agility is often mentioned in various practices: agile manufacturing. agile programming. agile architecture, etc. Concerning organizations and the objectives of EA, agility is often mentioned in conjunction with flexibility, managing change and adaptability. We defined agility in Table 3 as *the ability to sense environmental change and respond appropriately (Overby et al., 2005)*. We define flexibility as *the ability to change organizational components without major changes and investments.* We consider managing change and adaptability as synonymous with agility.

Sherehiy et al. (Sherehiy et al., 2007) have created a comprehensive overview and summary of agility concepts to come to an understanding of what Enterprise Agility (in this context, misleadingly abbreviated as EA) is. Agility has been classified by Sherehiy et al. (2007) in two ways. Firstly, according to the main attributes of agility: 1) flexibility and adaptability, 2) responsiveness, 3) speed, 4) integration and low complexity, 5) mobilization of core competences, 6) high quality products and customized products, and 7) culture of change. Each of these attributes is comprised of a number of characteristics (see Table 5).

The other way is a classification according to the adherence to a specific enterprise structure. According to Sherehiy et al., the main domains enterprises should focus on to achieve agility are customer satisfaction, cooperation, learning and knowledge management and development of culture of change. But also the organization of the enterprise and its workforce need to have certain characteristics to be agile, according to Sherehiy et al.. The organization can be defined in terms of authority, rules and procedures, coordination, structure, and HRM practices (Sherehiy et

al., 2007). These aspects in fact can be filled in by EA as a means and may be considered an aspect of alignment (Maes et al., 2000). We therefore used the attributes (used as dimensions) and characteristics (used as indicators) as a starting point to measure the agility objective (see Table 5). Organizations may use the dimensions as individual objectives for EA (Schelp and Stutz, 2007), since every organization may have a specific set of EA objectives, depending on the strategy (as already discussed in Section 4.3.3).

5.2 Dimensions and indicators of alignment

Luftman (Luftman, 2000) has developed a business-IT alignment (BITA) maturity assessment model, based on the view on alignment as described by (Henderson and Venkatraman, 1999). This model, based on the strategic alignment model, uses an extensive questionnaire with a 5-item Likert scale. In this questionnaire several BITA criteria (dimensions) are addressed. Several predefined levels are defined for attaining those criteria. The scores on the criteria are aggregated to form a general BITA appraisal. The model involves the following five levels of maturity: 1) Intital/ad-hoc process 2) committed process 3) established focused process 4) improved/managed process 5) optimized process. According to the model an organization is internally (although extended to external partners – e.g. contracted suppliers) aligned when the following alignment competencies are satisfied:

1) There is informal, pervasive *communication* and understanding between business and IT.
2) Business and IT *value measurements* are performed and understood by the business.
3) Prioritization and allocation of IT resources must be *governed* by business and IT.
4) Business and IT must be trusted *partners* with IT enabling and driving business change.
5) IT has an organization-wide *scope* and has a mature integrated *architecture*.
6) The organization's cultural and social environment is *skilled* to cope with change.

Alignment maturity can thus be expressed by the attainment of these six alignment criteria. It is evident these criteria mainly have an internal focus, although extended to partners. In Luftman's alignment model, alignment with the environment, with the exception of partners (e.g. external suppliers or other lines of business within the organization), is disregarded. The criteria of Luftman's BITA model have been used as dimensions of alignment in the context of EA. However, organizations may use the dimensions as individual objectives for the EA function.

The items of the individual criteria are specified according to five stages in Luftman's BITA model, which are item specific (i.e. each indicator has five different specifications according to the maturity level). Since stage five is the end objective according to Luftman (none of the Fortune 500 companies to which the model has been applied currently achieved such a maturity level on all of the six alignment criteria however), the items are translated into objectives focusing on the final stage (level 5) in order to make it possible to attach metrics. The overview of dimensions and indicators is provided in Table 6.

Table 5. Dimensions and indicators of agility, adapted from (Sherehiy et al., 2007)

Dimension χ1: Flexibility
1) Flexible product model
2) Flexible production systems
3) Workforce flexibility
4) Flexible organizational structures and practices
5) Workplace flexibility
6) Flexible business strategies

Dimension χ2: Responsiveness
1) Responsiveness to change in customers' preferences, demands
2) Responsiveness to market and business environment changes and trends
3) Responsiveness to social and environmental issues
4) Adjustability of business objectives to the changes

Dimension χ3: Culture of change
1) Environment supportive of experimentation, learning and innovation
2) Positive attitude to changes, new ideas, people, and technology
3) Continuous improvement, learning and employee training
4) Changes management 5) Organizational responsibilities change

Dimension χ4: Speed
1) Learning, carrying out tasks and operations and making changes in shortest possible time
2) Shortest time of operations, time of production changes, time of product/service delivery
3) Shortest time of learning and time of adaptation to change

Dimension χ5: Integration & low complexity
1) Intra-enterprise and inter-enterprise integration
2) Integration of people, technology and organization
3) Synthesis of diverse technologies, skills, competencies
4) Low complexity of structure, relationships between structure elements
5) Flow of material, communication and information between different organizational structures and systems components
6) Enhanced interaction between processes, products and suppliers
7) Easy and effortless process of making changes

Dimension χ6: High quality and customized products
1) Products and services with high information and value-adding content
2) Quality over product life
3) First time right decision
4) Short development cycle time

Dimension χ7: Mobilization of core competencies
1) Multi-venturing capabilities
2) Developed business practice difficult to copy
3) Skill and knowledge enhancing technologies
4) Rapid partnership formation
5) Close relationship with customers and suppliers
6) High rate of new product introduction

Table 6. Dimensions and indicators of alignment, adapted from (Luftman, 2000)

Dimension ζ1: Communication

1) Improved understanding of business by IT
2) Improved understanding of IT by business
3) More strong and structured inter and intra organizational learning
4) Less communication protocols and more informal communication
5) There is a knowledge bank available internally, facilitating knowledge sharing within and between business and IT and knowledge is shared extra-enterprise.
6) Broader and more effective internal and extra-enterprise liason(s)

Dimension ζ2: Competency/value measurements

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

Dimension ζ3: Governance

1) Business strategic planning is integrated across and outside the enterprise
2) IT strategic planning is integrated across and outside the enterprise
3) There is a federated reporting/organization structure where the CIO reports to the CEO
4) IT is seen as a cost and profit center
5) IT investment management is based on business value, extended to business partners
6) Decision-making is steered by partnerships
7) Prioritization is based on added value , extended to the added value of external partners

Dimension ζ4: Partnership

1) Business perceives IT as a partner in creating value
2) Business and IT develop the strategic plan together
3) Risks and rewards, concerning goal achievement, are shared among business and IT
4) The IT program is continuously improvement
5) Business and IT are trusted partners
6) CEO is IT sponsor/champion

Dimension ζ5: Scope and architecture

1) IT has an external scope and is a driver and enabler for the business strategy
2) There are enterprise and inter-enterprise standards
3) The functional organization architecture is integrated and has evolved with partners
4) The enterprise architecture is integrated and has evolved with partners
4) The inter-enterprise architecture is integrated and has evolved with all partners
5) The architecture is transparent and flexible across the infrastructure

Dimension ζ6: Skills

1) Innovation and entrepreneurship by employees is the norm
2) Executives, including CIO and partners have decision power
3) Management style is relationship based
4) There is high and focused change readiness throughout the organization
5) Employees can switch careers across the enterprise
6) Education and cross-training is possible across the organization
7) A trusting environment is created by valued partnerships

5.3 Eliminating redundancy between dimensions

There seems to be overlap between the dimensions and indicators of the agility objective, as summarized by Sherehiy et al. (Sherehiy et al., 2007) and the dimensions and indicators of the alignment objective (Luftman, 2003). Agility incorporates dimensions *culture of change* and *integration*. The first seems to show similarities with the *skills* dimension of alignment, while the latter seems to show similarities with the *technology scope & architecture* dimension of alignment. Furthermore, the *mobilization of core competencies* dimension of agility shows overlap with the *partnership* dimension and other dimensions of alignment. It thus seems the main objectives of EA, alignment and agility, are intertwined to some extent. The operationalizations of alignment and agility have been refined, since the sources on which the operationalization is based do not take each other into account.

The *culture of change* dimension of agility and the *skills* dimension of alignment both have overlapping indicators, as illustrated in Table 7. The two dimensions have been split by redefining them and specifying the indicators, according to the external or internal focus of agility and alignment respectively. *Change management* as a *culture of change* indicator has been disregarded in the newly formed dimensions, since this is not considered a culture aspect but a specific practice. The new indicators are depicted in Table 8.

Table 7. Comparison culture of change & skills

Alignment – skills, corresponds to…	**Agility – culture of change**
OVERLAP	**OVERLAP**
1. Innovation and entrepreneurship by employees is the norm	1. Environment supportive of experimentation, learning and innovation
2. There is high and focused change readiness throughout the organization	2. Positive attitude to changes, new ideas, people, and technology
3. Education and cross-training is possible across the organization	3. Continuous improvement, learning and employee training
4. Employees can switch careers across the Enterprise	4. Organizational responsibilities change
NO OVERLAP	**NO OVERLAP**
5. Executives, including CIO and partners have decision power	5. Change management
6. Management style is relationship based	
7. A trusting environment is created by valued partnerships	

Table 8. New dimensions: readiness for change & initiation of change

Alignment – Readiness for change	Agility – Initiation of change
DEFINITION	**DEFINITION**
Ability and willingness of the enterprise workforce to change their attitude, opinions, and behavior.	Ability and willingness of management to initiate change in order to implement new business ideas or introduce new technologies.
ATTRIBUTES	**ATTRIBUTES**
1. Innovation and entrepreneurship by the employees is the norm	1. Innovation and entrepreneurship by the management is the norm
2. There is high and focused change readiness throughout the organization	2. There is high and focused change readiness among managers
3. Education and cross-training is possible across the organization	3. Education and cross-training is possible across management functions
4. Employees can switch careers across the Organization	4. Managers can switch management roles across the organization
5. Management style is relationship based	5. Executives, including CIO and partners have decision power
6. A trusting environment is created by valued partnerships	

Integration is also mentioned in both concepts, alignment and agility. Integration in the alignment model is included as architectural integration, while the agility integration dimension focuses on integration of people, processes of technology. Concerning integration, alignment seems to be a means for agility. The two decompositions of the dimensions and the corresponding overlap and relationships are depicted in Table 9. The dimensions have been integrated into one dimension, because splitting both concepts appeared to be too difficult. This is done based on the definitions of integration and complexity as provided in section 4.2. The missing link between means and ends, architectural conformance, has been added as an indicator. The new dimension (depicted in Table 10) is included as an alignment dimension, because of the apparent internal focus of system integration, physical complexity and architectural integration. Inter-enterprise architectural integration has been disregarded, since inter-organizational aspects are beyond the scope of this research.

Table 9. Relationship between integration of alignment and agility respectively

Agility – Integration & Low complexity	Alignment – Technology Scope & architecture
OVERLAP	**OVERLAP**
1. Intra-enterprise and inter-enterprise integration	1. The enterprise architecture is integrated and has evolved with partners
2. Integration of people, technology and organization	2. The inter-enterprise architecture is integrated and has evolved with all partners
ENDS OF AGILITY	**MEANS FOR AGILITY (ends for alignment)**
3. Low complexity of structure, relationships between structure elements	3. The architecture is transparent and flexible across the infrastructure*
4. Easy and effortless process of making changes	
5. Easy flow of material, communication and information between different organizational structures and systems components	4. There are enterprise and inter-enterprise standards
4. Synthesis of diverse technologies, skills, competencies	5. The functional organization architecture is integrated and has evolved with partners
5. Enhanced interaction between processes, products and suppliers	
	6. IT has an external scope and is a driver and enabler for the business strategy

Table 10. New alignment dimension: architectural conformance & system integration

Alignment – Architectural conformance and system integration
DEFINITION Consolidation and integration of organizational components through standardization and conformance of change projects and operational environment.
ATTRIBUTES 1. IT has an external scope and is a driver and enabler for the business strategy 2. Enterprise and inter-enterprise standards are specified and maintained 3. The EA is integrated vertically (from strategy to operations) 4. The EA is integrated horizontally (between business units) 5. The EA is transparent and flexible across the organization (change projects shape EA) 6. Synthesis of diverse technologies (system integration)

Mobilization of core competencies, as a dimension of agility, seems already to be represented by other alignment and agility dimensions (see Table 11), except for the indicator *developed business practice difficult to copy*. But this indicator is too abstract to include in the model. Furthermore, it is unclear how the EA function would contribute to this objective. *Mobilization of core competencies* as therefore not considered an objective of the EA function and removed from the model.

Table 11. Mobilization of core competencies already represented

Agility – Mobilization of core competencies	**Represented by various indicators**
Attributes:	
1. Multi-venturing capabilities	Broader and more effective internal and extra-enterprise liaisons (communication – alignment)
2. Developed business practice difficult to copy	-
3. Skill and knowledge enhancing technologies	There is a knowledge bank available internally (communication – alignment)
4. Rapid partnership formation	Shortest time of operations (speed – agility)
5. Close relationship with customers and suppliers	A trusting environment is created by valued partnerships (Readiness for change – alignment)
6. High rate of new product introduction	Shortest time-to-market (speed – agility)

5.4 Contribution of EA to the attainment of objective dimensions

This section describes how EA processes and products *may contribute* to achieving its main objectives. Table 12 shows the definitions of the dimensions of alignment and describes how EA may contribute to the attainment of these objective dimensions.

Table 12. Alignment dimensions and contribution of EA implementation

Dimension	Definition	Contributing Outcome of EA Function
Internal performance monitoring	Routine assessments and benchmarks of operational performance of both business and IT organizational components.	EA products describe the quality attributes of all organizational components, and thus provide input for the specification of performance indicators and service level agreements.
Understanding & communication	Common understanding of business and IT through knowledge sharing, and insight in consequences of decision-making.	EA products contain explicit knowledge (descriptions) of business and IT components, which allows knowledge sharing. Architects provide management with insight in, and advice about, the consequences of decision making on existing organizational components.
Governance	Formal decision-making, monitoring, and control priorities and budget for both business and IT.	EA products translate strategic decisions to operational decisions, concerning both business and IT using principles and roadmaps, ensuring traceability between decisions on various levels and domains. Such traceability provides input for priorities, budgets and planning."
Partnership	Business and IT are trusted partners where the business sponsors IT, and risks and rewards are shared.	EA products link the strategic plans and organizational components of the business (optimized on value creation) and IT (optimized on business support). By embracing and ratifying these EA products, business and IT management together create a sense of partnership.
Conformance & integration	Consolidation and integration of organizational components through standardization and conformance of change projects and operational environment.	EA products provide a transparent and enterprise-wide coherent architecture and standards. They describe and prescribe the consolidation and integration of organizational components..
Readiness for change	Ability and willingness of the enterprise workforce to change their attitude, opinions, and behavior.	EA products provide insight in the consequences of, and the rationale for, organizational changes. By actively explaining the consequences and rationale, architects help in changing the attitude, opinions, and behavior of the employees impacted by the organizational changes.

Table 13 defines the dimensions of agility and indicates the positive impact of EA on the attainment of these objective dimensions.

Table 13. Agility dimensions and contribution of EA implementation

Dimension	Definition	Outcome of EA Function
Initiation of change	Ability and willingness of management to initiate change to implement new business ideas or introduce new technologies.	Architects helps management in decision making about new business and IT ideas, by creating solution alternatives and analyzing their profitability and feasibility.
External change monitoring	Identification of changes and opportunities, and the ability to translate these to new business and IT ideas.	Architects keep up with the social, market, technological and regulatory developments, and help management in identifying opportunities and required changes.
Flexibility	Ability to change organizational components without major changes and investments.	Standardized organizational components (through EA products and EA governance) enable easy re-orchestration of components to implement changes.
Speed	Shortest time-to-market, time to act upon change, educate employees, and run end-to-end operations.	Architects use their domain knowledge to help projects identify reuse of existing organizational components, and to help integrate the new solution with the existing organizational components.
Quality & customization	High quality and customizable (using parameters) organizational components.	Architects use their domain knowledge to guide projects in making high quality solution designs, based on high-end standards.

5.5 Measurement model

Figure 12 shows the measurement model based on the definitions of the dimensions (depicted in Table 13): the alignment and agility concepts are operationalized in terms of dimensions and indicators. See Appendix G for the description of the indicators. The purpose of the case study, described in Chapter 6, is to determine, whether this theoretical operationalization approximates reality in determining the effectiveness of EA.

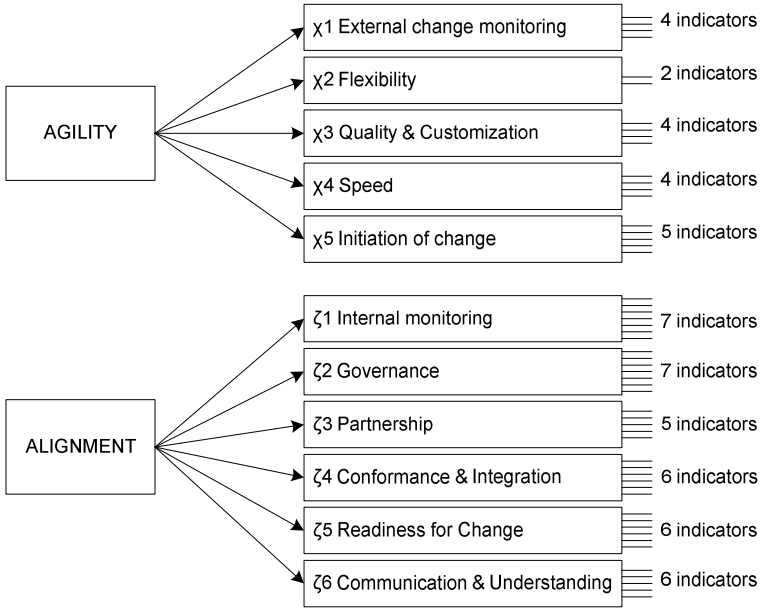

Figure 12. Measurement Model

5.6 Mapping objectives on the measurement model

The objectives derived in Section 4.2 and visualized in Section 4.3 are mapped onto the operationalization of the main objectives: each objective has been checked whether it is covered by the measurement model, by creating a matrix (Appendix C). It seemed that all objectives are represented by the measurement model.

Operational efficiency and compliancy are not explicitly mentioned in the operationalizations. This section describes how these objectives have been mapped on the model nonetheless. Operational efficiency is either about producing as much in the shortest amount of time. This is reflected by the speed of operations, an attribute of the sub objective of agility. Or it is reflected by the cost-income ratio, which is disregarded in this research for the reasons discussed in Section 1.4. Compliancy with law and regulation is represented by the external monitoring and quality dimensions of agility.

Concluding, the operationalization of agility and alignment seems comprehensive in covering EA objectives from a theoretical perspective.

PART III: CASE STUDY

6. Case study

A case study has been performed at a large financial services company, henceforth called FinaCom (please note that FinaCom and all related names and figures are fictional in this public version of the thesis, due to confidentiality reasons). The purpose of this case study is to provide an early indication of the extent to which the measurement model fits reality in measuring the effectiveness of EA at a financial services provider.

The methodology is described in section 6.1. The background of FinaCom, its EA products and processes are described in section 6.2. Interview findings are depicted in section 6.3. The lessons learnt from these findings are described in section 6.4. Section 6.5 concludes with recommendations based on the findings.

6.1 Methodology

6.1.1 Document analysis

The case study involved analysis of various EA related documents. Documents included strategy plans, an EA baseline study, workshop results (of two workshops held with LoB managers on the value of EA), presentations, and other EA related material made available by FinaCom (16 documents in total). Unfortunately we had no access to the EA itself.

6.1.2 Interviews: EA decision-makers

5 managers (kept anonymous due to confidentiality reasons) of FinaCom, with EA decision-making authority (i.e. residing in the EA Council), have been interviewed. Based on their roles (3 Local Architecture Function (LAF) leaders, 1 sponsor of the EA program, and 1 program manager), the interviewees are considered to show a broad perspective on the objectives of EA (more information on the LAF is provided in section 7.2.2). These stakeholders were all members of middle management, actively involved in implementing the EA products, and responsible for the effectiveness of that EA implementation. They have been interviewed primarily to identify the perceived relevant objectives of EA, and additionally to identify possible indicators and/or metrics to measure the attainment of those objectives. Interviews were semi-structured (only certain themes (i.e. objectives, indicators, and metrics for EA) were put forward by the interviewer, but the interview was prohibited from getting off-track).

Triangulation has been used to determine the validity (1) and reliability (2) of interview findings (Golafshani, 2003): (1) the findings have been cross-checked with the analyzed documents available (methodological triangulation; (Denzin, 1978), (2) interview reports (near-transcriptions) have been sent to the interviewees one day after the interview to provide the interviewees the possibility of making alterations to their answers and/or confirm the content of the report (data triangulation (Denzin, 1978)). We were able to cross-check several general EA objectives with documents. Moreover, all interview reports have been confirmed (whether or not with very minor alterations). The interview findings can therefore be considered reliable.

6.1.3 Questionnaire and interviews: external consultants

Additionally, 4 external consultants operating at FinaCom have completed a questionnaire (see Appendix F for the questionnaire). They were all members of the program team occupied with the design and implementation of the EA function (to be explained in Section 6.2) and the creation of the initial set of EA products required to successfully roll out the EA function.

Furthermore, 3 of 4 respondents are certified architects (according to Capgemini criteria, see Appendix H). Based on their roles and certifications (see Table 14) they are considered to be able to provide information on the objectives of FinaCom's EA from an external architect and consultant perspective. The purpose of targeting the external consultants was to identify additional objectives and indicators not mentioned by FinaCom interviewees and documents (note: only objectives not mentioned by the other respondents group have been included in the questionnaire, to limit its length; because, unfortunately, respondents had very limited time). It also allowed us to cross-check the relevance of objectives mentioned by the respondents of the decision-making function, but not by the model (additional methodology triangulation). To assess that the results have a broad meaning: (1) additional semi-structured interviews have been held addressing the questionnaire responses (methodology/data triangulation), and (2) again interview reports (near-transcriptions) have been sent to the interviewees one day after the interview to provide the interviewees the possibility of making alterations to their answers and/or confirm the content of the report (data triangulation (Denzin, 1978)). All interview reports have been confirmed (whether or not with very minor alterations). Internal validity (i.e. credibility) has been assumed but not tested (i.e. the questionnaire did not incorporate convergent and discriminant validity measures; no documents were available to cross-check the findings).

Table 14. External consultants in FinaCom ITO EA program

Certification	Role	Duration
L1 certified architect	Project /co-lead EA definition and implementation	1 hour
No architect certification	EA program manager	1 hour
L4 certified architect	Lead EA architect	1 hour
L2 certified architect	QA principles & alignment between projects in EA program	1 hour

6.1.4 Mapping on the measurement model

The derived objectives have been mapped onto the measurement model (see Figure 12) by interpretation of the author. A gap analysis has been made to identify which indicators were not recognized by the interviewees and which objectives were mentioned by the interviewees but not by the model in the form of dimensions and/or indicators. Results of that gap analysis may provide indications concerning the incompleteness of the model on one hand (i.e. the indicators are not relevant), and lead to recommendations concerning the relevant EA objectives for FinaCom on the other (temporarily assuming the model is 'correct').

6.1.5 Interviews: Capgemini assessors and architects

Subsequently, interviews[5] have been held with experienced Capgemini architects (4) and assessors (2) to provide an *early indication* of the external validity of the measurement model. In total, 6 interviews varying in duration from one hour to one hour and a half were held. See Table 15 for interviewee details. The interviewees have been selected based on certification (3) or by recommendation (3). More information on Capgemini's criteria of different architect certification levels is provided in Appendix H.

Table 15. Capgemini interviewees

Certification or other selection criterion	Date	Time
Level 4 certified architect	23-04-2008	12:00 – 13:00
Business/Information architect; Business Analyst	20-05-2008	13:30 – 15:00
Level 4 certified architect	21-05-2008	11:00 – 12:00
Level 1 certified architect; Assessor	23-05-2008	09:00 – 10:00
Author of thesis on stakeholder perception of architecture	04-06-2008	09:00 – 10:30
SOA architect & expert group leader (SOA)	29-05-2008	11:00 – 12:00

[5] These are the same interviews used for the problem exploration.

The interviews were semi-structured, meaning some main questions where formulated up-front, guiding the direction of the interview but not restricting it. The questions generally addressed the following topics: 1) typical objectives of EA, 2) measurement of those objectives and corresponding problems, and 3) comprehensiveness of the alignment and agility, and the corresponding dimensions as being encountered as typical objects at client organizations. A short introduction on this research had been e-mailed to the interviewee in advance. To check for reliability, interview reports (near-transcriptions) have been sent to the interviewees after the interview to provide the interviewees the possibility of making alterations to their answers and/or confirm the content of the report (data triangulation (Denzin, 1978)).

6.2 Background

FinaCom was developing and implementing the EA at the time of writing. The new EA products are based upon a baseline report identifying several architectural issues within FinaCom. The progress since the start of implementation of the EA products has to be demonstrated (learning process in case of low effectiveness; potential best practice in case of high effectiveness). Developing an EA effectiveness measurement instrument is therefore an integral part of FinaCom's EA program (i.e. developing and implementing the EA products).

6.2.1 FinaCom's ITO division & architecture

FinaCom is a large global financial services company operating in fields like banking, insurance and investment management. At the time of the assessment, FinaCom was in the process of implementing the new EA products within its IT & Operations (ITO) division. ITO consists of 8 Lines of Business (LoBs) that deliver operational services and IT solutions to FinaCom's European front-office divisions. ITO has one central technology division responsible for providing infrastructural services to the 8 LoBs within ITO (see Figure 13).

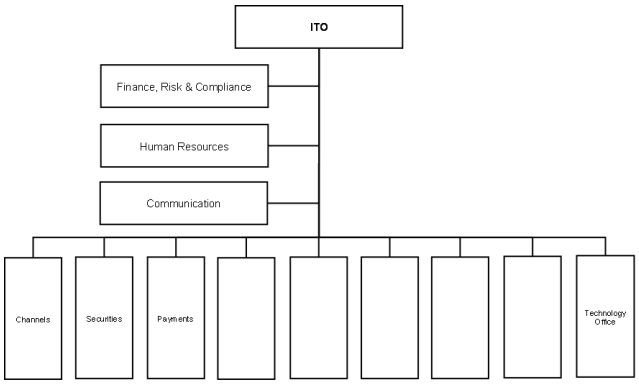

Figure 13. ITO organizational structure

Within ITO, LoBs have their own business architectures, information and application architectures, created by architects operating within those verticals on one or more of these domains. Within LoBs, projects are performed in order to fulfill change requests posed by the business. The end result of those projects are called solutions (sometimes a variety of projects are required to fulfill a change request; these projects are then combined in a program). Solution architectures are created by solution architects to guide the design and implementation of these solutions (more information about the relationship between architecture and design can be found in section 4.2). In total, there are approximately 150 employees within ITO who work in the field of architecture.

There are thus various types of architecture, depending on the organizational level: a top level ITO architecture (EA), LoB (segment) architectures (TO-BE) and solution architectures. However, most of them are still in development. There are no AS-IS EA or LoB architectures available. The EA, LoB and solution architectures consist of principles to guide the design of solutions and coordinate programs.

To create the EA and LoB architectures, and ensure architectural conformance of solution architectures with higher level architectures (either LoB or ITO level), an EA governance policy has been designed and implemented. This led to an institutional body positioned within ITO, which is responsible for facilitating development and maintenance of the enterprise and segment architectures and EA policies: *the EA Function* (similar to the EA function as defined by (van der Raadt and van Vliet, 2008); see Chapter 3). Furthermore, the EA function must ensure compliance of solutions with the architectures and EA policies, and provide communication and support to projects. The previous EA function, according to a baseline report, faced difficulties in ensuring efficient, effective and compliant services and solutions. Therefore, a new EA function has been designed, based on the outcomes of the baseline study, to develop and implement the EA products (thus with exception of the EA governance policy which manifests itself in the EA function). The implementation of the EA function (i.e. the governed EA implementation processes, the development and decision-making processes were in place) was still underway at the time of writing. In other words, some LoBs operated according to the governance policy, and thus try to deliver EA compliant solutions. Other LoBs did not operate according to the implementation processes prescribed by the EA governance policy.

6.2.2 FinaCom's EA Function

The new EA function that was being implemented within ITO is responsible for: (1) setting the long term strategic direction for ITO by means of creating and maintaining enterprise and domain architectures and EA policies, and (2) reviewing all solutions developed and changes implemented by ITO on their quality and conformance to the architectures and EA policies. The main objective of ITO's EA function is to ensure that the solutions and changes implemented within ITO, are fit for purpose, are of high quality, and contribute to the simplification of ITO's landscape of business processes, IT systems, and technical infrastructure.

In the new design the EA function is divided into several sub-functions with specific responsibilities: one EA Council, one central architecture function, and several decentral architecture functions. The central architecture function is responsible for strategic decision-making and monitoring of the decentral architecture functions and change management of the architectures. The central architecture function also advises the EA Council, which guards the cross-LoB alignment and overall EA function performance. There is one decentral architecture function focusing on the Technology Office (TO) and ensures compliancy and change management concerning infrastructure principles. Other decentral architecture functions are focusing on the corresponding LoBs. The general, simplified structure and scoping of the sub-functions is illustrated in Figure 14.

Table 16. Correspondence EA aspects and FinaCom's EA function

Generic EA function	**FinaCom's EA function**
EA Decision-making	EA Council
Architecting	Central architecture function, and decentral architecture functions.
EA Implementation	Decentral architecture functions, LoBs, Technology Office, programs, and projects

The EA function validates solution architectures on compliancy with central and local design principles. This illustrates the top-down approach of architecting (see section 3.1.2). However, a waiver may be requested by projects in order to get a temporary approval to deviate from a principle. The EA function handles these waivers. A waiver may be requested by any member or stakeholder of the EA function to deviate temporarily, but structurally, from principles. These waivers are handled by line management. Based on waivers, and technological, legislative and business developments, decentral architecture functions may change the respective architecture documents. In case of changes to central architecture documents, a request for change (RfC) is communicated to the central architecture function which may in turn change these central principles. This clearly illustrates the bottom-up approach of architecting (see section 3.1.2), next to the evident top-down approach of FinaCom's EA processes. The correspondence of the structure of FinaCom's EA function and the generic aspects of EA as conceptualized in chapter 3 is illustrated in Table 16.

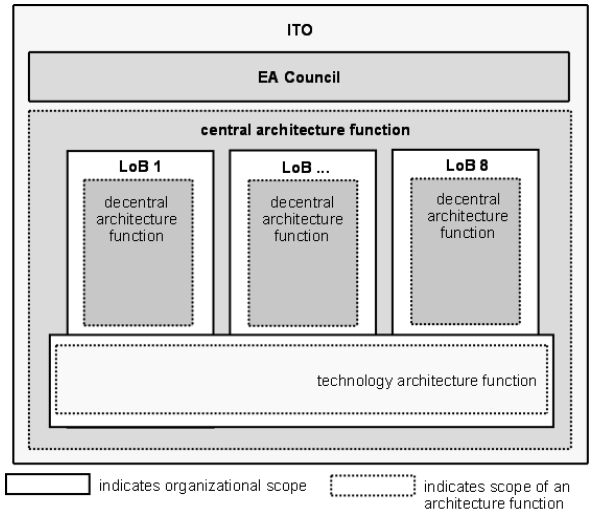

Figure 14. Simplified FinaCom architecture functions and their scope

6.2.3 EA function scope and positioning

Based on the EA objective conceptualization in chapter 5, EA in general aims to create alignment and achieve enterprise agility. EA is a discipline providing a holistic view of the organization. This means the scope of the EA should include both business and IT domains. And in order for the EA function to have a say in both of those areas, it should be positioned in the organization such that it overarches business and IT. The EA besides capturing business requirements, should also be able to shape business processes (Doucet et al., 2008, Bouwman and Versteeg, 2006).

The scope and positioning of the FinaCom's EA function is somewhat different (which is acceptable since organizations may evidently choose their own EA scope). This EA function is located within ITO, which is mainly focusing on IT. No AS-IS business architectures exist within ITO on LoB level. The EA of FinaCom has more of an Enterprise IT Architecture character (Amour et al., 1999). To achieve full business-IT alignment, the business must be involved, so that the EA function addresses (captures *and* designs; AS-IS and TO-BE) both business, as well as IT aspects. Fortunately, the business involvement and potential expansion of the scope to the business already is an ongoing topic of debate. But at the moment, business is not yet involved (see Figure 15). Business stakeholders are therefore non-existent during the current implementation phase and are therefore not addressed in this case study. The case study thus focuses on FinaCom's ITO division.

The business is included in terms of back-office process requirements. Furthermore, these back-office processes must conform to the requirements of the mid-office and front-office of the business side of FinaCom. ITO has no saying in the business strategy or front-office processes. Mid-office processes are both included in the business side and ITO side of FinaCom, but it varies where the mid-office resides per theme, product or process. There is no formal mid-office, sometimes it is at the front-office side, sometimes it is at the back-office side implicitly. The EA function does not create business architectures, but gets those business architectures (if they exist) from the business. ITO therefore has no influence on business processes. The specific scope and positioning of the EA function also has consequences for the alignment and agility objectives. There are four specific types of alignment possible in this context. By means of EA, the alignment of types 2 and 3 can only be increased from the IT and BO side respectively (ITO, and therefore the EA has no influence (i.e. authority) on the FO. Agility is only relevant with respect to the environment as an input factor for IT.

1) Alignment between LoBs
2) Alignment between FO and IT
3) Alignment between FO and BO
4) Alignment between BO and IT

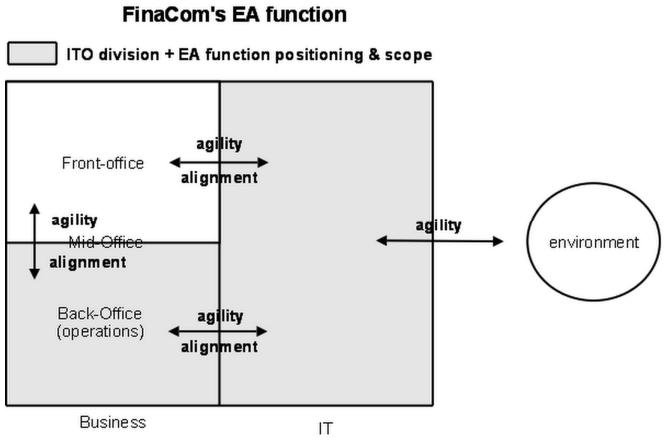

Figure 15. FinaCom EA positioning & scope

6.3 Findings

6.3.1 Document analysis

Several formal objectives of the EA function have been identified based on the internal documents of FinaCom, related to its EA function: (1) solutions and changes implemented by FinaCom/ITO are fit for purpose, (2) solutions and changes implemented by FinaCom/ITO increase the stability of the IT landscape, (3) solutions and changes implemented by FinaCom/ITO increase the simplicity of the IT landscape (or at least do not increase the complexity), (4) professionalization of architects, and (5) professionalization of architectural processes (EA maturity; CMMI). These objectives of the EA function should lead to the attainment of additional strategic objectives of ITO (and are thus objectives to which the EA function is expected to contribute): (6) cost-reduction of non-quality, (7) continued stability, (8) improvement of Time-To-Market and (9) increase of organizational maturity (CMMI). Furthermore, several other objectives have been extracted: (10) Cross LoB end-to-end synergy and consistency, (11) Cross LoB end-to-end synergy and consistency, (12) Quality of solutions, (13) Translation of business strategy into Segment Architecture, (14) Strategic direction for ITO

architecture, (15) Strategic direction for LoB architecture, (16) Increased involvement of the business, (17) Provide pro-active support, (18) Solutions compliant with architectures, (19) Central knowledge sharing, (20) Central technology choices. Furthermore, several operationalizations (called KPIs by FinaCom) have been found (these operationalizations have not been included in this thesis due to confidentiality reasons). The operationalizations have been linked to the dimensions of alignment and agility to identify which of the dimensions is quantitatively operationalized and measured.

The following observations can be made based on the overviews presented above: (1) 3 of 5 (60%) formal objectives of EA are not being measured on attainment, (2) 3 of 4 (75%) EA related strategic objectives are not being measured on attainment, (3) 9 of 10 (90%) of other extracted (informal) objectives are not being measured on attainment, (4) objectives (and operationalizations) are ill-defined, and (5) the effect of EA implementation is not isolated in the operationalizations of the objectives (i.e. the operationalization does not relate the outcome to the EA implementation).

6.3.2 EA Decision-makers

These interviewees mentioned 18 of a total of 55 indicators (33%) of the dimensions in our measurement model, by interpretation of the author.

Regarding the dimensions of alignment, 'conformance & integration' is perceived as most important. All 6 indicators (100%) of this dimension have been mentioned in the interviews with the respondents. For example, according to the interviewees, IT should enable the business (but not drive the business), ITO's LoBs should be both horizontally and vertically integrated, and the diverse technologies used within ITO should be consolidated. Following, 3 out of 5 indicators (60%) of the 'communication & understanding' dimension were mentioned by the respondents. They mentioned mutual understanding and knowledge sharing between business and IT as indicators. Regarding the 'governance' dimension, 3 of the 7 indicators (43%) were mentioned, namely project prioritization based on added value, budget allocation based on formal decision making, and cost-profit balance. The 'partnership' dimension only had 1 out of 5 indicators (20%) mentioned in the interviews – i.e., the business perceives the IT organization as a partner in creating value. The respondents mentioned 1 of the 7 indicators (14%) of the 'internal monitoring' dimension, namely the routinely evaluation of projects on their quality and conformance to ITO's governance. For 'readiness for change' no indicators (0%) were mentioned in the interviews, and thus not deemed important by the interviewees of the decision-making function.

The EA decision-making respondents put less emphasis on the agility dimensions in the interviews (21%). The most emphasized agility dimension was 'quality & customization', with 2 out of 4 indicators (50%) mentioned in the interviews – i.e., quality of the IT systems, and quality of the products and services delivered to the customers. Two dimensions – 'external monitoring' and 'speed' – had just 1 out of 4 indicators (25%) mentioned in the interviews. For the external monitoring dimension, only responsiveness to market and technology developments was mentioned. Time-to-market was the only indicator of speed mentioned in the interviews. The 'initiation of change' and 'flexibility' dimensions both did not have any indicator (0%) mentioned in the interviews.

Table 17. Proposed metrics by EA decision-makers.

Objective	Metric
Internal monitoring	None
Communication & understanding	**# of recommendations to MT**
	# of meetings with architects
Governance	System costs
Partnership	% of jointly written mandates
Conformance & Integration	# of applications
	# of vendors
	# of new systems versus re-use
	% of PID approvals by LAF
	# of PID exceptions
	% of requirements implemented
Culture of change	**# of certified architects**
	% of CAF staff certified
	# domain rotations per architect
External monitoring	None
Flexibility	**# of re-use possibilities the EA function is able to catalyze**
Speed	STP ratio
	Budget overrun
	Time overrun
	# of change projects / time
	Response time to approve requests from LAFs
Quality & Customization	Mean-Time-To-Repair (MTTR) / Mean-Time-Between-Failures (MTBF)*
Financial objectives (e.g. cost-reduction)**	**Cost of the CAF as a percentage of the total ITO workforce**
	Efficiency against total change portfolio by provable examples of re-use
	(Total potential savings held against the total change management, equals a percentage of efficiency)
	# of Savings opportunities recommended by CAF

* provided by external consultant

** Not included in the model, but put forward by ITO respondents.

In total, 13 objectives of the EA function were mentioned, that are not explicitly described in our measurement model: (1) 'having a healthy balance between old and new IT systems', (2) 'traceability of decisions', (3) 'identifying re-use possibilities', (4) 'evaluating component business models and industry frameworks', (5) a 'clear long term strategic vision concerning both business and IT', (6) 'stability of the IT landscape', (7) 'reliable projects in terms of budget, lead time and scope', (8) 'identification of where the main cost issues are', (9) 'professionalization of architects', (10) 'documentation of architectural processes', (11) 'risk reduction', (12) 'cost-reduction', and (13) 'cost-effectiveness'. The individual scores on the indicators are presented in Appendix G.

Several metrics (23) to measure the attainment of EA objectives came forward from the interviews. The metrics proposed by the ITO stakeholders during the interviews are summarized in

Table 17. These metrics have not been validated, approved and have no formal status. Metrics with a direct relationship to the EA function are marked bold (48%). Half of the metrics (52%) does not indicate such a relationship though, meaning the effect of EA is not isolated. None of the metrics are translated to a SMART (Specific, Measurable, Acceptable, Realistic, and Time-bound) KPI. None of the proposed metrics were formally measured during the time of writing.

6.3.3 External consultants

The external consultants acknowledged an additional 12 indicators (of indicators not mentioned by the respondents of the decision-making function).

'Conformance & integration' already had all indicators mentioned in the interviews with the respondents of the decision-making function and therefore was not discussed in the interviews with the respondents of the delivery function. For 'communication & understanding', 'speed' and 'external monitoring', the third-party experts did not mention any additional indicators. They did identify, for each of the 'flexibility', and 'readiness for change' dimensions, 1 additional indicator as important for the EA function to attain. For 'internal monitoring', 'governance', 'quality & customization', 'partnership' and 'initiation of change', the respondents mentioned 2 additional indicators. For quality & customization, they mentioned the ability to customize the IT systems, as well as the products and services delivered to the customers as being relevant. For partnership they deemed as important that the business is sponsor of the IT, and that IT portfolio management is based on standards approved by and continuously improved with the business. Regarding initiation of change, the interviewees mentioned that it is important that management is properly trained to understand what the impact of changes they initiate is to the functions and disciplines within the organization, and that they have the appropriate decision power to initiate change. External consultants, in summary, emphasized approximately as much additional alignment indicators (19%) as agility indicators (26%). External consultants and decision-makers combined thus identified 58% of alignment indicators and 47% of agility indicators

External consultant interviewees provided contradictory answers concerning 20 of 37 (54%) dimensions, of which 11 (50% of alignment indicators surveyed) were alignment indicators and 9 (56% of agility indicators surveyed) were agility indicators. These indicators were mainly business related (e.g. business strategic planning is integrated across and outside the enterprise), related to the culture of change (e.g. there is high and focused change readiness throughout the organization) and related to the external environment (e.g. responsiveness to change in customers' preferences, demands). See Appendix G for the detailed responses. Interviewees furthermore indicated the difficulty of identifying relevant objectives is the absence of a time-bound specification of objectives; in other words, objectives should be specified in as being a short-term, mid-term or long-term objective. Also target values should be dependent on the time-frame.

6.3.4 Capgemini assessors and architects

Interviewed Capgemini assessors and architects generally indicated that the objectives and corresponding dimensions (thus excluding the indicators) are typical objectives of EA as encountered at client organizations. However, because of the short time the objectives of the model have been addressed during the interview and the small, company specific, sample, assuming the possibility of generalization based on these findings is very questionable.

6.4 Recommendations for FinaCom

Based on the research findings, several recommendations have been communicated to FinaCom. Although case-specific recommendations are not the focus of this research, the recommendations communicated to FinaCom show how the application of the measurement model may guide the organization concerning EA and especially the measurement of its effectiveness.

- **The EA function should design (i.e. architect) both IT *and* the business**[6]. Although the EA decision-makers seem to aim for alignment, up to 61% of the 36 indicators of alignment dimensions included in the model has not been mentioned. Most of these indicators are business related (e.g. 'IT has an external scope and is a driver and enabler for the business strategy', or 'business and IT develop the strategic plan together'), culture related (e.g. 'there is high and focused change readiness throughout the organization') or related to metrics the business can understand (e.g. 'business and IT performance is assessed by using mutually dependent indicators, with respect to external partners'). If alignment is considered an objective of EA, these sub-objectives have to be attained too. The EA function is only partly responsible for the back-office processes of the business. The business is captured to determine the requirements for solutions, but is not designed by the EA function; IT does not drive the business. By including the business in architectural processes, the scope and potential of the EA function is broadened. Experts support a broadening of the EA function's scope to include the business (eventually). The EA currently has more of an EITA (Enterprise IT Architecture) character. In short: the business should be addressed and involved to a larger extent. We are fully aware of the fact that this recommendation is very case-specific and cannot be generalized.

- **Objectives of EA should be defined, specified and formalized in a more detailed and measurable way.** Currently there does not seem to be a common vision on which objectives to attain on the short-term, mid-term or long-term. Such a common vision is absent among the decision-making function, but also among the delivery-function. Respondents in both groups had quite different perceptions of the objectives of the EA. There is no formalized set of objectives that is measurable (either by perception or measurement data). Abstract objectives like stability and simplification of the IT

  lized. However, the contribution of the EA function to the attainment of such objectives is difficult to isolate; such objectives are hard to trace back to the EA function. Furthermore, these abstract objectives are ill-defined; questions on the meaning of stability or simplification are inevitable. Finally, operationalization of such abstract objectives proved to be quite difficult. A formalized set of objectives, based on the decomposition delineated in the measurement model is necessary, specified according to various stages in the EA life cycle. FinaCom could be motivated to adopt the dimensions of alignment and agility objectives by communicating the potential of EA implementation as described by the model.
- **The formal set of objectives should be operationalized qualitatively and/or quantitatively.** None of the objectives that are found relevant by the EA decision-makers have been qualitatively operationalized (like the measurement model) nor quantitatively (using metrics) operationalized and related to EA implementation, with the exception of one central KPI focusing on the compliancy of new solutions to architecture standards (considered an efficiency aspect of EA implementation). Some metrics and KPIs have been defined, but are mostly not measured throughout the organization, and not related to EA implementation. Metrics need to be defined *and*

[6] For this recommendation, the measurement model is leading and therefore temporarily assumed correct and complete.

measured, which are related to the EA function (either by the metric definitions or by stakeholder perceptions of the relationship between metrics data and EA implementation). Based on those metrics, leading KPIs and corresponding target values must be specified according to the life cycle stages of the EA function. A combination of a qualitative and quantitative operationalization is preferred though, due to the both tangible (e.g. reduction of amount of applications) and intangible (e.g. motivated employees, better communication between business and IT) nature of EA value (Saha, 2006, de Vries and van Rensburg, 2008, Nightingale and Rhodes, 2004), which is also recognized by FinaCom based on the objectives mentioned.

- **To measure the attainment of the alignment objective, there should be more focus on internal monitoring, governance, partnership and readiness for change specifically[7].** This is partly implied by the first recommendation, but will be discussed separately again. Apparently, alignment is an objective to be attained. However, 61% of the indicators of the measurement odel have not been mentioned. The EA function should focus on business-IT linked metrics and SLAs to improve internal monitoring. Governance issues should focus on business and IT planning and value integration equally. More emphasis should be on trust between various business and IT parties. The culture of change among employees should achieve additional attention. Without measuring the attainment of those objectives, according to the model, FinaCom is assumed to only partly evaluate its EA function on achieving alignment.

- **Decision-makers should recognize the distinction between the objectives of architecting and the objectives of EA implementation[8].** Respondents seem to focus (i.e. first and most mentioned) on objectives of architecting (e.g. professionalization of architects, and improve architectural maturity). Despite the fact it can certainly be a relevant performance aspect of EA, in the context of its effectiveness it is considered irrelevant. We believe, when measuring the effectiveness of EA, FinaCom/ITO should focus on the attainment of objectives improving the performance of the organization (thus the objectives of EA implementation), not EA implementation as an objective itself (we call this EA efficiency (Hoorn, 2006)).

- **Better communication of potential objectives of EA between the architect community (and within that community) and EA decision-makers.** Based on the findings of the external consultants at FinaCom, it seems external consultants, responsible for the design and implementation of EA products, have a broader perception of the objectives of EA. The fact that stakeholders have not adopted this broader perception *indicates* a lack in communication of the purpose of EA from the experts to the decision-makers. It could also indicate that decision-makers did not effectively communicate FinaCom's objectives concerning EA to the architect community. The respondents indicated the specification of the objective according to the position in the EA implementation path is another issue. Because the respondents apparently acknowledge this problem, we consider it a missed opportunity to communicate the objectives, per 'plateau' in the transition path, to the EA decision-makers. Not knowing when an objective has to be attained, obviously makes formal operationalization of that objective a difficult task. Furthermore, due to the contradictory answers of the external consultants, we believe the architect community at FinaCom should achieve consensus on the operationalized objectives of EA; it seems logical to design the EA according to what it should achieve.

[7] For this recommendation, the measurement model is leading and therefore temporarily assumed correct.

[8] For this recommendation, the conceptual model of EA effectiveness is leading, and therefore temporarily assumed correct.

6.5 Conclusion

First of all, the case study context fits the problem context as defined and explored in Section 1.2. The relevant issues derived in the problem exploration, also apply for FinaCom: (1) the effectiveness of the EA function is not assessed, (2) EA is considered to have both tangible and intangible value, (3) measurement data concerning EA does exist within the organization, (4) different stakeholders have different perceptions of EA, (5) the organization does not have clear objectives for EA defined up-front, (6) the organization has difficulty to isolate the effect of EA (i.e. metrics concerning effectiveness objectives are not related to EA implementation), (7) several initiatives contribute to the attainment of strategic goals, of which EA is only one. Furthermore, the case study and application of the measurement model have led to three conclusions concerning (1) the fit of the measurement model with reality (Section 6.6.1), (2) the fit of the conceptual model, and (3) the usability of both the conceptual model and measurement model in providing recommendations for FinaCom on the other hand (Section 6.6.2).

6.5.1 Fit of the measurement model

The case study provides an early indication of the fit of the measurement model with reality (see Figure 16). The percentage (55%) of indicators acknowledged by both groups of respondents (EA decision-makers and external consultants) *indicates* that the measurement model includes a significant amount of relevant objectives, dimensions and indicators. Furthermore, Capgemini respondents provided a (questionable) early indication of possible generalizability of the model.

58% of alignment indicators are acknowledged to be relevant. However, this also means 42% of the indicators is not acknowledged. Since alignment is an objective of the EA function, this indicates either the model does not include the correct dimensions (e.g. readiness for change) and indicators to measure the achievement of alignment *or* FinaCom respondents are not able to make the alignment concept measurable *or* FinaCom may only aim to achieve specific aspects of alignment. However, the 58% of acknowledged indicators concerning alignment shows the measurement model is a promising starting point to measure the effectiveness of EA. 47% of agility indicators is acknowledged by FinaCom. The 53% of indicators not acknowledged by the respondents may be explained by the fact that FinaCom's EA is focusing on IT, because a large part of the indicators of agility dimensions focus on business aspects. It may also be an indication that financial service providers focus on flexibility, speed and initiation of change, more than external change monitoring and overall quality, although we are aware that this finding may be very case-specific. Nonetheless the 47% of indicators acknowledged shows the measurement model concerning agility is a promising starting point to measure the effectiveness of EA.

In the interviews with the decision-making respondents, in total 13 objectives of EA were mentioned, that are not included in our measurement model. Of these, 8 are potentially new indicators to be added to existing dimensions in the model: (1) 'having a healthy balance between old and new IT systems', (2) 'traceability of decisions', (3) 'identifying re-use possibilities', (4) 'evaluating component business models and industry frameworks', (5) a 'clear long term strategic vision concerning both business and IT', (6) 'stability of the IT landscape', (7) 'reliable projects in terms of budget, lead time and scope', and (8) 'identification of where the main cost issues are'. Two topics that would fit in the category EA efficiency, as discussed earlier, were mentioned as objectives of the ITO's EA function: (1) 'professionalization of architects', and (2) 'documentation of architectural processes'. Furthermore, 3 objectives that are assumed immeasurable according to the impact of the EA and beyond scope of this research. Of these 3 objectives, 1 objective ('risk reduction') is of non-financial, and 2 objectives ('cost reduction' and 'cost effectiveness') are of financial nature. The individual scores on the attributes are presented in Appendix G.

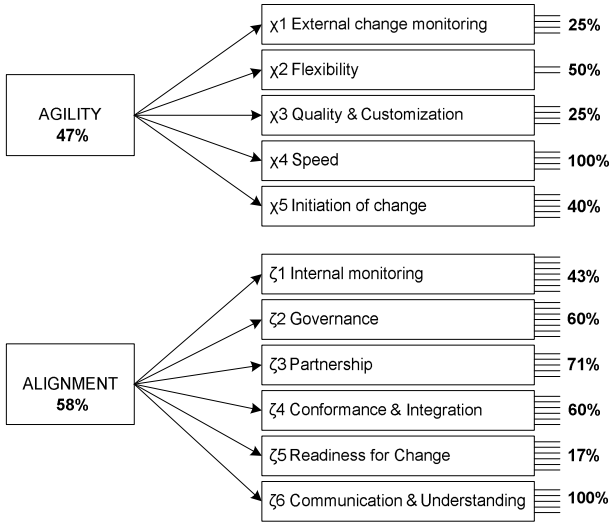

Figure 16. Measurement model as perceived

6.5.2 Fit of the conceptual model

The case study findings provide an early indication of a partial fit of the conceptual model (See Section 4.4, Figure 11). We did not relate specific EA product characteristics to the attainment of alignment and agility objectives, so this relationship remains untested. However, the relationship between the implementation of EA (in terms of working according to the EA governance policy – working under architecture –, consulting EA products, and/or communication with architects) and the attainment of alignment and agility objectives has been investigated in this research. The findings provide an early indication that EA implementation *should* lead to the attainment of alignment and agility. However, whether EA implementation indeed did contribute to the attainment of these objectives remains untested, because an actual assessment has not been performed due to time limitations and political issues within FinaCom. Moreover, respondents also considered professionalization of architects and architecture maturity as objectives of EA, indicating the conceptual model may be incomplete concerning these objectives. Nonetheless, we consider these aspects of efficiency (or in other words: effectiveness of architecting, not EA implementation), until further research has been performed. The respondents may have mentioned these objectives because the difference between the objectives of architecting and the objectives of EA implementation was not clear to them (although we tried to avoid this in the interviews).

6.5.3 Usability in providing recommendations

Temporarily assuming both the conceptual model and the measurement model are correct (of which we are aware it is a big assumption to make), the case study shows that the models may provide guidance in identifying and structuring the objectives of EA at a specific organization, based on interviews and a document study. The measurement model helped in discerning between various EA objective-expressions, as well as identifying the gap between theoretical objectives of EA and the objectives of FinaCom's EA Function. This may prevent FinaCom from operationalizing objectives irrelevant for EA effectiveness. Furthermore, the conceptual model helped in discerning between various aspects of EA performance (e.g., efficiency and effectiveness). All in all, by interpretation of the author, the conceptualization of EA and the operationalization of its objectives contributed greatly in providing recommendations for improvement concerning EA effectiveness in this case.

PART IV: CONCLUSION

7. Conclusion

The purpose of this research was to design and test an initial conceptual model and initial measurement model to guide organizations in assessing the effectiveness of EA and answer the question: *How to measure the effectiveness of EA?* By designing and testing the models, we provided an early foundation for such a measurement and gained valuable insights concerning the measurement of EA effectiveness.

To gain an understanding of what EA effectiveness is, we described the aspects and processes of EA (*What does EA, as a management discipline, entail?)*. Furthermore, we identified the main objectives of EA implementation (*What are the main objectives of EA implementation?*), and operationalized them qualitatively in terms of dimensions and indicators (*How can the main objectives be measured?*). Then, we described the relationship between EA implementation and the attainment of its objectives (*How does EA implementation contribute to the attainment of its objectives?)*. Based on these descriptions, a conceptual model of EA effectiveness and a measurement model of alignment and agility have been created. Both models have been tested by conducting a case study at a large financial services company (*To what extent does the operationalization match (case-specific) reality?*), leading the specific recommendations (*How do these findings lead to(case-specific) recommendations?)*.

This research (1) created an overview of problems organizations may encounter when starting an assessment of its EA effectiveness (see Section 7.1), (2) provided a foundation of what EA effectiveness is (see Section 7.2), (3) provided a foundation to measure the effectiveness of EA implementation (see Section 7.3), and (4) provided an indication of how a correct measurement tool may aid in providing recommendations for organizations (Section 7.4). Furthermore, research limitations and recommendations for future research are provided in Section 7.5 and Section 7.6 respectively.

7.1 Problems organizations may encounter

General, potential, issues, organizations may encounter concerning the measurement of the effectiveness of EA have been identified: (1) EA has both tangible and intangible value, (2) measurement data concerning EA often does not exist within the organization, or it is very time-consuming to extract, (3) Different stakeholders have different perceptions of EA, (4) assessing the effectiveness based on perceptions is a multi-level problem (i.e. perceptions of different organizational levels should be weighted preceding aggregation), (5) most organizations do not have clear objectives for EA formulated up-front, (6) organizations have difficulty to isolate the effect of EA, (7) objectives of EA change during the implementation path, (11) most employees do not know about architecture, (12) several initiatives contribute to the attainment of strategic goals, of which EA is only one, and (13) there is little guidance in determining the effectiveness of EA available.

7.2 Conceptual model of EA effectiveness

Figure 17 shows for which relationships in the conceptual model we have found an indication of plausibility (dotted lines represent a relationship that is not tested, while straight lines represent a relation for which we have an indication of plausibility). We now have reason to believe the effectiveness of EA implementation can be determined by measuring the attainment of agility and alignment objectives. However, respondents also considered other objectives to be attained (e.g., professionalization of architects and architecture maturity). Although we believe these are efficiency aspects and not part of effectiveness, more research is necessary on this topic.

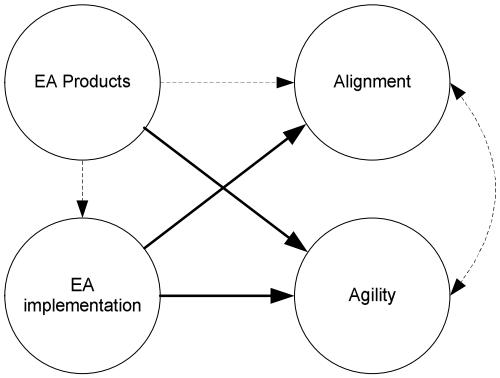

Figure 17. Conceptual model result

7.3 Measurement model

The case study provides an early indication of the fit of the measurement model. Although, several indicators may have to be added to and/or omitted from the model, the measurement model provides an early foundation of how to measure the effectiveness of EA implementation. Additional research has to be performed in order to come to a reliable and valid measurement instrument for EA effectiveness.

7.4 Usability

The conceptual model proved to be helpful in discerning between various perceptions on EA effectiveness (i.e. the difference between effectiveness of architecting – efficiency –, and EA implementation). Furthermore, the measurement model aided in discerning between various definitions of EA objectives. We feel a clear conceptualization of EA effectiveness and a proper measurement model or instrument will enable organizations to easily measure the effectiveness of EA, despite the refinement the models need.

7.5 Research limitations

This research has a few limitations. First of all, interviewees providing an indication of the external validity of the critical issues were all affiliated with Capgemini and operating foremost within the financial services industry. Furthermore, the measurement model was addressed only very shortly. External validation can therefore not be claimed based on these interviews (e.g. architects of other companies may come to different answers). Another limitation is the validity of the measurement model. The model could not be tested quantitatively on internal validity due to the small sample size of interviewees. External validity (generalizability) has not been tested either, because only one case-study has been performed. Furthermore, different types of organizations are expected to pursue different objectives. Therefore, the validity of the measurement instrument may differ per organization, or type of organization. Consequently, the findings may thus be explained by the specific focus of FinaCom's EA and say only little about the fit of the model concerning the indicators not mentioned. This research only addressed one organization. Another important limitation is the fact that the usefulness of both the conceptual and measurement model has been evaluated by the author and therefore is highly subjective. Different researchers may come to different conclusions (although this is not expected). Finally in this research, an actual effectiveness assessment has not been performed. Consequently, we did not prove that EA implementation is in fact capable of attaining the objectives alignment and agility (or a sub-set of its dimensions).

7.6 Recommendations for future research

Since respondents indicate presumed EA efficiency aspects are also part of effectiveness, additional research on the interplay between efficiency and effectiveness in the field of EA is recommended. In other words, the relationship between architecting and implementation of EA, and between architecting and the attainment of objectives should be investigated. Furthermore, the effect of the quality of EA products (e.g. the use specific standards or the comprehensiveness of the EA in terms of areas of concern) on the attainment of objectives needs to be determined, since this research did not address this relationship. The number of respondents in the case study was not large enough to conduct a quantitative analysis of the internal and external validity of the conceptual and measurement model. Statistical analysis on the relationships and constructs of the models, based on a large amount of case studies with a sufficient amount of respondents, is recommended. Moreover, this research may provide a foundation for longitudinal research at organizations in different industries, to investigate the change in EA objectives (Amour and Kaisler, 2001) for various types of organizations (Schelp and Stutz, 2007) across time. This thesis can also provide a foundation for research on the development of proper metrics concerning EA effectiveness.

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Appendix A

Overview of globally established EA definitions

Source	Reference	Definition
IEEE	**(Maier, 2001)**	Architecture: the fundamental organization of a system embodied by its components, their relationships to each other and the environment, and the principles guiding its design and evolution.
Zachman	**(Zachman, 1997)**	Architecture is that set of design artifacts, or descriptive representations, that are relevant for describing an object, such that it can be produced to requirements as well as maintained over the period of its useful life.
The Open Group	**(The Open Group, 2006)**	Architecture is: 1. A formal description of a system, or a detailed plan of the system at component level to guide its implementation. 2. The structure of components, their interrelationships, and the principles and guidelines governing their design and evolution over time.
Institute For Enterprise Architecture Developments (IFEAD)	**(Schekkerman, 2004)**	EA is a complete expression of the enterprise; a master plan which "acts as a collaboration force" between aspects of business planning such as goals, visions, strategies and governance principles; aspects of business operations such as business terms, organization structures, tasks, activities and information; aspects of automation such as information systems and databases; and the enabling technological infrastructure of the business such as computers, operating systems and networks.
Office of Management and Budget (OMB)	**(Federal Enterprise Architecture Program Management Office, 2006)**	A management practice for aligning resources to improve business performance and help agencies better execute their core missions. An EA describes the current and future state of the agency, and lays out a plan for transitioning from the current state to the desired future state.
Office of the Chief Information Officer, Department of Commerce		Enterprise Architecture (EA) is a blueprint that explains how the results of Strategic Planning, Performance Planning, Budgeting, Capital Planning and Investment Control, Security and Privacy, Acquisition, and other related IT and general management processes work together to meet the enterprises's mission and objectives. The EA defines the future state of the Department's information technology based on business and technology drivers as well as the transition plan for moving from the current state to the future.
Gartner	**(Lapkin, 2006)**	Enterprise architecture is the process of translating business vision and strategy into effective enterprise change by creating, communicating and improving the key 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.
Capgemini	**(Capgemini, 2007)**	Enterprise Architecture details the structure and relationships of the Enterprise, its business models, the way an organization will work, and how and in what way Information, Information Systems and Technology will support the organization's business objectives and goals. Enterprise Architecture provides an all-encompassing, holistic, end-to-end view of the business in terms of people, process, governance and technology, within (and external to) the business that supports these objectives and goals. Enterprise Architecture is often likened to "City Planning."

Appendix B

Quote #	COLUMNS: **GROUPED OBJECTIVES** ROWS: **OBJECTIVES MENTIONED IN LITERATURE**	**Alignment**	**Agility**	Reduce	**Improved**	Improve	**knowledge**	**system**	**reduced**	**cost**	reuse	**quality**	governanc	resource	complianc	efficiency
	TOTALS:	**41**	**27**	**4**	**27**	**2**	**10**	**19**	**10**	**10**	**4**	**21**	**3**	**2**	**1**	**3**
1	coherence to the expression and implementation of strategy (Veasy, 2001)	1														
2	help in managing change (Veasy, 2001)		1													
3	reduce complexity (Veasy, 2001)			1												
4	increase the precision with which strategy and plans can be articulated (Veasy, 2001)	1														
5	reduce misunderstandings (Veasy, 2001)				1											
6	sharpen focus on priorities (Veasy, 2001)					1										
7	more precise scoping of programme's projects (Veasy, 2001)	1														
8	identify inter-project impacts (Veasy, 2001)				1											
9	identify solution sharing potential (Veasy, 2001)	1			1											
10	cultural and process impact identification (Veasy, 2001)				1											
11	aid the CIO decision-making process (Johnson et al., 2004)				1											
12	Alignment (Zachman, 2001)	1														
13	integration (Zachman, 2001)						1	1								
14	managing change (Zachman, 2001)	1	1													
15	reduced time-to-market (Zachman, 2001)								1							
16	readily available documentation of the enterprise (Brown, 2003)				1		1									
17	ability to unify and integrate business processes across the enterprise (Brown, 2003)	1														
18	ability to unify and integrate data across the enterprise and to link with external partners(Brown, 2003)	1						1								
19	increased agility by lowering the complexity barrier (Brown, 2003)		1	1												
20	reduced solution delivery time and development costs by maximizing reuse of enterprise models(Brown, 2003)	1							1	1	1					
21	ability to create and maintain a common vision of the future shared by both the business and IT communities, driving continuous business/IT alignment(Brown, 2003)	1			1											
22	integrating business and IT, by providing traceability (Wegmann, 2002)	1														
23	reduce time-to-market of new business functionality (Hoogervorst, 2004)								1							
24	ensure seamless interoperability and interconnectivity of systems, networks and data sources (Hoogervorst, 2004)							1								
25	reduce IT complexity and costs (Hoogervorst, 2004)			1						1						
26	business and organizational integration (Hoogervorst, 2004)	1														
27	agility and the ability to change(Hoogervorst, 2004)		1													
28	enable business and process flexibility (Schekkerman, 2005)		1													
29	simplify technology and applications portfolio (Infosys, 2007)			1				1								
30	better align business and IT organizations (Infosys, 2007)	1														
31	improve process effectiveness (Infosys, 2007)											1				
32	move to a loosely coupled, component-based architecture (Infosys, 2007)		1								1					
33	enable business and process change (Infosys, 2007)		1													
34	reduce time or risk to deliver IT projects (Infosys, 2007)				1				1							
35	reduce IT cost (Infosys, 2007)									1						
36	improve customer satisfaction (Infosys, 2007)											1				
37	standardize business processes (Infosys, 2007)	1														
38	improve ability to exchange information between business units (Infosys, 2007)	1					1									
39	support organizational change, restructuring, mergers, acquisitions (Infosys, 2007)	1	1													
40	eliminate or re-architect legacy (Infosys, 2007)		1					1								
41	optimize value generated from IT investments (Infosys, 2007)											1				
42	improve reliability/availability of processes and systems (Infosys, 2007)											1				
43	enable effective IT governance (Infosys, 2007)												1			
44	enable IT innovation (Schekkerman, 2005)		1													
45	upgrade to new operating system/platform versions		1													
46	resource management (Christiansen and Gøtze, 2006)													1		
47	improved service delivery (Christiansen and Gøtze, 2006)											1				
48	enable outsourcing (Christiansen and Gøtze, 2006)	1			1			1								
49	legacy transformation (Christiansen and Gøtze, 2006)		1					1								
50	infrastructure renewal (Christiansen and Gøtze, 2006)		1													
51	improve cross-governmental interoperability (Christiansen and Gøtze, 2006)	1						1								
52	improve process effectiveness (Christiansen and Gøtze, 2006)											1				
53	reduce time to deliver IT projects (Christiansen and Gøtze, 2006)								1							
54	enable greater flexibility in business processes (Christiansen and Gøtze, 2006)		1													
55	better align business and IT organizations (Christiansen and Gøtze, 2006)	1														
56	support and enable business change (Christiansen and Gøtze, 2006)		1													
57	reduce IT cost (Christiansen and Gøtze, 2006)									1						
58	support out/in sourcing (Schekkerman, 2005)	1			1			1								
59	helpful by mergers and acquisitions (Schekkerman, 2005)	1			1			1								
60	delivers road maps for change (Schekkerman, 2005)		1		1											
61	supports business & IT budget prioritization (Schekkerman, 2005)					1										
62	manages IT portfolio (Schekkerman, 2005)							1								
63	supports system development (Schekkerman, 2005)															
64	delivers inisght and overview of business & IT (Schekkerman, 2005)				1											
65	managing complexity (Schekkerman, 2005)		1													
66	supports decision-making (Schekkerman, 2005)				1											
67	legacy transformation (Schekkerman, 2005)		1					1								
68	infrastructure renewal (Schekkerman, 2005)		1													
69	business-IT alignment (Schekkerman, 2005)	1														

70	transformation road map (Schekkerman, 2005)		1		1										
71	application renewal (Schekkerman, 2005)		1												
72	mergers/acquisitions (Schekkerman, 2005)	1			1		1								
73	business change (Schekkerman, 2005)		1												
74	ERP implementation (Schekkerman, 2005)														
75	Providing a full and coherent overview and understanding of an enterprise, and where the competitive value exists i.e. people, roles, processes, organization, goals, policies, rules, events, locations, etc. (Capgemini, 2007)				1										
76	Enabling business process improvement by structuring the business according to key services needed by the enterprise, based on a clear understanding of the goals and drivers of the business. (Capgemini, 2007)	1													
77	Identifying and eliminating (or resolving) duplication across the enterprise, enabling a move towards a "shared service" model, including identification of those non-core services that may be better sourced externally. (Capgemini, 2007)	1			1		1								
78	Ensuring business compliance. (Capgemini, 2007)	1													
79	Reducing solution delivery time and development costs by maximizing reuse of architecture models and existing systems, services and solutions. (Capgemini, 2007)							1		1					
80	Improving project success by reducing risk and complexity and having early visibility of IT and business issues inside and outside the project. (Capgemini, 2007)		1		1										
81	Reducing the risk of IT non-compliance with key regulations, especially as business becomes more regulated, e.g. HIPAA, Sarbanes-Oxley, etc. (Capgemini, 2007)	1												1	
82	Improving IT planning and the management of IT roadmaps and portfolios, also enabling improved planning for resource skills and training. (Capgemini, 2007)		1		1		1						1		
83	Implementing and managing security by design instead of reacting to breaches as they are discovered. (Capgemini, 2007)										1				
84	Delivering solutions that meet IT Service Level definitions that are linked back to real business objectives. This will reduce instances of costly, overengineered solutions. (Capgemini, 2007)	1							1						
85	Reducing the cost of "Business As Usual" by better managing operational costs through the consideration of Governance as part of the overall architecture and not, as is often the case, an afterthought. (Capgemini, 2007)								1			1			
86	Improving Business and IT alignment, allowing, for example, the identification of misalignment of individual projects with strategic outcome in early stages. (Capgemini, 2007)	1													
87	Cost Control and Improved ROI by ensuring departmentally-focused project teams can understand what shared or reusable services are available and long-term costs of not using these. (Capgemini, 2007)				1				1						
88	Increased Agility and Competitiveness where IT becomes an enabler and partner for the business, instead of being seen as a cost or constraint. (Capgemini, 2007)	1	1												
89	Helping Deliver Strategy and Better Business/IT Alignment through the governance model for solution development and portfolio management from an Enterprise Architecture. (Capgemini, 2007)	1										1			
90	Ensuring alignment of data and information management with business objectives (e.g. partnerships). (Capgemini, 2007)	1													
91	Creating and maintaining a common vision of the future that is shared by both the Business and IT communities. (Capgemini, 2007)	1			1										
92	Process effectiveness (Metastorm, 2007)										1				
93	Opportunity creation (Metastorm, 2007)		1												
94	Operational efficiency (Metastorm, 2007)														1
95	Automation efficiency (Metastorm, 2007)														1
96	Increased collaboration with multiple stakeholders—through precise, standardized communication about the essential elements and functioning of the enterprise (Sullivan, 2004)	1			1		1								
97	Centralized, stable and consistent information about the enterprise and its assets such as applications, hardware, databases and human resources (Sullivan, 2004)						1								
98	Faster response and flexibility in the face of change—making it easier for an organization and its system partners to manage changes as they occur (Sullivan, 2004)		1								1				
99	Improved return on investment (ROI) on an organization's various IT implementations—by reducing the duplication and inconsistencies in the information and accelerating the delivery of systems from integration or outsourcing partners (Sullivan, 2004)						1				1				
100	More predictable results—when the information about the enterprise is more precise and supported by automated traceability, higher quality and better decision making can be achieved (Sullivan, 2004)				1						1				
101	Cost avoidance or reduction (Sullivan, 2004)								1						
102	reduction in development and deployment cycles (Sullivan, 2004)							1							
103	reduction in support and maintenance costs (Sullivan, 2004)								1						
104	improvement in time-to-market for applications needed to grow the business (Sullivan, 2004)							1							
105	risk mitigation by limiting the acquisition of incompatible architectures or systems (Sullivan, 2004)	1					1								
106	Common visiion and shared principles between business and IT (alignment) (Sullivan, 2004)	1													
107	Consensus-driven creation of deliverables and processes/governance as an organization (Sullivan, 2004)	1													
108	Enhanced communications and knowledge (Sullivan, 2004)				1		1								
109	Common language and centralized information (Sullivan, 2004)	1			1		1								
110	Appropriate government information and services will be accessible regardless of location, time, and method of access and group (e.g. language, culture, age and ability). (Ryan et al., 2005)						1								
111	Access to information and services will be authenticated to the degree required by specific information and services. Information will be protected to the level required both internally and externally.(Ryan et al., 2005)										1				
112	Coherent and navigable access will be provided across multiple points of interaction for government information and services spanning departments and other levels of government (i.e., "no wrong door").(Ryan et al., 2005)	1													
113	Government information and services will quickly respond to the client's changing expectations										1				
114	Government service levels and functionality, focused on citizen values that are provided via technology improvements will be pursued providing there is no proportional impact relative to costs. Costs and quality will be considered as 'tradeoffs' to the citizen value equation.(Ryan et al., 2005)										1				
115	Government will reduce the total cost of ownership of IT investments through the elimination of duplicate infrastructures or support services and the leveraging of economies of scale.(Ryan et al., 2005)						1		1						
116	Government will increase attractiveness for business investment in the State to build stronger local economies.(Ryan et al., 2005)										1				

117	Improved developer productivity (van den Berg and Hoogervorst, 2004)														1
118	Faster realization of system interfaces (van den Berg and Hoogervorst, 2004)										1				
119	reduced network traffic (van den Berg and Hoogervorst, 2004)										1				
120	reduced time to fix outages (van den Berg and Hoogervorst, 2004)										1				
121	reduced system downtime (van den Berg and Hoogervorst, 2004)										1				
122	reduced application maintenance and enhancement (van den Berg and Hoogervorst, 2004)										1				
123	improved project delivery (van den Berg and Hoogervorst, 2004)							1							
124	better project definitions (simplified project portfolio) (van den Berg and Hoogervorst, 2004)						1								
125	enhanced re-use of existing designs (van den Berg and Hoogervorst, 2004)									1					
126	improved product roll-out (reduced time to market) (van den Berg and Hoogervorst, 2004)							1							
127	faster information delivery (van den Berg and Hoogervorst, 2004)										1				
128	Common understanding of terms, future operations, processes and change impact (Hain, 2002)				1										
129	facilitation of communication and feedback (Hain, 2002)					1									
130	encouragement of collaboration between groups (Hain, 2002)	1				1									
131	coordination of technology inititiatives (Hain, 2002)	1													
	TOTALS	**41**	**27**	**4**	**27**	**2**	**10**	**19**	**10**	**10**	**4**	**21**	**3**	**2**	**1**	**3**

Appendix C

Quote #	COLUMNS: Dimensions of objectives in measurement model ROWS: Consolidated objectives from Chapter 4	Alignment	Agility	Internal monitoring	Governance	Partnership	Conformance & Integration	Readiness for change	Communication & Understnading	Flexibility	External monitoring	Initiation of change	Speed	Quality
1	Alignment	●	●											
2	Agility		●											
3	Understanding								●					
4	Quality													●
5	System integration						●							
6	Knowledge sharing								●					
7	Time-to-market reduction												●	
8	Cost reduction													
9	Re-use						●							
10	Complexity reduction						●		●					
11	in/out sourcing support								●					
12	Governance				●									
13	Operational efficiency							●					●	
14	Prioritization				●									
15	Resource management							●				●		
16	Compliancy	●	●				●				●			
17	Risk reduction								●					

Consolidated EA objectives can all be mapped upon the measurement model.

Appendix D

Relevant quotes from Capgemini interviews.

Quote	Interviewee
But everybody you ask within a company will give you another view: what is the truth then? You should work with an average of a number of people.	Level 4 certified architect
Many companies do things of which they didn't formulate upfront what they want to accomplish with it and what isn't measurable afterwards.	Level 4 certified architect
The annoying thing is that to measure, you need a norm and it is very difficult to create an objective norm to measure easily against.	Level 4 certified architect
And companies at which architecture is quite progressed, are companies that just started with architecture because someone has the belief that it has added value. But I never heard of a business case for creating an architecture department.	Level 4 certified architect
There are a lot of companies that A) don't know the word architecture or B) have very different views on this.	Level 4 certified architect
The tool I use is architecture. I don't sell them architecture. I don't even tell them I use architecture. But I work as an architect.	Level 4 certified architect
For me, these (cost-reduction, risk reduction, returns increase) are not three goals of an organization, but three reasons to change.	Level 4 certified architect
Some companies have a culture concerning changes that it is almost impossible to change these companies. Often, if such a change has to be implemented, a new company is created within the new goal architecture and other companies is left to die.	Level 4 certified architect
What I notice a lot that immediately the discussion arises that it didn't happen due to architecture.	Level 4 certified architect
Organizations don't think in terms of: we need an architect.	Business/Information architect; Business Analyst
Important is: all initiatives lead to the goals of the company.	Business/Information architect; Business Analyst
No of course these(cost-reduction, risk-reduction, returns increase) are the business drivers.	Business/Information architect; Business Analyst
You could say flexibility [is assessed] if people really need to change or only the possibility exists to change.	Business/Information architect; Business Analyst
I think most companies are already happy that they have an architecture function at all.	Business/Information architect; Business Analyst
Implementation of EA takes about 3 to 5 years, so the goals after implementation have been changed drastically most often. So it is critical to identify the goals still valid and the goals already obsolete.	Level 4 certified architect
When EA is assessed in the way you describe it, in a subjective way that is, the answers you get are very personal or even conflicting ("I see I strong decrease in X" versus "The architecture doesn't influence X that much"). In the worst case you won't even get a valuable answer, since many stakeholders don't know how to trace certain 'outcomes' back to the EA.	Level 4 certified architect
Business people only understand the quantitative value of EA: costs and returns is what they care about	Level 4 certified architect
I think I would acknowledge both the qualitative and quantitative value of Enterprise Architecture.	Level 4 certified architect
The main organizational goals as I see them are: 1) cost reduction 2) returns increase and 3) risk reduction in terms of projects gone wrong. EA goals are directly derived from these organizational goals and even may be the same.	Level 4 certified architect
It is almost impossible to compare Enterprise Architectures, because every architecture is different. It is possible to compare the processes though, that's where NAOMI comes in.	Level 4 certified architect
Current research on factors and goals is too high level in my opinion	Level 4 certified architect
Sec architecture and measuring the effectiveness of architecture in practice doesn't happen that much in my perception.	Level 1 certified architect; Assessor
We always do a mixed approach. But in practice that comes down to the fact that we're only able to do a qualitative assessment.	Level 1 certified architect; Assessor
If it exists, it is fairly easy to get that data. But in practice, often that just doesn't exist. Or that it is hidden to an extent that it is very time-consuming to extract.	Level 1 certified architect; Assessor
In the average IT organizations, measurements are not yet done.	Level 1 certified architect; Assessor
Assessments take between 3 to 8 weeks. Otherwise, if it is shorter, you don't	Level 1 certified architect; Assessor

measure anything. Then you only quick scan, that's also possible. If you conduct a longer assessment, you don't have the effect of the measurement. You have to provide the status of an organization on a certain point, not too long, in time. A stamp.	
You isolate by conducting an assessment by using a predefined reference frame.	Level 1 certified architect; Assessor
The manager thinks everything is OK, but the work force says we're still not there.	Level 1 certified architect; Assessor
The business manager doesn't want an opinion of a programmer or maintenance guy he doesn't control. Of course we say then that you should involve him in the scope of the process. But it's his choice to decide about that. We give advice, but not binding advice. We don't say that if he isn't involved, we don't do it for you. Then you have a result in the scope you yourself defined.	Level 1 certified architect; Assessor
But the average project employee does not know about architecture functions.	SOA architect & expert group leader (SOA)
Every profit organization has goals like cost reduction, risk reduction and increase of returns.	SOA architect & expert group leader (SOA)
Various types of organizations have different goals	SOA architect & expert group leader (SOA)

* Complete interview transcriptions are available on request.

** Quotes have been translated from Dutch to English

Appendix E

Alignment

Alignment is most often mentioned in various sources on EA goals. Unfortunately, alignment has been given various different meanings in these sources, if any context is given at all. Therefore, a definition of alignment is provided in this section. Furthermore, the concept is described in detail.

Alignment can be defined as *the continuous process, involving management and design sub-processes, of consciously and coherently interrelating all components of the business – IT relationship (Maes et al., 2000).* This definitions states alignment is a dynamic process, occurring on all organizational levels (from strategic to operational). The latter corresponding to the view of the Strategic Alignment model. Alignment has an overall internal focus, which can be extended to external partners. Coherence between functional domains within an organization (business units) is part of alignment, implied by the fact that operations should fit with strategy. This is called horizontal alignment in this research (not to be mistaken with the horizontal arrows in the strategic alignment model to be discussed in this section). Strategy is assumed to be overarching separate functional domains.

Alignment is necessary to internally cope with external dynamics. Organizations need to be harmonious internally, to offer its products and services to its customers appropriately. When people talk about alignment, mostly business-IT alignment is meant (BITA). BITA in a nutshell is about making IT implementations fit for purpose, so that optimal value is created for the business. As explained in the introduction EA as a discipline promises to bridge the gap between business and IT.

Henderson and Venkatraman (Henderson and Venkatraman, 1999) have illustrated the aspects of alignment in their strategic alignment model (Figure 18). Summarizing, the model proposes six types of alignment: 1) alignment between business strategy and business operations 2) alignment between IT strategy and IT operations 3) alignment between business strategy and IT strategy and 4) alignment between business operations and IT operations. These four types of alignment will lead to two additional cross-alignment types: 5) alignment with IT strategy and business operations and 6) alignment between business strategy and IT operations. These types of alignment are based on two dimensions: strategic fit and functional integration.

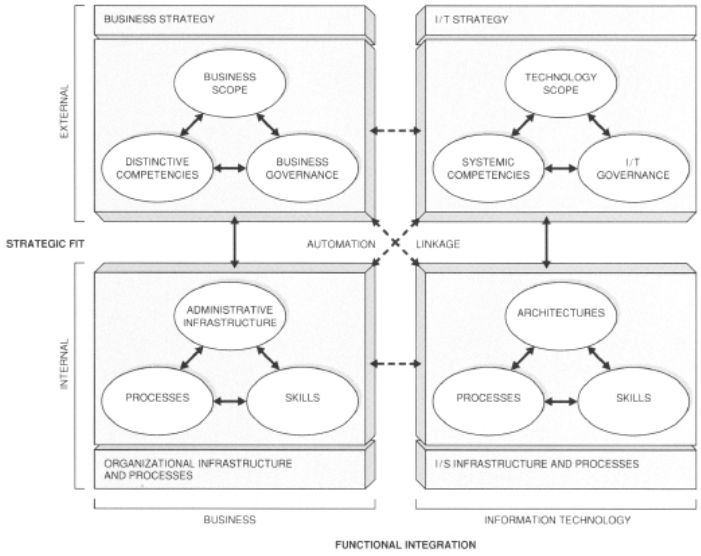


Figure 18. Strategic Alignment Model (Henderson and Venkatraman, 1999)

The Generic framework from Maes et al. (Maes et al., 2000) includes two additional supporting layers. They argue there is no direct relationship between business and IT and strategy and operations. Business and IT communicate through information sharing, while strategy is translated to operations through organizational structures (see Figure 19).

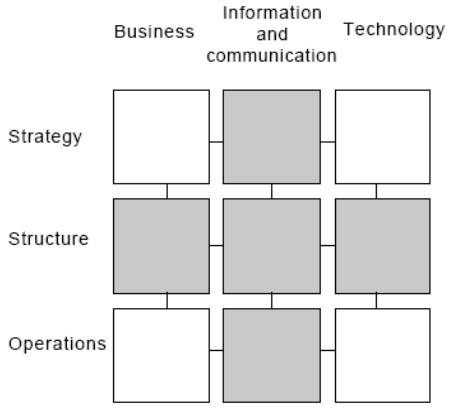


Figure 19. A generic framework for the business -IT relationship (Maes et al., 2000)

Although strategy has an external focus, alignment concentrates on the internal harmony. Henderson and Venkatraman (Henderson and Venkatraman, 1999) identify four perspectives on alignment: the strategy execution, technology transformation, competitive potential and service level perspective. Each perspective consists of a driver domain, a levering domain and the domain being impacted, based on the strategic alignment model. In the strategy execution perspective business strategy is defining the IT infrastructure through the business processes. This is the most classic, bottom-down view. In the technology transformation perspective, the best IT strategy is chosen to articulate the business strategy, translated to IT infrastructure. In both perspectives, business drives IT. In the competitive perspective, technology can influence the business strategy by exploring new technologies, eventually demanding a certain organizational infrastructure. In the service level perspective, IT strategy focuses on customer

demand and leverages business processes through appropriate IT infrastructure adaptation. These last two perspectives focus on IT as a business driver. Each of these perspectives is of equal importance, illustrating the way business influences IT and vice versa.

An additional aspect, implied, but not explicitly mentioned by these models, is the difference between horizontal and vertical alignment. Vertical alignment concerns the strategic fit between strategy and operations, while maintaining the functional integration between the business and IT domain. The functional integration is illustrated by the Strategic Alignment model of Henderson and Venkatraman (1999) as a horizontal relationship. This is not the same as horizontal alignment. Business and IT are just different areas of concern, which can be addressed vertically on several organizational levels (strategic, tactical, operational). Vertical alignment is what the alignment models discussed are addressing. An aspect they fail to address explicitly is the existence of various business lines or business units within organizations. Organizations may operate according to a horizontally decentralized organizational structure. This horizontal decentralization may lead to specific business units. The business unit classification can either be based on various functional purposes or diversified markets (Mintzberg, 2003). Although the strategic fit assumes horizontal alignment, business units within organizations may have various interpretations of the organization-wide business and/or IT strategy. So within the alignment elements in general as described by Henderson and Venkatraman, complemented by those of Maes et al., horizontal alignment between various business units is crucial. So the organization-wide strategy is translated to and formed by various business units, each having its own alignment properties. This is illustrated by Figure 20. The thick black horizontal arrows represent the horizontal alignment.

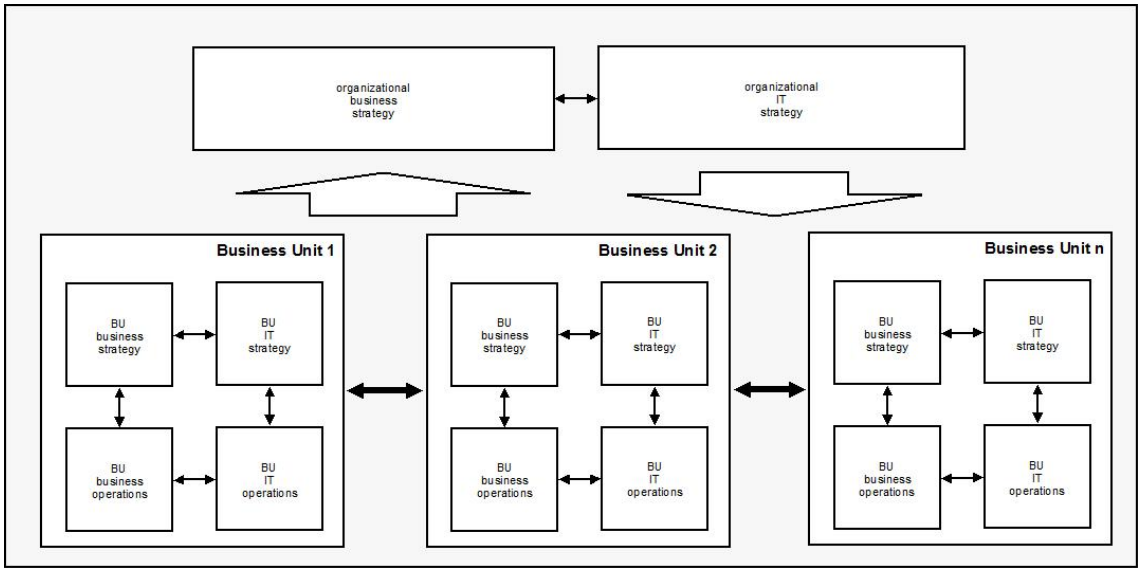


Figure 20. Horizontal BU alignment (not including the extra dimension of Maes et al.)

In summary, alignment entails vertical alignment, in terms of functional integration and strategic fit, and horizontal alignment between business units. The latter is only of importance in case of a divisional organizational structure, which is expected to be the case in EA eligible organizations (which are generally quite large).

As mentioned before, the term integration is closely related to alignment (even mentioned as a separate alignment dimension in the Strategic Alignment model. However, in this research, integration is perceived a different concept as the following definition will explain.

Appendix F

Questionnaire "the goals of the EA function"
Date of distribution 03-10-2008 | Response deadline 10-10-2008

The purpose of this questionnaire is to specify the *direct* goals of the FinaCom ITO EA function. An EA goal reference model is to be used as input for this goal specification. Based on interviews held with five EA function stakeholders, documents and input from two LoB workshops, we have identified a large number of goals in the EA goal reference model as relevant for the ITO EA function. However, some remaining goals mentioned in the EA goal reference model are not (yet) explicitly mentioned by ITO. Furthermore, several goals are mentioned by ITO which are not included in the EA goal reference model as direct goals of architecture. The objective of this questionnaire is to capture your knowledge in determining what the detailed goals of the EA function are. Interviews may follow in case of further questions from either side. You should be able to complete this questionnaire in approximately one hour and a half. **Please consult the appendix (explaining the meaning of the goals) in case of unclear terminology.**

Your name:

Your role regarding the EA function:

The following EA reference goals were not identified explicitly as EA function goals by ITO stakeholders. **Does/should the EA function (through architects, processes or architectures/policies) <u>directly</u> contribute to achieving the following goals?** Please motivate your answers.

1. General

1.1 Alignment								
Yes		Yes, if rephrased		No		I don't know		
Why?								
1.2 Agility								
Yes		Yes, if rephrased		No		I don't know		
Why?								

2. Alignment – Internal monitoring

2.1 Business metrics are defined and measured, considering costs, ROI and customer value, extended to external partners (e.g. suppliers)								
Yes		Yes, if rephrased		No		I don't know		
Why?								
2.2 IT metrics are defined and measured, considering technical attributes, cost efficiency, ROI and cost effectiveness, extended to external partners (e.g. suppliers)								
Yes		Yes, if rephrased		No		I don't know		
Why?								

2.3 Business , partners and IT metrics are linked								
Yes		Yes, if rephrased		No		I don't know		
Why?								
2.4 Service Level Agreements are used enterprise-wide, extended to external partners (e.g. suppliers)								
Yes		Yes, if rephrased		No		I don't know		
Why?								
2.5 Benchmarks are routinely performed in collaboration with external partners (e.g. suppliers)								
Yes		Yes, if rephrased		No		I don't know		
Why?								
2.6 There are routine practices for continuous improvement								
Yes		Yes, if rephrased		No		I don't know		
Why?								

3. Alignment – Communication and understanding

3.1 There is two-way informal communication between business and IT								
Yes		Yes, if rephrased		No		I don't know		
Why?								

4. Alignment – Governance

4.1 There is a federated reporting/organizational structure where the CIO reports to the CEO								
Yes		Yes, if rephrased		No		I don't know		
Why?								
4.2 IT investment management is based on business value, extended to business partners								
Yes		Yes, if rephrased		No		I don't know		
Why?								
4.3 The formal business strategy planning is integrated across the enterprise and developed with IT and partners								
Yes		Yes, if rephrased		No		I don't know		
Why?								
4.4 The formal IT strategy planning is integrated across the enterprise and developed with business and partners								
Yes		Yes, if rephrased		No		I don't know		
Why?								

5. Alignment – Partnership between business and IT

5.1 IT enables and drives the business strategy in a co-adaptive way								
Yes		Yes, if rephrased		No		I don't know		
Why?								
5.2 IT program management is based on continuously improved standards								
Yes		Yes, if rephrased		No		I don't know		
Why?								
5.3 Business and IT are trusted partners								
Yes		Yes, if rephrased		No		I don't know		
Why?								
5.4 Business is IT sponsor								
Yes		Yes, if rephrased		No		I don't know		
Why?								

6. Alignment/Agility – Culture of change

6.1 Innovation and entrepreneurship by employees is the norm								
Yes		Yes, if rephrased		No		I don't know		
Why?								
6.2 Executives, including CIO and in collaboration with partners, have decision power								
Yes		Yes, if rephrased		No		I don't know		
Why?								
6.3 Management style is relationship based								
Yes		Yes, if rephrased		No		I don't know		
Why?								
6.4 There is high and focused change readiness throughout the organization								
Yes		Yes, if rephrased		No		I don't know		
Why?								
6.5 There are career crossover opportunities								
Yes		Yes, if rephrased		No		I don't know		
Why?								
6.6 Cross-functional training is formalized by systematic programs throughout the organization, extended to partners								
Yes		Yes, if rephrased		No		I don't know		
Why?								

6.7 The social, political and interpersonal environment is based on trust and confidence in customers and partners								
Yes		Yes, if rephrased		No		I don't know		
Why?								

7. Agility – Monitoring of external environment

7.1 Responsiveness to change in customer preferences and demands								
Yes		Yes, if rephrased		No		I don't know		
Why?								
7.2 Responsiveness to social, regulatory and environmental issues								
Yes		Yes, if rephrased		No		I don't know		
Why?								
7.3 Adjustability of business and/or IT strategy based on trend reports								
Yes		Yes, if rephrased		No		I don't know		
Why?								

8. Agility – Flexibility

8.1 Flexible product/service model								
Yes		Yes, if rephrased		No		I don't know		
Why?								
8.2 Flexible IT systems								
Yes		Yes, if rephrased		No		I don't know		
Why?								

9. Agility – Speed

9.1 Shortest time between identifying necessary changes and acting upon that identification								
Yes		Yes, if rephrased		No		I don't know		
Why?								
9.2 Shortest time of educating employees								
Yes		Yes, if rephrased		No		I don't know		
Why?								
9.3 Shortest time of operations (time needed for end-to-end chain)								
Yes		Yes, if rephrased		No		I don't know		
Why?								

10. Agility – Quality and customization

10.1 Product/service quality								
Yes		Yes, if rephrased		No		I don't know		
Why?								

10.2 IT quality								
Yes		Yes, if rephrased		No		I don't know		
Why?								
10.3 Customization of products/services								
Yes		Yes, if rephrased		No		I don't know		
Why?								
10.4 Customization of IT systems								
Yes		Yes, if rephrased		No		I don't know		
Why?								

The following goals were identified as EA goals by ITO, but are not included in the EA goal reference model. **Does/should the EA function (through architects, processes or architectures/policies) directly contribute to achieving the following goals?** Please motivate your answers.

11.1 Cost reduction								
Yes		Yes, if rephrased		No		I don't know		
Why?								
11.2 Risk reduction								
Yes		Yes, if rephrased		No		I don't know		
Why?								
11.3 Balancing old versus new systems								
Yes		Yes, if rephrased		No		I don't know		
Why?								
11.4 Identification of where the main cost issues are								
Yes		Yes, if rephrased		No		I don't know		
Why?								
11.5 Traceability								
Yes		Yes, if rephrased		No		I don't know		
Why?								
11.6 Documentation of (architectural) processes								
Yes		Yes, if rephrased		No		I don't know		
Why?								

11.7 Cost-effectiveness								
Yes		Yes, if rephrased		No		I don't know		
Why?								
11.8 Identifying re-use possibilities								
Yes		Yes, if rephrased		No		I don't know		
Why?								
11.9 Evaluating component business models and industry frameworks								
Yes		Yes, if rephrased		No		I don't know		
Why?								
11.10 Reliable projects in terms of budget, lead time and scope								
Yes		Yes, if rephrased		No		I don't know		
Why?								
11.11 A clear (strategic) vision of the coming 5 years concerning both business and IT								
Yes		Yes, if rephrased		No		I don't know		
Why?								
11.12 Professionalization of architects								
Yes		Yes, if rephrased		No		I don't know		
Why?								
11.3 Stability								
Yes		Yes, if rephrased		No		I don't know		
Why?								

Any questions and/or remarks?

Thank you for completing this questionnaire!
You will be contacted whether a subsequent interview is deemed necessary.

Appendix: Explanation of EA reference goals

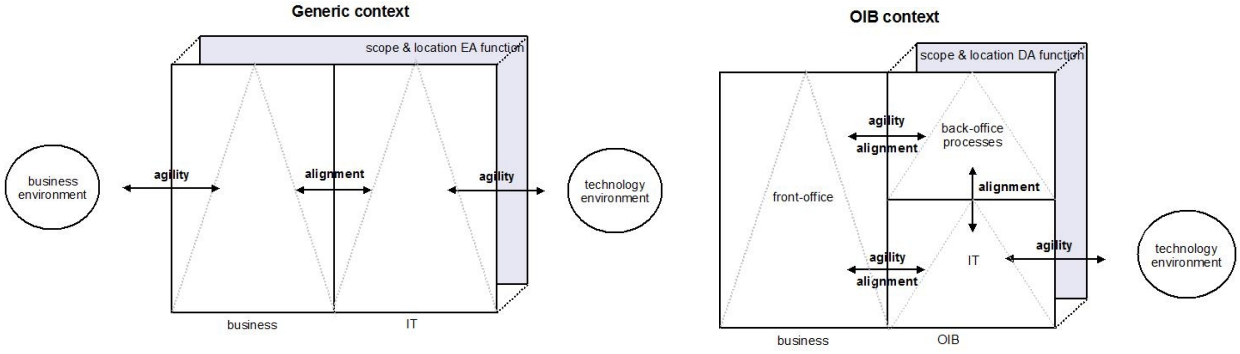
The theoretical potential of EA lies in the realization of business-IT alignment and enterprise agility. These main goals consist of several sub goals, which are measured by assessing specific organizational attributes. This approach thus treats these attributes as specific sub goals of the sub goals. We will call them attributes to make the goal hierarchy clear (main goals -> sub goals – > sub-goals of sub-goals (attributes)). Not all these attributes, or even higher level sub goals may be relevant though. Evaluating the relevance of the sub goals and their attributes requires a thorough understanding of their meaning. This document describes what the attributes entail specifically and how an EA function is able to contribute to realizing those organizational attributes in theory. Please note that the descriptions do not address the FinaCom ITO case specifically, but aim at the generic context of an EA function.

1. Main goals

1.1 The organization is aligned internally
The organization is continuously, consciously and coherently interrelating all components of the business – IT relationship, involving management and design sub-processes. This includes horizontal alignment between verticals, (vertical) fit between strategy and operations, and functional integration between business and IT. The EA function may contribute to alignment by ensuring enterprise-wide adherence to standards specified by the EA documentation for example.

1.2 The organization is agile
The organization is able to sense environmental change and respond appropriately to that change. The EA function may contribute to enterprise agility through proactive architects and identification of interdependencies.

The main goals are formulated in the context of a generic EA function. Based on documents and interviews, the alignment and agility concepts can be positioned somewhat different in the ITO context, compared to the generic context of an EA function. This is illustrated by the figures below. Attributes mention the term 'business' frequently. ***We kindly ask you to specify what you mean by business (font-office or back-office) in your answers when needed, based on the illustrations below (please indicate if you do not agree with the representation of ITO in the first place; use the comments area at the end of the survey).***



2. Alignment - internal monitoring

2.1 Business metrics are defined and measured, considering costs, ROI and customer value, extended to external partners (e.g. suppliers)
Business metrics (or Key Performance Indicators) are defined and are based upon traditional financial approaches and customer value. These metrics take collaboration with external partners (e.g. suppliers) into account. Business metrics are contextual (though internal) input for business or IT change. The EA function may identify necessary business metrics and catalyze the implementation of such business metrics.

2.2 IT metrics are defined and measured, considering technical attributes, cost efficiency, ROI and cost effectiveness, extended to external partners (e.g. suppliers)
IT metrics (or Key Performance Indicators) are defined and are based upon IT quality attributes, cost efficiency, ROI and cost effectiveness. These metrics take collaboration with external partners (e.g. suppliers)

into account. IT metrics are contextual (though internal) input for business or IT change. The EA function may identify necessary IT metrics and catalyze the implementation of such IT metrics.

2.3 Business, partners and IT metrics are linked
Business and IT metrics (or Key Performance Indicators) are correlated. The performance of the organization is being evaluated by relating IT metrics to business metrics with regard to collaboration with external partners (e.g. suppliers). This is done by means of a balanced score-card, included external partners. Linkage of metrics may be facilitated by the EA function through identification of interfaces between business and IT and the need for IT to show its business value due to input for business or IT change.

2.4 Service Level Agreements are used enterprise-wide, extended to external partners (e.g. suppliers)
The collaboration within the enterprise and external partners is improved by using SLA's. SLA's are used on interfaces, which may be identified by the EA function.

2.5 Benchmarks are routinely performed in collaboration with external partners (e.g. suppliers)
Business and IT metrics (separately and linked) are benchmarked against a norm or comparative organizations, in collaboration with partners. The EA function may clarify internal and external relationships and therefore make benchmarking easier: appropriate norms and/or comparable organizations are easier te select.

2.7 There are routine practices for continuous improvement
There are well established practices for continuous improvement, based on well established measurements of effectiveness (business and IT). The EA function may have an EA improvement cycle defined in the EA development process, based on EA effectiveness or business/IT metrics.

3. Alignment – Communication and understanding

3.1 There is two-way informal communication between business and IT
Rigid protocols are avoided in discussions and sharing of ideas between business and IT, making accessing business or IT information and contacts easy. The EA function may be a facilitator in communication through its architects, who know about business and IT without ending up in rigid protocols. They are able to communicate their knowledge in an informal way to business and IT. Transparency in roles and responsibilities may also be created by the EA documentation, which improves ease of access.

4. Alignment - Governance

4.1 There is a federated reporting/organizational structure where the CIO reports to the CEO
The business is also reactive to IT. The CEO knows whether the business strategy needs change according to changes or problems of IT reported by the CIO. Linked metrics reach the CEO in order to be useful. The EA function may contribute by policies and creating active involvement of the business. The EA function clarifies how the business retrieves value from IT.

4.2 IT investment management is based on business value, extended to business partners
Budgeting of IT projects is based upon cost-effectiveness and business value extended to external partners (e.g. suppliers). IT is not seen as a cost center, which leads to a focus on cost reduction and disregarding strategic planning. The EA function may contribute by demanding IT projects to show business value, either by conformance or by granting exceptions. Linked metrics reaching the CEO and architects communicating IT issues to the business may also contribute.

4.3 The formal business strategy planning is integrated across the enterprise and developed with IT and partners
IT and external partners (e.g. suppliers) are involved with the creation of the long term business goals and how to achieve those goals. The business strategic planning does not focus on one specific business unit, but all business units and the organization as a whole. The EA function may contribute by architects bringing business and IT together in strategy meetings, or by the EA documents which clarify the relationship between business and IT on a strategic level.

4.4 The formal IT strategy planning is integrated across the enterprise and developed with business and partners
Business and external partners (e.g. suppliers) are involved with the creation of the long term IT goals and how to achieve those goals. The IT strategic planning does not focus on one specific business unit, but all

business units and the organization as a whole. The EA function may contribute by architects bringing business and IT together in strategy meetings, or by the EA documents which clarify the relationship between business and IT on a strategic level.

5. Alignment – Partnership between business and IT

5.1 IT enables and drives the business strategy in a co-adaptive way
The business strategy is influenced by IT. But IT also has a purely enabling factor: how to realize the strategy. The business strategy is quickly adapted to changes in the business and IT adapts quickly according to changes in the business strategy. The EA function may contribute by clarifying business-IT relationship: consequences of IT developments for the business strategy are made explicit and vice versa.

5.2 IT program management is based on continuously improved standards
IT projects and programs are managed based on their adherence to standards. But projects and programs deviating from standards continuously drive the improvement of existing standards. The EA function may contribute by defining standards and ensuring their adherence and validity through the EA policies.

5.3 Business and IT are trusted partners
There is a long-term partnership between business and IT, beyond IT being only a service provider. Conflicts rarely occur. The EA function may contribute by clarifying the business-IT relationship. Architects may prohibit conflicts. The EA function may delineate a long-term planning of the organization, involving both business and IT.

5.4 Business is IT sponsor
There is a high level corporate level business sponsor or champion for IT programs, preferably the CEO. The EA function may contribute through its architects and by clarifying the business-IT relationship.

6. Alignment / Agility - Culture of change

6.1 Innovation and entrepreneurship by employees, including managers and partners is encouraged
There is an environment in which employees, also at corporate level, are motivated to come up with innovative ideas and start entrepreneurial initiatives. Partners are being involved and are also able to provide innovation input. The EA function may contribute to this by a providing a better understanding of change implications.

6.2 Executives across the organization, including the CIO and partners, have decision power.
Decision-power is at the top of the organization, but both in business and IT areas, avoiding several vendor specific cultures for example, delineating how to operate business and IT. The EA function may contribute by its policies.

6.3 Management style is relationship based
Management style is based on employee relationships. Although performance targets are included, emphasis is on collaboration skills. The EA function may contribute by clarifying responsibilities and exemplifying the need for collaboration with other disciplines.

6.4 There is high and focused change readiness throughout the organization
Employees are proactive and anticipate change. The EA function may contribute by educating employees about possible changes through architects or architectural products.

6.5 There are career crossover opportunities
Employees, also at corporate and business unit levels, regularly transfer from one job to another. There are programs in place to encourage career crossovers. The EA function may contribute by clearly specifying responsibilities and roles, thus identifying potential overlap or creating interest for other areas.

6.6 Cross-functional training is formalized by systematic programs throughout the organization, extended to partners
There are programs running that provide broad training to employees throughout the organization. The EA function may contribute by providing education concerning the EA products. (in fact, the EA function could be one of those systematic programs)

6.7 The social, political and interpersonal environment is based on trust and confidence in customers and partners
The above sentence should speak for itself. The EA function may contribute by providing transparency in relationships, as well as how changes are realized. The as-is and to-be state is described, creating understanding in the current situation, but also trust and confidence in the future.

7. Agility – Monitoring of external environment

7.1 Responsiveness to change in customer preferences and demands
Changes in market trends (business, not technology) and customer behavior are monitored by creating trend reports. The EA function may contribute by incorporating these reports as necessary input in the EA products and by the proactive role of architects.

7.2 Responsiveness to social, regulatory and environmental issues
Changes in law and regulation, social tension or the environment are monitored and recognized. The EA function may contribute by incorporating these reports as necessary input in the EA products and by the proactive role of architects.

7.3 Adjustability of business and/or IT strategy based on trend reports
Creators of the business and IT strategy take recommendations of trend reports into account. The EA function may contribute by clarifying what implications specific trends may have in both business and IT areas.

8. Agility – Flexibility

8.1 Flexible product/service model
The business model anticipates possible required changes in the product/service offering and has predefined ways to offer different products/services than those currently offered. The EA function may contribute by providing a long-term vision and clarifying interdependencies in the EA documents. The visionary role of architects may also play an important role.

8.2 Flexible IT systems
The IT systems (ranging from applications to the technical infrastructure) are able to cope with various throughputs. Changes in IT systems are anticipated and functionality can easily (i.e. without having to change the entire system) be replaced or added through the use of for example a componentized IT approach. The EA function may contribute by providing a long-term vision and clarifying interdependencies in the EA documents. The visionary role of architects may also play an important role. A Service Oriented Architecture may specifically aid in IT flexibility.

9. Agility – Speed

9.1 Shortest time between identifying necessary changes and acting upon tat identification
The time between the recognition of external developments demanding change and the initiation of the change process (presumably started by adapting business or IT strategy based on these developments) is minimized. The EA function may contribute by identifying interdependencies and the clear view of the envisioned end-state of the organization. Architects also play an important role.

9.2 Shortest time of educating employees
Employees on all levels of the organization finish their required courses as fast as possible. The EA function my contribute by early identifying competencies required in the future.

9.3 Shortest time of operations (time needed for end-to-end chain)
The time between the request of a customer or an employee till the time the request has been fulfilled is minimized. Example indicators may be the responsiveness of IT systems, availability of resources, etc. The EA function may contribute by identifying bottlenecks in the end-to-end chain in the as-is architecture, streamlining the end-t-end chain in the future state of the organization and integrating IT.

10. Quality and customization

10.1 Product/service quality
The products/services offered are of high quality. High quality may be expressed by high customer satisfaction for example. The EA function may contribute by matching demand with production.

10.2 IT quality
The quality of IT is high. Specific IT quality attributes are met on technological level (maintainability, capacity, throughput, reliability, etc.). But quality may also be expressed by how its value is perceived; business satisfaction for example. The EA function may contribute by showing bottlenecks in the as-is architecture. Furthermore, the EA function may contribute by ensuring the added value of IT solutions.

10.3 Customization of products/services
Products/services offered can be customized by customers and/or employees by changing parameters. For example: an insurance policy can be customized according to the wishes of the customer. The EA function may contribute by clarifying the possibilities and implications of customization for example.

10.4 Customization of IT systems
IT applications and systems may be customized according to the wishes of the customers and/or employees by changing parameters. Note that this is not the same as IT flexibility. Customization means the degree to which parameters can be changed, without adding components, changing general functionality or capacity. For example: an invoice must be sent to three addresses instead of one; then the 'invoice service/application' must have a 'number of addresses the invoice must be sent to' parameter to start with. The EA function may contribute by showing the relationship between processes, roles and IT, thus identifying possible need for (additional) parameters.

11. Goals mentioned by interviewees and/or documentation (but not by the model)

11.1 Cost-reduction
Speaks for itself. Costs were not specified in the interviews.

11.2 Risk reduction
"Het doel van de validatie is: kwaliteitsverhoging, risico reductie. Als er geen kwaliteit staat in een PID moet dat vroeg geïdentificeerd en verbeterd worden voordat het project gestart wordt. Daarbij moet ook op executietijd gelet worden. Gevalideerde projecten leveren on-time."

11.3 Balancing old versus new systems
Every time implementation of a new system is considered, management weighs up the new system against the existing system(s).

11.4 Identification of where the main cost issues are
Identification of where in the organization costs can be reduced (through re-use of IT solutions, by selecting other vendors, etc.)

11.5 Traceability
"Elk project krijgt de relevante business en ITO requirements mee vanuit de architectuur. De projecten moeten in lijn gebracht worden met de architectuur, zodoende onstaat er traceability."

11.6 Documentation of (architectural) processes
"Wat betreft processen: processen moeten volledig gedocumenteerd en geïmplementeerd zijn door de hele organisatie."

11.7 Cost-effectiveness
"ITO is using a standard driven approach in which cross operations and IT is standardized to simplify the current environment and make this environment more manageable and cost-effective."

11.8 Identifying re-use possibilities
"The number of re-use opportunities the EA function is able to catalyze. Solutions have to be shared and you could monetize that. This could lead to less cost and faster time to market. The EA function get a KPI to find 5% efficiency against the total change portfolio by provable examples of re-use. That could be possible."

11.9 Evaluating component business models and industry frameworks
"Through the EA function, ITO wants to have an opinion on component business models, industry frameworks (IFW for banking and IAA for insurance, etc.). ITO also cares about high level business architectures. That's where added value is created."

11.10 Reliable projects in terms of budget, lead-time and scope

“Betrouwbare verandering houdt in dat er meer gedacht moet worden in de voortrajecten, alvorens te handelen”

“En dan in projecten, zijn deze betrouwbaarder? Op het gebied van budget, doorlooptijd en scope”

11.11 A clear (strategic) vision of the coming 5 years concerning both business and IT

“Er moet vanuit de EA functie een inspirerend verhaal komen betreffende de richting waar we als ITO op gebied van business en IT architectuur naartoe willen gaan. Nu zijn er wel wat karakteristieken, maar wat is de visie? En is die visie up-to-date? Dat kan je gaan meten. De EAfunctie is een middel om zeker te weten dat je je doel bereikt, maar wat is dat doel? Als het doel is dat de CAA architecturen gezien moet hebben, kan je dat monitoren. Maar gaat het nog verder? Wat is het doel?”

11.12 Professionalization of architects

“De EA functie moet ervoor zorgen dat de architectuur rol geprofessionaliseerd worden. Ik heb bijvoorbeeld dit jaar nog een KPI die zegt of architecten getraind en gecertificeerd zijn. Dat is dus in de context van people.”

11.13 Stability

The EA function’s mission: “Ensure the solutions and changes implemented by FinaCom ITO are of high quality, increase stability, and contribute to the simplication of the IT landscape.”

Appendix G

	Decision-making function	Delivery function
Communication indicators: 5	3	3
1) Improved understanding of business by IT	**yes**	/
2) Improved understanding of IT by business	**yes**	/
3) Less communication protocols and more informal communication	no	no
4) Knowledge is shared within and between business IT and extra-enterprise.	**yes**	/
5) Broader and more effective internal and extra-enterprise liason(s)	no	no
Internal monitoring indicators: 7	1	3
1) IT metrics are available concerning technical performance, cost efficiency, ROI, cost effectiveness and external partners.	no	**yes**
2) Business metrics are available based on functional organization, traditional financial indicators, clients and cooperation with external partners	no	unclear
3) Business and IT performance is assessed by using mutually dependent indicators, with respect to external partners	no	unclear
4) Service Level Agreements are used throughout the enterprise, extended to external partners	no	no
5) Benchmarking is routinely performed, with feedback from external partners	no	**yes**
6) Formal assessments and reviews are performed routinely	**yes**	/
7) Continuous improvement takes place based on the assessments using routine practices	no	unclear
Governance indicators: 7	3	5
1) Business strategic planning is integrated across and outside the enterprise	no	unclear
2) IT strategic planning is integrated across and outside the enterprise	no	unclear
3) There is a federated reporting/organization structure where the CIO reports to the CEO	no	**yes**
4) IT is seen as a cost and profit center	**yes**	/
5) Decision-making is steered by partnerships	**yes**	/
6) Prioritization is based on added value , extended to the added value of external partners	**yes**	/
7) IT program management is based on continuously improved standards	no	**yes**
Partnership indicators: 5	1	3
1) Business perceives IT as a partner in creating value	**yes**	/
2) Business and IT develop the strategic plan together	no	no
3) Risks and rewards, concerning goal achievement, are shared among business and IT	no	unclear
4) Business and IT are trusted partners	no	**yes**
5) CEO is IT sponsor/champion	no	**yes**
Conformance & Integration indicators: 6	6	6
1. IT has an external scope and is a driver and enabler for the business strategy	**yes**	/
2. Enterprise and inter-enterprise standards are specified and maintained	**yes**	/

3. The EA is integrated vertically (from strategy to operations)	**yes**	/
4. The EA is integrated horizontally (between business units)	**yes**	/
5. The EA is transparent and flexible across the organization (change projects shape EA)	**yes**	/
6. Synthesis of diverse technologies (system integration)	**yes**	/
Readiness for change indicators: 6	0	1
1. Innovation and entrepreneurship by the employees is the norm	no	unclear
2. There is high and focused change readiness throughout the organization	no	unclear
3. Education and cross-training is possible across the organization	no	**yes**
4. Employees can switch careers across the organization	no	unclear
5. Management style is relationship based	no	unclear
6. A trusted environment is created by valued partnerships	no	unclear
Flexibility indicators: 2	0	1
1) Flexible product model	no	unclear
2) Flexible IT systems	no	**yes**
Responsiveness indicators: 4	1	1
1) Responsiveness to change in customers' preferences, demands	no	unclear
2) Responsiveness to market and technological hanges and trends	**yes**	unclear
3) Responsiveness to social, regulatory and environmental issues	no	unclear
4) Adjustability of business objectives to the changes	no	unclear
Initiation of change indicators: 5	0	2
1) Innovation and entrepreneurship by management is the norm	no	unclear
2) There is high en focused change readiness among management	no	unclear
3) Education and cross-training is possible between management roles	no	**yes**
4) Managers can switch roles	no	unclear
5) Executives, including CIO and partners, have decision-power	no	**yes**
Speed indicators: 4	1	1
Shortest Time-To-Market	**yes**	/
Shortest time between identifying necessary changes and acting upon that identification	no	no
Shortest time of educating employees	no	no
Shortest time of operations (time needed for end-to-end chain)	no	unclear
High quality and customized products indicators: 4	2	4
High product quality	**yes**	/
High IT quality	**yes**	/
Customization of products/services	no	**yes**
Customization of IT systems	no	**yes**

Yes = considered relevant | No = considered irrelevant | Unclear = contradictory responses

Categorization rules

Four experts have been surveyed and interviewed based on their survey response. The following rules have been attained to categorize the attributes as relevant, irrelevant or unclear, based on these expert opinions (right column attribute score overview).

Yes	Yes, if rephrased	No	Don't know	**Unclear**
Yes	Yes	No	Don't know	**Unclear**
Yes	Yes	Yes	Don't know	**Yes**
Yes	Yes	Yes	No	**Yes**
Yes	Yes	No	No	**Unclear**
Yes	No	No	No	**No**
Yes, if rephrased	Yes, if rephrased	Don't know	Don't know	**Depends on motivation**
Yes, if rephrased	Yes, if rephrased	No	Don't know	**Unclear**
Yes, if rephrased	Yes, if rephrased	No	No	**Unclear**
Yes, if rephrased	Yes	Yes	No	**Depends on motivation**
No	No	Don't know	Don't know	**No**
No	No	No	Don't know	**No**

Appendix H

Capgemini has an Internal Architect Certification Scheme for its architecture community. It has four certification levels (whereby levels 1 and 2 are handled by the local or regional Certification Board, and level 3 and 4 are handled by the Global Certification Board of Capgemini):

Level 1: Certified Architect
Level 2: Certified Senior Architect
Level 3: Certified Enterprise Architect
Level 4: Certified Global Architect.

Certification focuses on various areas: responsibility level, engagement type, architecture experience, architecture thinking, IAF experience, IAF knowledge, community contributions, soft skills, and personal profile.

The criteria for the specific levels are as follows.

Level 1: Certified Architect

The first level of certification shows that the individual has gained an initial level of training and engagement experience.

Responsibility Level

- Team Member

Engagement Type

- Stream member in any IAF engagement type

Architecture Experience

- Worked on 3 Architecture Engagements covering at least one IAF Aspect Area (B/I/IS/TI/Sec/Gov)
- Can specialize (and only have experience) in one Aspect Area

Architecture Thinking

- Delivers Logical (not just Physical) Architectures
- Abstracts complex problems, i.e. not just a technical specialist
- Aware of technical and delivery risk and takes active steps to mitigate it

IAF Experience

- Worked on at least 2 engagements with Capgemini using IAF
- Worked on at least 1 engagement in a delivery role
- Worked on Conceptual and/or Logical architectures as well as Physical
- Experience across all four levels in IAF (Contextual, Conceptual, Logical and Physical)

Note that for candidates coming to Capgemini with significant experience in Architecture, one IAF Engagement is sufficient evidence (all other conditions still apply).

IAF Knowledge

- Received training in at least IAF Essentials, Architecture Core, or equivalent IAF course
- Knows the philosophy and can demonstrate understanding rather than applying by rote

Community Contributions

- Participates in discussions on the Architecture Forum

Soft Skills

- Communicates complex technical solutions to technical and non-technical staff effectively
- Recognises stakeholders and their objectives and communicates accordingly

Personal Profile

- Worked directly with client as opposed to e.g. major programme with limited client contact
- Worked with the business as well as technology stakeholders

Level 2: Certified Senior Architect

The second level indicates that the individual has taken on larger projects, providing more significant contribution back into the network and undergone a broader range of training.

Responsibility Level

- Stream Leader

Engagement Type

- Lead Architect in Single IAF Stream or Small Scope (less than 4 Business Areas) Architecture

Architecture Experience

- Worked on at least 5 Architecture Engagements
- Worked on at least 2 complex/multi-stream engagements
- Successfully led at least 2 streams or small engagements
- Worked on at least 2 different Aspect Areas

Architecture Thinking

- Delivers Logical (not just Physical) Architectures
- Abstracts complex problems, i.e. not just a technical specialist
- Aware of technical and delivery risk and takes active steps to mitigate it

IAF Experience

- 3 engagements with Capgemini using IAF
- Experience with all four levels in IAF (Contextual, Conceptual, Logical and Physical)
- At least 1 engagement working through all levels (Conceptual to Physical)

Note that for candidates coming to Capgemini with significant experience in Architecture, one IAF Engagement is sufficient evidence (all other conditions still apply).

IAF Knowledge

- Attended at least one of the IAF Advanced courses, for example Advanced IS&TI

Community Contributions

- Participates in discussions on the Architecture Forum
- Actively mentors others in Architecture and IAF

Soft Skills

- Communicates complex technical solutions to technical and non-technical staff effectively
- Recognises stakeholders and their objectives and communicates accordingly

Personal Profile

- Worked directly with senior client business and technology stakeholders

Level 3: Certified Enterprise Architect

The first Group certification level recognises the ability to tackle a complete and complex business solution for a major account. Do not confuse the title "Certified Enterprise Architect" with the role of Enterprise Architect.

Responsibility Level

- Engagement Leader

Engagement Type

- Lead architect in complex architecture engagements, typically architecture addressing multiple aspect areas, deployment in one geographic region

Architecture Experience

- Worked on more than 5 Architecture Engagements
- Worked on at least 2 complex/multi-stream engagements
- Worked on at least 2 different Aspect Areas
- Successfully led at least 2 engagements

Architecture Thinking

- Delivers Logical (not just Physical) Architectures
- Abstracts complex problems, i.e. not just a technical specialist
- Aware of technical and delivery risk and takes active steps to mitigate it

IAF Experience

- Experienced in more than 3 IAF architecture engagements
- Experience with all four levels in IAF (Contextual, Conceptual, Logical and Physical)
- At least 1 engagement working through all levels (Conceptual to Physical)

Note that at Level 3, candidates can still be specialists (e.g. Business, Information, Security, etc.) but they need to demonstrate coverage, within their specialist area, of all aspects of IAF. So, for example, a Security Architect would need to show that their security architecture worked across Business, Information, IS&TI – not just TI.

IAF Knowledge

- Attended at least one of the IAF Advanced courses, ideally more
- Masters the IAF concepts and thinking
- Understand all aspect areas of IAF and how they interact
- Able to present IAF concepts and details to clients or internal people

Community Contributions

- Participates in discussions on the Architecture Forum
- Active coach and mentor in Architecture and IAF
- Actively contributing through participation in the development methods, training, etc.

Soft Skills

- Team player attitude with client, Engagement Manager, Consultants, Engineers, etc.
- Able to manage the relation with the client.
- Communicates complex technical solutions to technical and non-technical staff effectively
- Recognises stakeholders and their objectives and communicates accordingly

Personal Profile

- Ability to understand a complete and design a complex Cross Line-of-Business solution
- Ability to design a complete a complex solution for a major account
- Worked directly with senior client business and technology stakeholders

Please also note that you must be Certified at Level 2 (Certified Senior Architect) for your nomination to Level 3 to be accepted by the Certification Board.

Level 4: Certified Global Architect

The second Group certification level recognises the ability of the individual to manage complex deal for a major account as well as activity and visibility in an external facing role. It generally implies a deep personal network within (and ideally outside) the Group.

Responsibility Level

- Engagement Leader and/or Community Guru

Being a Leader and Guru to the Architects Community can be through delivery focussed work, by serving the Group through leadership of our most complex engagements with major accounts, designing complex solutions for major engagements, etc. or by providing active and visible promotion of the value of architecture to the Group and our clients through development of thought leadership materials, development and sales of architecture-based services or architecture practice leadership.

Engagement Type

- Lead architect in complex, enterprise wide architecture
- Typically this will be multi aspect, with deployment in multiple geographic regions

Architecture Experience

- Experienced in many Architecture Engagements
- Recognised outside Capgemini as an authority on Architecture.
- Successfully led at least 2 engagements
- Worked on at least 2 complex/multi-stream engagements
- Worked on at least 2 or more of the Aspect Areas

Architecture Thinking

- Delivers Logical (not just Physical) Architectures
- Abstracts complex problems, i.e. not just a technical specialist
- Aware of technical and delivery risk and takes active steps to mitigate it

IAF Experience

- Experienced in more than 3 IAF architecture engagements
- At least 1 engagement working through all levels (Conceptual to Physical)
- Experience of working in more than 1 of the Aspect Areas

Note that at Level 4, candidates are expected to be able to lead across Aspects Areas and understand the critical issues of any of these.

IAF Knowledge

- Attended or facilitated on more than one of the IAF Advanced courses
- Understand all aspect areas of IAF and how they interact
- Masters the IAF concepts, details and thinking
- Able to present our vision at large events to clients or internal people

Community Contributions

- Participates in discussions on the Architecture Forum
- Active coach and mentor in Architecture and IAF
- Leader and Guru to the Architects Community
- Actively contributing to community/thought leadership

Soft Skills

- Team player attitude with client, Engagement Manager, Consultants, Engineers, etc.
- Able to manage the relation with the client.
- Communicates complex technical solutions to technical and non-technical staff effectively
- Recognises stakeholders and their objectives and communicates accordingly

Personal Profile

- Ability to understand a complete and design a complex Cross Line-of-Business solution
- Ability to design a complete a complex solution for a major account
- Worked directly with senior client business and technology stakeholders

Please also note that you must be Certified at Level 3 (Certified Enterprise Architect) for your nomination to Level 4 to be accepted by the Certification Board.