TOWARDS CRITICAL SUCCESS FACTORS FOR ENTERPRISE ARCHITECTURE

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AISA Project Report

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Summary

This report describes the work done in the first phase of the AISA project. The aim of this phase was to discuss what quality means in the context of Enterprise Architecture, to identify the potential critical success factors for Enterprise Architecture, and to prioritize the factors. In the report an example of prioritization is given.

EA can be seen as a collection of all those models necessary for managing and developing an organization. Generally EA can be considered to consist of interrelated architectures or architectural views, such as business architecture, information architecture, systems/application architecture and technology architecture.

META Group (META Group Inc. 2000) claims that "EA success will be driven by the extent to which corporate line managers comprehend, support, and enforce the architecture. EA efforts that are not successful in gaining line management support will fail, regardless of the architecture's design and engineering quality". Enterprise Architecture of good quality can simply be defined as the one that is used and brings value to the organization.

What are the factors that help gaining an EA of good quality, then? Critical success factors (CSF) are used e.g. in Total Quality Management, Business-IT Alignment, Project Management and Software Engineering to describe the things that must be done exceedingly well in order to succeed. Accordingly, in EA a CSF means the things that must be done exceedingly well in order to succeed in EA efforts, i.e. to develop and implement an EA that brings value to the organization.

Because there is a lack of studies on CSFs for EA, various related domains have been used to give support for defining the potential success factors for EA. Additionally a workshop was arranged for the representatives of the co-operating organizations to discuss, validate and prioritize the findings of the literature review. The following prioritization of the potential CSFs for EA indicates the most important issues in the initial steps of EA development:

- Communication & Common Language
- EA Model / Artifacts
- Commitment
- Business Driven Approach
- Organizational Culture
- Training / Education
- Scoping and Purpose
- Governance
- Assessment
- Development Methodology
- Tool Support
- Skilled Team
- Project Management

When all these factors are taken into consideration as the EA development advances, ate least to some extent, Enterprise Architecture enables – but not guarantees – the business to gain more success.

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1 Introduction

This report is the result of the AISA Project's first phase in the first year. The aim of this phase was 1) to determine what quality means in the context of Enterprise Architecture (EA), 2) to identify the potential critical success factors (CSF) for EA, and 3) to prioritize the potential CSFs for EA. The phase consisted of the following steps (see the left-hand side of Figure 1):

1. Literature review of EA and related areas: Listing, consolidating and grouping the CSF issues → Potential CSFs for EA.

2. Workshop/focus group interview (Krueger and Casey 2000) → Review, discussion, validation and prioritization of the potential CSFs for EA.

3. Analysis and consolidation of the results of the workshop/focus group interview → Report on the CSFs for EA.

The CSFs for software architecture (right-hand side in Figure 1) are reported in a separate document.
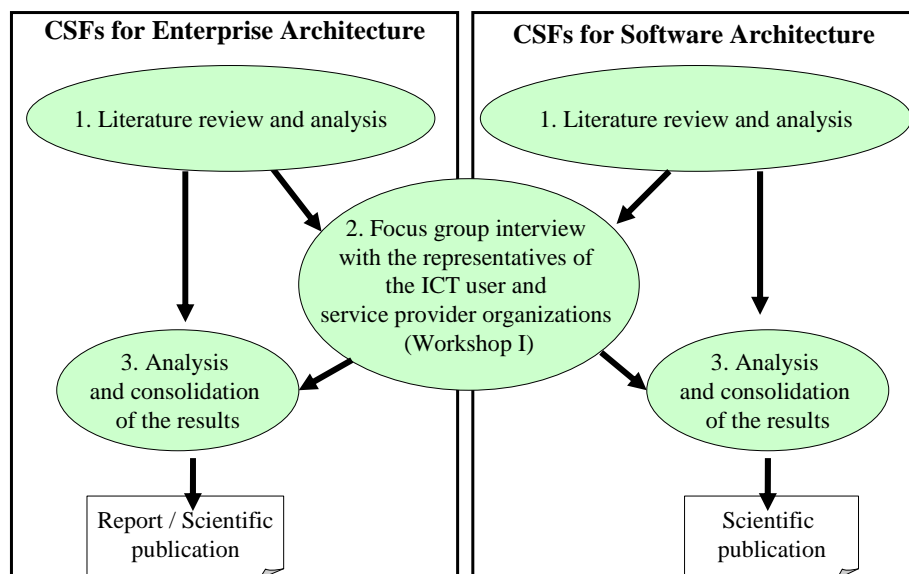
**Figure 1.** The steps of defining the critical success factors in the first phase of the AISA project.

CSFs are usually studied in the context of Total Quality Management (TQM) to describe the things that are needed in order to gain good quality (Badri, Davis et al. 1995; Claver, Tarí et al. 2003; Dale 2003). In Enterprise Architecture domain hardly any research exists on CSFs. Therefore, we needed to figure out how to find the

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potential CSFs for EA and how to define the most critical ones that enable an EA of good quality.

In addition to TQM domain, critical success factors have been studied in other domains closely related to Enterprise Architecture approach, such as Business Process Re-engineering, Business-IT Alignment, Project Management and Software Engineering. These several domains were studied to give support for deriving the potential critical success factors for EA (see Figure 2). In the first workshop of AISA project these potential CSFs were discussed and reviewed.
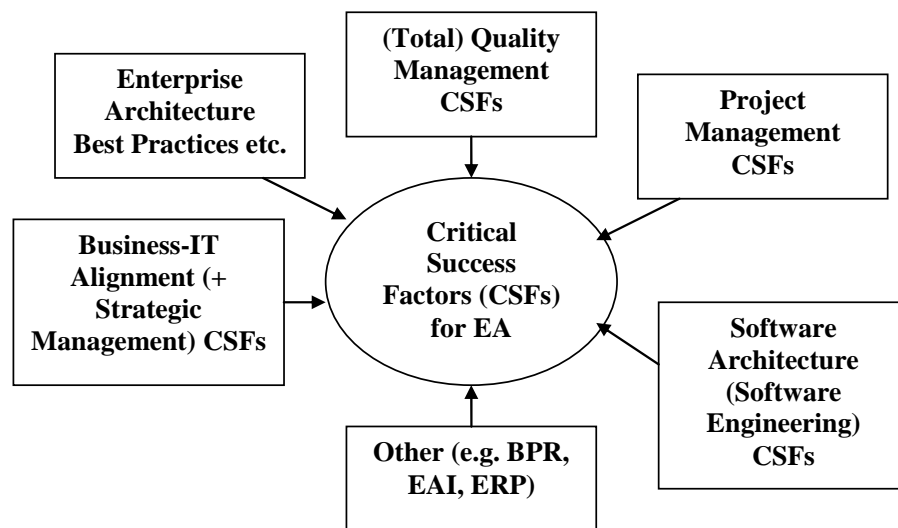
Figure 2. Critical Success Factors for Enterprise Architecture are derived from several related domains where critical success factors have been studied.

In the Appendix 1 there is a table showing a collection of relevant studies in Enterprise Architecture related domains that was used in addition to various EA references to develop a list of the potential CSFs for EA.

The remainder of this report is organized as follows. In the next section, we discuss the main concepts of enterprise, architecture, and Enterprise Architecture, as well as the concept of quality and what it means in the context of Enterprise Architecture, concluding with the definition of the concept of critical success factor. In the proceeding section, the set of potential critical success factors for EA is described, and the last section summarizes the report.

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2 Background

In this section we describe the main concepts relating to Enterprise Architecture, quality and what quality means in the context of Enterprise Architecture. We conclude by defining the concept of critical success factor.

2.1 Enterprise, Architecture & Enterprise Architecture

To be able to define the concept of Enterprise Architecture, we first discuss briefly the concepts of enterprise and architecture separately (See (Ylimäki, Halttunen et al. 2005) for more information).

A rather simple view of an *enterprise* is "a group of people organized for a particular purpose to produce a product or provide a service" (O'Rourke, Fishman et al. 2003). Enterprise can be seen analytically as consisting of the components people, organizational structures, processes, corporate culture, strategies tasks, the information adherent to these and technologies (Rood 1994). Enterprise can be seen also more synthetically (The Open Group 2002):

"... "enterprise" in this context is any collection of organizations that has a common set of goals and/or a single bottom line. In that sense, an enterprise can be a government agency, a whole corporation, a division of a corporation, a single department, or a chain of geographically distant organizations linked together by common ownership."

Architecture can be defined generally as "the design of any type of structure whether physical or conceptual, real or virtual" (O'Rourke, Fishman et al. 2003). A more precise definition of architecture given in the recommended practice (IEEE 2000):

"The fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution."

Besides these rather static definitions of architecture, it can be understood more functionally to gain an understanding what activities are associated with architecture:

- Architectures are described with different models for different viewpoints, layers or dimensions of the architecture to lay out different aspects of the system or enterprise for analysis and planning of designs, evaluation of them, and documentation of the implemented constructs (Zachman 1987; Spewak and Hill 2000; The Open Group 2002).

- Architecture descriptions are used for further specification, design and development work on systems that are within the architecture or adjoin it over an interface. Architecture descriptions are in the case of enterprise architecture very probably created by different roles and different people than those who use them for this further work.

Enterprise Architecture (EA) can be seen as a collection of all those models necessary for managing and developing an organization (Halttunen 2002). It is vital that Enterprise Architecture is derived from the visions and business strategies of an organization. Only then the enterprise architecture enables the organization to achieve its business goals (Armour, Kaisler et al. 1999a).

Lately the concept of Enterprise Architecture has been defined as follows (Kaisler, Armour et al. 2005):

Enterprise Architecture "identifies the main components of the organization, its information systems, the ways in which these components work together in order to achieve defined business objectives, and the way in which the information systems support the business processes of the organization. The components include staff, business processes, technology, information, financial and other resources, etc. Enterprise architecting is the set of processes, tools, and structures necessary to implement an enterprise-wide coherent and consistent IT architecture for supporting the enterprise's business operations. It takes a holistic view of the enterprise's IT resources rather than an application-by-application view."

Generally Enterprise Architecture can be considered to consist of interrelated architectures or architectural views (FEAF 1999; The Open Group 2002). These views can comprise e.g. business architecture, information architecture, systems/application architecture and technology architecture (see Figure 3). *Business architecture* models e.g. the business processes (and possibly deals with re-engineering of those processes), *information architecture* is a high-level model of information needed in performing the organization's processes (Halttunen 2002), and *systems/applications architecture* refers to the integrated structural design of a system its elements and their relationships depending on given system requirements (Bernus, Mertins et al. 1998). Within the systems architecture single software is described through the *software architecture*. Software architecture (Bass, Clements et al. 1998) of a program or computing system is the structure(s) of the system, which comprise software components, the externally visible properties of those components, and the relationships among them. Finally, *technology architecture/infrastructure* can be seen as a design of how the information system is implemented using diversified technologies.
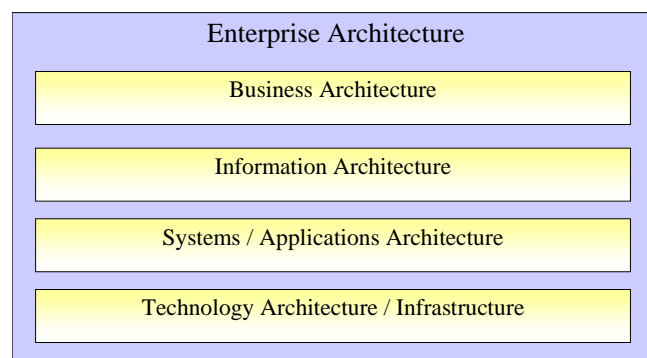
Figure 3. Enterprise Architecture comprises several architectures of different levels.

2.2 Success and Quality of Enterprise Architecture

In this section we will briefly discuss the concepts of successful Enterprise Architecture and quality in the context of Enterprise Architecture.

Successful Enterprise Architecture

META Group (META Group Inc. 2000) has claimed that "EA success will be driven by the extent to which corporate line managers comprehend, support, and enforce the architecture. EA efforts that are not successful in gaining line management support will fail, regardless of the architecture's design and engineering quality." 15% of all architecture efforts will fail due to misalignment between the maturity and readiness of the architecture effort within the IT organization and the business (META Group Inc. 2000). Moreover, the architecture effort's success is only measurable by the degree to which it contributes to the business' success (Rehkopf and Wybolt 2003). Successful Enterprise Architecture is one that is understood, accepted and used in every day business functions. The success needs to be measured in order to ensure that results are achieved.

Quality of Enterprise Architecture

There seems to be very few studies where the quality of EA has been discussed. Therefore, in this report we aim at a preliminary definition on quality of EA, based on studies in EA and related domains (see the domains in Figure 2).

Generally, quality (of a product, service, etc.) has for example the following characteristics (Lecklin 2002; Dale 2003):

-   conformance to agreed and fully understood requirements
-   fitness for purpose or use
-   satisfying customer expectations and understanding their needs and future requirements in a cost-effective way.

If these ideas are applied to Enterprise Architecture domain, we could suggest that an Enterprise Architecture has a good quality if it

-   conforms to the agreed and fully understood business requirements,
-   fits for the purpose, which is to gain business value through EA, and/or
-   satisfies the different stakeholders' (e.g. the top management, IT management, architects, developers) expectations in a cost-effective way and understands their current needs as well as the future requirements.

There are also other views, such as:

-   In the context of computer systems (Braa and Øgrim 1994) say that "when a computer system is well adapted to the organization, it can be said to be of high organizational quality". If this same idea is transferred to Enterprise Architecture domain, we could suggest that when Enterprise Architecture is well adapted to the organization, it can be said to be of high organizational quality.

- Enterprise Architecture quality refers to the high maturity of Enterprise Architecture (Department of Commerce (USA) 2003; Government Accountability Office (GAO) 2003; National Association of State Chief Information Officers (NASCIO) 2003). The different maturity models can be regarded as tools that enable gaining good quality.

- Enterprise Architecture of good quality is the one that brings value to the organization. There are two things to remember about value: 1) Value does not unfold naturally from building an EA, it requires a systematic analysis, a lot of business thinking and political orchestration to succeed (Boster, Liu et al. 2000). 2) Value actually "involves two interacting concepts: financial efficiency and business effectiveness. Financial efficiency results from reducing costs or enhancing the financial yield from investments. Business effectiveness results when the company increases its market share, beats competitors, improves quality or cements a tighter relationship with customers." (Buchanan and Soley 2003)

Consolidating the ideas presented above we could suggest an alternative definition of the *Enterprise Architecture of good quality*: it is the one that is understood, accepted and used in every day business functions; and the EA is measured in order to ensure that the quality requirements are met. In the AISA workshop it was suggested that the quality of EA could be measured e.g. to the extent it supports 1) the information system development projects, 2) the top management's business decisions, and 3) ICT enhancement in the organization from the CIO's point of view.

The different views to EA quality presented above implicitly imply that the quality of EA is more than merely the quality of the implemented EA indicating that it is successfully used. The quality of EA may also refer to e.g. the quality of EA documentation, the quality of the EA development process, and/or the quality of EA governance (process).

2.3   Critical Success Factors

Critical success factor (CSF) is a common concept used e.g. in the context of total quality management, software engineering or project management (see references in the Appendix 1). Various definitions exist for critical success factor:

1. "An element that contributes to the success of a project, without which the project will fail." (it.csumb.edu/departments/data/glossary.html)

2. "One of a few organisational activities that, if done well, should result in the strategic success of an organization." (www.engmanage.co.za/terms_strategy.htm)

3. "The things that must be done exceedingly well to really succeed." (www.otte.vic.gov.au/publications/benchmark/resources/docs_what/what02_gloss ary.htm)

4. "The limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization'. They are the few key areas where 'things must go right' for the business to flourish. As a result, the CSFs are areas of activity that should receive constant and careful attention form management. The current status of performance in each area should be continually measured, and that information should be made widely available." (Ward and Peppard 2002)

5. A limited number of factors the business success of failure depends on. CSFs are the things that have to fall into place in order to reach the business objectives. (Lecklin 2002)

However the CSF is being defined, it is important to notice that 'critical' factors should be differentiated from 'important' factors (Ward and Peppard 2002). Generally CSFs are also both time sensitive and time dependent, so they should be re-examined as often as necessary to keep abreast of the current business climate (McNurlin and Sprague 2002). Furthermore, a CSF usually consists of more than one key indicators or statements concerning characteristics within a CSF.

Based on the different definitions given above we can say that *critical success factors for Enterprise Architecture* are those things that have to be done exceedingly well in order to gain a high quality Enterprise Architecture which in turn enables the business to reach its business objectives and gain more value. However, EA is not the silver bullet, and the EA success does not happen over night. As (Boster, Liu et al. 2000) put it: "The development of an EA is often perceived with great expectations of benefits and value. Unfortunately, reality can be cold and hard… The EA effort merely helps the organization analyze IT costs and understand IT problems. It provides an opportunity to get more value from the architecture, but realizing that value takes time and a long-term strategic process."

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3 Potential Critical Success Factors for EA

In this section we present the results of the literature review and the workshop, where the potential critical success factors for EA were reviewed and discussed.

Potential critical success factors for EA based on the literature review are related to the topics depicted in the Figure 4.

Figure 4. Potential critical success factors for EA.

The potential success factors were discussed in the first workshop of AISA project in September 15th, 2005 in order to review, discuss and gather perceptions about them. Discussion was guided by questions like: Do the practitioners think the potential CSFs are valid in their work? Are all issues taken into consideration? Can the CSFs be prioritized? In addition to these general level questions, each factor was discussed separately. In the Appendix 2 the main discussion topics are listed.

Prioritization of the CSFs was done with the help of an evaluation form which each participant filled in the workshop (see Appendix 3). In Table 1 the outcome of the prioritization is presented. Communication, common language, commitment and EA model/artifacts were regarded the most critical factors (average over 2.5). Development methodology, tool support, team work and project management were regarded as the least critical factors (average less than 2.0). It was also suggested that project management should not be on the list at all.

Table 1. Critical success factors for Enterprise Architecture prioritized.

Potential CSF	Avg.
Communication	2,8
EA Model / Artifacts	2,8
Commitment	2,8
Common Language	2,6
Business Driven Approach	2,4
Organizational Culture	2,4
Training / Education	2,4
Scoping and Purpose	2,3
Governance	2,2
Assessment	2,0
Development Methodology	1,8
Tool Support	1,8
Skilled Team	1,8
Project Management	1,6
Scale: 1,0 = not at all critical 2,0 = somewhat critical 3,0 = very critical	

In the following each CSF is discussed in more detail. At this point no factors are dropped out.

3.1 Communication & Common Language

"Communicating what an EA is and how it will benefit the organization is paramount to its success."
(META Group Inc. 2000)

In order to share knowledge, to achieve a common understanding, agreement and a shared view of the EA scope, vision, objectives, developed models and other artifacts, and to gain commitment to the EA effort, it is vitally important to **communicate with all the stakeholders** (Bredemeyer Consulting 2000; Luftman 2000; Rehkopf and Wybolt 2003; The Office of Enterprise Technology Strategies 2003; Industry Advisory Council 2005; Lankhorst 2005).

In the AISA workshop it came up that because EA deals with large and diversified issues, and it is usually divided into smaller pieces conducted by several projects, there is a need to communicate between these projects in order to rationalize the project work, to help work distribution and to increase co-operation.

Furthermore, communication should be proactive, i.e. everyone should be told in advance what is happening, including e.g. the scope, objectives and activities of the project (Sumner 1999; Nah, Lau et al. 2001).

How to support communication, then? First, a common language is a must; there is a need to adopt or develop **a common, well-defined vocabulary of terms and concepts**

used (Hilliard, Kurland et al. 1996; Jonkers, Lankhorst et al. 2004; Lankhorst 2005; Motwani, Prasad et al. 2005; Ylimäki and Halttunen 2005). Ideally, because there are also business people (that may not be so technically oriented) involved in EA project, the language used should be understandable by them (Boster, Liu et al. 2000). On the other hand, the architecture team, and especially the enterprise architect (or the chief architect) should be able to use the language the audience can comprehend (Ylimäki and Halttunen 2005). Hence, *enterprise architect can be seen as an interpreter* between the various stakeholder groups analyzing and combining their views and opinions – that may even be contradictory – into commonly acceptable and agreeable format. To some extent it is also rational that ICT people (CIO, architects, developers etc.) understand the firm's business environment and are *able to communicate in business terms* (Luftman, Papp et al. 1999; Teo and Ang 1999; D'Souza and Mukherjee 2004).

In the AISA workshop it was suggested that in addition to definition of the basic architectural terms and concepts, other common concepts for all stakeholders may include e.g. concepts of the (system) development methodology, and concepts related to the development and investment processes of the enterprise to enable a broader view to the issue.

Second, *various channels and means of communication* should be utilized to enable the stakeholders to get the information needed (Rudawitz 2003). Examples of these are the following:

- personal communication, e.g. meetings, forums, teleconferences,
- electronic communication, e.g. video, audio, website, and
- "hardcopy" communication, e.g. message carrier and/or thought provoker.

It should be noticed that different stakeholder groups may require different channels and media in order to be reached. "An Architecture Portal" is one possible channel for distributing the EA information (Rehkopf and Wybolt 2003). This website should include architecture information e.g. about processes, practices, standards, metrics, engineering models, training, checklists/forms, and governance. Usually various descriptions (graphical or textual) are the most important means of communications (Department of Commerce (USA) 2003; Lankhorst 2005). These are discussed in more detail in the EA model section.

Third, there is the *time aspect of communication*. Communication should be regular and frequent, there should be channels for feedback, and it should be regarded as an ongoing process (Porter and Parker 1993; Al-Mashari and Zairi 1999). Successful communication needs to be focused and timing is of crucial importance (Clarke 1999). This encourages team work, increases motivation and ensures the involvement of all key players (Clarke 1999).

Communication policies, channels, principles etc. need to be defined in a *communications plan* or in a *communications strategy* (META Group Inc. 2000; Coronado and Antony 2002; Rehkopf and Wybolt 2003; Industry Advisory Council 2005).

3.2 Commitment

"A motivated management team is the primary key to architecture success."
(META Group Inc. 2000)

Top management leadership, sponsorship, involvement and ***commitment*** are critical success factors that are mentioned almost in all papers and studies both in the EA domain as well as in the related domains (see the table in the Appendix 1). Furthermore, commitment must be long-term (Ashmore, Henson et al. 2004; D'Souza and Mukherjee 2004; van der Raadt, Soetendal et al. 2004) and strong leadership motivates employees to participate (Porter and Parker 1993). In the AISA workshop it came up, that even though the top management commitment has existed on the conversational level already for a long time, it has not yet become very concrete or put into action.

In addition to the top management commitment ***organizational buy-in*** is also needed. Obtaining EA support from within an organization requires buy-in from stakeholders that represent all of the various business and technical components (Bredemeyer Consulting 2000; Belout and Gauvreau 2004; Industry Advisory Council 2005; OMB FEA Program Management Office 2005). In order to get this acceptance the EA must be made attractive to the customers (e.g. developers and business stakeholders); they must perceive that EA efforts add value and aid them in their jobs (Ambler 2005). Also identification and utilization of a ***thought leader*** of the organization (Sumner 1999; Industry Advisory Council 2005) or a project champion (Somers and Nelson 2001) to facilitate and market the approach to stakeholders may help getting the acceptance. (Rehkopf and Wybolt 2003) puts it this way:

"Do not crash the party when you're not invited. Seek the "willing victims" of the organization who perceive hints of value in the discipline of architecture. These partners of the architecture group become a very credible sales force when they communicate the benefits and results of the architecture partnership to their peers."

Furthermore, ***politics*** has an important role in the acceptance of architecture (The Open Group 2002) and in the success of an IT project (Belassi & Tukel 1996). In the AISA workshop it was brought up that, especially, silo thinking and strict profit responsibilities may be barriers to EA success, if each department in an organization acts on a stand alone basis, not interacting or co-operating with other departments, focusing only to the departmental bottom line. Also the role of architecture has impact on the commitment: in the first place EA should be seen as ***a mentor and a guide*** helping business and ICT decision making, not only as an auditing or controlling mechanism. In addition to these, EA is also an important communication tool within the organization.

3.3 Scoping and Purpose

"If there is a clear strategic vision for the enterprise, it seems logical to have an equally broad vision
for the systems that support that strategy."
(Armour, Kaisler et al. 1999a)

Before starting to design an EA, the ***mission – goals and direction*** – should be made clear (Pinto and Mantel 1990; Belout and Gauvreau 2004; Turner and Müller 2005); what the objectives of the organization are (Somers and Nelson 2001), why it wants to apply the EA approach (finding a business case), what the existing problem is that it wants to solve through EA (Bredemeyer Consulting 2000). In the AISA workshop it was suggested that someone should be responsible for the ***mission statement*** or the ***"declaration of will"*** indicating what the organization really wants. Furthermore, EA should also be prepared to the future problems encountered in the organization. Quarter based economy impedes the long-term thinking that EA requires; it is sometimes difficult to justify the top management that the investment that seems expensive at the moment will save money in the future.

The next thing to do is to get everyone on the same wavelength, to ***get everyone to share the same architectural vision***. Management, developers, designers, as well as other stakeholders must all have realistic expectations about the project (Reel 1999; Armour and Kaisler 2001).

The EA (project) scope should be clearly defined (Clarke 1999; Lam 2005). Scoping relates to the questions of how wide organizationally, how deep and detailed, and how fast an EA should be developed (Industry Advisory Council 2005). In the literature there is a lot of advice given about scoping. Most of them relate to the following issues:

- ***Continuous improvement approach***. Start small and grow the EA slowly (Kaisler, Armour et al. 2005). Always start with the doable and the critical. Adjust the breath or depth of your architectural effort so you can produce concrete results in six months. (Armour, Kaisler et al. 1999b). In order to be able to do this the organization needs to understand what is important to the business (Ramsay 2004).

- ***Prioritize*** (Ramsay 2004), ***break large projects down into sub-projects*** or work packages ("bite sized chunks") (Clarke 1999), and think long term (Ramsay 2004). In the AISA workshop it came up that scoping may be a painful task to do. Sometimes the topic may be almost too large and complicated to encompass and therefore breaking it into manageable pieces is an uneasy job, especially, if there is not enough time available to think over and discuss this issue.

Finally, the EA should definitely be ***holistic*** in scope (Lankhorst 2005) and be ***specific to the enterprise*** (Ashmore, Henson et al. 2004). It should take into account all aspects of the enterprise, such as business, information, applications, technology, standards and policies (META Group Inc. 2000; The Office of Enterprise Technology Strategies 2003; Schekkerman 2004).

3.4 Business Driven Approach

"Developing enterprise architectures without first determining strategic business requirements is a sure recipe for failure"
(Perkins 2003)

Business linkage is elementary in developing an Enterprise Architecture (META Group Inc. 2000; Department of Commerce (USA) 2003; The Office of Enterprise Technology Strategies 2003; Carbone 2004; Ramsay 2004; The MITRE Corporation 2004; Baker and Janiszewski 2005). Furthermore, it is also suggested that EA should be build around business processes (Harmon 2004). Business driven approach is about defining the ***business requirements*** and ensuring that they are also met. In other words there should be ***clear alignment between business and IT*** (Henderson and Venkatraman 1993; Al-Mashari and Zairi 1999; Van Eck, Blanken et al. 2004; Lam 2005). Enterprise Architecture "must address the need to directly align business and technology drivers in a way that is comprehensible and transparent to all key stakeholders, with a continued process of tracing enterprise architecture initiatives to the business strategy" (Schekkerman 2004).

In the AISA workshop it was brought up that in addition to business requirements also the ***requirements set by external stakeholders*** should be taken into consideration. External requirements are set e.g. by legislation, standards, even by the business owners and partners. Furthermore, the architectural vision was discussed. It was acknowledged that a strong architectural vision is needed, but the vision can be the one kept within the architecture team only. This vision should, nevertheless, be compatible with the business objectives and business vision and strategies. When budgets, time tables and other resources as well as the boundaries set by the business are taken into account, a realistic objective or the vision that can be realized is reached.

3.5 Development Methodology

"The key to EA success is not the final product, but the process an organization follows to create it."
(META Group Inc. 2000)

In the literature a lot of requirements for methods to develop and maintain EA in the ever changing business environment are presented. Whether you create a method of your own or use existing ones, the following issues should be kept in mind. First of all they should be ***structured, well-defined and documented*** including e.g. processes, guidelines, best practices, drawing standards and other means to promote quality of the architectures as well as support for tracking architectural decisions and changes (Lankhorst et al., 2005).

Definition of architecture and guiding principles are also suggested. Architecture principles are simple, direct statements of how an organization wants to use IT. They establish a context for architecture design decisions by translating business criteria into language and specifications that technology managers can understand and use; they put boundaries around decisions about system architecture (Armour, Kaisler et al. 1999a). Guiding principles are critical to any architecture framework; they provide

consistent, shared vision for developing new architectures; and they are used to ensure that development initiatives are in line with the enterprise's overall strategic goals (Armour, Kaisler et al. 1999a)

It is suggested that an *successful architecture process* is top-down and/or bottom-up, business-strategic-driven, customer-focused, practice-oriented, situational, model-based, disciplined, rigorous, repeatable, future-oriented, and widely usable with reasonable costs (Perkins 2003; Morganwalp and Sage 2004; van der Raadt, Soetendal et al. 2004), as well as iterative and incremental (Armour, Kaisler et al. 1999a; Bredemeyer Consulting 2000; Ramsay 2004; Ambler 2005). It should also provide means to visualize precisely the relevant aspects for a particular group of stakeholders (Lankhorst et al., 2005).

Furthermore *reuse of principles, processes and artifacts* etc. should also be considered (Kaisler, Armour et al. 2005).Usually modification to existing methods are needed in order to better fit for your company environment. It is also suggested that the development iterations should be kept short; e.g. 6-12 months at most if possible (Armour and Kaisler 2001), because the EA must have immediate significant impact on the organization within the first six months of its completion (Ashmore et al. 2004). However, in the organizations that are just about to begin the EA approach it takes more time to gain the common understanding and agreement before taking any actual steps of development.

In addition to the methods, *enterprise architecture frameworks* are suggested to be applied or used as a baseline for developing a custom framework (OMB FEA Program Management Office 2005). A framework can be seen as a structure which defines the scope, the set of outputs and possibly the methods to create the outputs for EA (National Association of State Chief Information Officers (NASCIO) 2003; Carbone 2004). For example the Zachman framework is a two-dimensional logical structure for classifying and organizing the descriptive representations of an enterprise that are significant to the management of the enterprise as well as to the development of the enterprise's systems, but it does not include any kind of method (process) to create the representations (Zachman 1987). The different frameworks are used e.g. for the purpose of categorization and to communicate the EA descriptions or other output from the development process. In the AISA workshop it was stated that an organization has to develop a framework of its own – possibly based on an existing framework – because it is strongly related to the organization's culture and ways of doing things. It might be too difficult to gain agreement and commitment within an organization when trying to adopt an existing framework as such. Another point of view was that because EA field is still somewhat immature, there are still very few best practices available, or they are not regarded or identified as good references e.g. due to busy project schedules.

Several different methods (processes) and frameworks for Enterprise Architecture are briefly described e.g. in (Ylimäki, Halttunen et al. 2005).

3.6 EA Model & Artifacts

"By keeping your enterprise architecture artifacts simple you increase the chances that your audience will understand them, that project teams will actually read them, and that you will be able to keep them up to date over time."
(Ambler 2005)

The development method used guides the creation of Enterprise Architecture artifacts. As the models (descriptions, graphics etc.) are a valuable help in communicating the architecture to the various stakeholder groups, it is important that ***all the necessary levels or views of the architecture are modeled***; e.g. business view, information view, application view and technical view. Other views are also possible depending on the framework and methodology used as well as the needs of the organization. These views should focus on the concerns of each stakeholder groups leaving out all the information that is unnecessary (Lankhorst 2005).

Furthermore, the models should address both the ***current situation*** (as-is descriptions), ***future situation*** (to-be descriptions) and the ***transition plan*** telling how (and when) to get to the target architecture (Armour, Kaisler et al. 1999a; Industry Advisory Council 2005; OMB FEA Program Management Office 2005). Essential in creating these different views is that they are ***coherent*** and give ***a concise picture of the enterprise*** (National Association of State Chief Information Officers (NASCIO) 2003; van der Raadt, Soetendal et al. 2004; Kaisler, Armour et al. 2005; Lankhorst 2005), and provide guidance to application developers, IT managers, and end-users that need to plan, budget, implement and use IT (National Association of State Chief Information Officers (NASCIO) 2003).

Other ***requirements for EA models and descriptions*** are as follows:

- Must meet the business requirements (van der Raadt, Soetendal et al. 2004)

- Traceability between the business requirements and models (Armour, Kaisler et al. 1999b), as well as between the business requirements and architectural decisions (Erder and Pureur 2003)

- Conformance to the principles and standards (Armour, Kaisler et al. 1999b; van der Raadt, Soetendal et al. 2004)

- Modifiable and flexible in reacting to changes (National Association of State Chief Information Officers (NASCIO) 2003)

- Well documented, current and available for use by stakeholders (Hilliard, Kurland et al. 1996; Baker and Janiszewski 2005) providing for easy access – e.g. web-enabled, easy to view, with traverse and query functionality (National Association of State Chief Information Officers (NASCIO) 2003)

- Efficient and complete (Bernus 2003):

  - "An enterprise model is efficient if it conveys the intended meaning concisely between the parties producing or using the model."

- "An enterprise model is complete relative to a process using it if the resources performing the process can create (and behave according to) the intended interpretation of the model for the use of the process"

- Clear, readable, comprehensible and including dependencies (Bredemeyer Consulting 2000; The MITRE Corporation 2004; van der Raadt, Soetendal et al. 2004)

- Verified ("is the model correctly built?") and validated ("does the model correspond accurately to the reality, does it take into account the needs and context"?) (Chapurlat, Kamsu-Foguem et al. 2003; Industry Advisory Council 2005).

The list of requirements for successful descriptions and other artifacts seems to be exhausting. However, in practice the models and documents do not need to be 100 % perfect, they just need to be good enough (Ambler 2005), and *simplification, clarification and minimization are key to long-term architecture success* (Dikel, Kane et al. 1995). In the AISA workshop it was suggested that because everything cannot possibly be documented, it is more important that the architect explains the models and artifacts to stakeholders. In addition, it is useful to define who to contact when more information is needed, i.e. the ownership of models and other artifacts should be clear.

3.7 Tool Support

Usage of a *set of tools that work together* and enable successful enterprise modeling language adoption, visualization and analysis of architectures as well as maintenance of the EA is recommended e.g. by (Perkins 2003; Kaisler, Armour et al. 2005; Lam 2005; Lankhorst 2005). Tools are also a valuable help in communicating the architecture to the different stakeholder groups (Baker and Janiszewski 2005).

In the AISA project it was brought up that tools used for EA modeling should be compatible both with the tools used for business process modeling and analysis and with the tools used for system/software development in order to decrease the need to do the models all over again when moving to the single system development phase.

A proper EA tool should have e.g. the following features (Menefee and Rudawitz 2003; Lankhorst 2005):

- Modeling technology: the tool provides a framework within which the EA information itself is modeled and maintained.
- Artifact repository built on database technology.
- Unrestricted ability to link EA information, artifacts and concepts in the EA.
- Simple ability to update, add, replace, and change the EA information.
- Ability to produce a web accessible result to the enterprise (web publishing).
- Provide both graphical and textual data.
- Support intuitive graphical navigation paradigm.

More information about the EA tools can be found e.g. in (Ylimäki, Halttunen et al. 2005).

3.8 Governance

"Architectural governance is a key element to ensuring that the EA vision is maintained across the enterprise".
(Baker and Janiszewski 2005)

Governance and management are terms that have various definitions in the literature. In general, governance deals with the management and organizational aspects of architecture (van der Raadt, Hoorn et al. 2005). It can also refer to "how an organization makes decisions, sets priorities, allocates resources, designates accountability, and manages its architectural processes" (Baker and Janiszewski 2005). However, the term itself is defined, the organization needs to identify and define its governance activities (COBIT 2000; van der Raadt, Hoorn et al. 2005).

Established governance structure is identified as a critical factor in literature (META Group Inc. 2000; The Office of Enterprise Technology Strategies 2003; Carbone 2004; Industry Advisory Council 2005). Effective governance process – i.e. the one that is defined, established, repeatable and auditable – enables e.g. better IT decisions, keeps IT and business accountable for linking technology to business objectives (Rehkopf and Wybolt 2003).

Critical elements in EA governance are e.g. the following (The Open Group 2002; Curran 2005; van der Raadt, Hoorn et al. 2005):

- selling the idea to gain broad acceptance to the governance plans
- setting the right metrics to measure the effectiveness of EA (e.g. EA governance metrics, EA compliance metrics, business alignment metrics)
- establishing the right organizational roles, responsibilities and authorizations
- establishing processes and communication and coordination means, such as feedback, discussion and reports of progress, and coordination committees.

The governance team can be organized in several ways. One possibility is to set up an architecture (review) board to facilitate the governance activities – e.g. ensuring that the implementation of the Enterprise Architecture is conducted in conformance to the transition strategy (The Open Group 2002; Leganza 2003). *Architecture policies, principles and architecture compliance strategy* guide the work of the architecture governance team (The Open Group 2002; van der Raadt, Hoorn et al. 2005). The need for an *"EA statute book"* guiding the EA was also acknowledged in the AISA workshop.

In addition, effective *change management environment* is needed (Bolton 2004; Kaisler, Armour et al. 2005) where the assessment of the impact of changes is done beforehand and the evolution of architectures is carefully planned (Lankhorst et al., 2005), see also (Al-Mashari and Zairi 1999; Nah, Lau et al. 2001; Somers and Nelson 2001; Kaisler, Armour et al. 2005; Motwani, Prasad et al. 2005; Motwani, Subramanian et al. 2005). In the AISA workshop it was pointed out that all possible changes in the future cannot be considered, it would only result in a solution that is too complicated. A decision has to be made about the possible changes in the business environment (e.g. a future merger) or in the business requirements that are taken into

account in the architecture design. Moreover, it is important that the governance team has the ability to handle unexpected crises through effective *risk management* (Pinto and Mantel 1990; Al-Mashari and Zairi 1999; Belout and Gauvreau 2004).

Finally, governance activities should be integrated into the enterprise governance process and leadership behaviours and structures as a continuous program that invites participation across the enterprise (COBIT 2000; Ashmore, Henson et al. 2004).

3.9 Measuring the EA Success

"Implementing and using architecture metrics proactively provides the basis for demonstrating the value of your EA."
(Baker and Janiszewski 2005)

Measurement, assessment and/or evaluation of Enterprise Architecture are undertaken as a part of the EA governance. Essential questions relating to the measurement are 1) *what* is measured, assessed or evaluated, and *why* 2) and *how* the work is done, *what metrics* should be used and *when* the measurement activities should be conducted. Measurement and evaluation should be a *continuous process* (Claver, Tarí et al. 2003; Dale 2003; National Association of State Chief Information Officers (NASCIO) 2003) conducted e.g. during each step of the (development) process (Bredemeyer Consulting 2000).

What should be measured, assessed or evaluated then? In the following some examples are suggested (Hilliard, Kurland et al. 1996; National Association of State Chief Information Officers (NASCIO) 2003; Morganwalp and Sage 2004; Curran 2005; Industry Advisory Council 2005; Saleh and Alshawi 2005):

- EA descriptions/documentation
- EA processes,
- EA maturity,
- Value of EA, business value added by EA (business-IT alignment)
- Effectiveness of EA
- Completeness and correctness of EA
- EA adoption
- People (competency and skills)
- Work environment (culture, leadership, structure).

There are *no established metrics available* for evaluation or assessing EA. It is, however, recommended that the metrics should be developed as early as possible in the development process (Industry Advisory Council 2005) and the measurement should be proactive (Baker and Janiszewski 2005). In quality management domain it is suggested that procedures and expectations for high quality are established before any other development begins and progress is tracked and a "post-mortem analysis" is conducted to enable learning from mistakes (Reel 1999). These ideas can be adopted in EA assessment as well.

In the following *some examples for metric categories* are presented (Luftman 2000; Industry Advisory Council 2005):

- Business metrics combined with IT metrics
- EA program impact metrics
- EA and EA program maturity measurement
- Quality metrics
- Usage of the EA by the business units of the organization.

For example, META Group's Enterprise Architecture Program Maturity Assessment helps organization in the first place to identify the things that are stopping it from being as effective as it can be, i.e. the critical constraints (META Group Inc. 2004). *Different tools can be used* for evaluation and assessment of EA, such as benchmarking, reviews, quality function deployment, and maturity models (Luftman 2000; Dale 2003; Erder and Pureur 2003; Schekkerman 2003; Industry Advisory Council 2005).

In the AISA workshop the following perceptions on the EA measurement were brought up:

- Scenarios could be one possible way to evaluate EA.
- One metrics could be the number of system environments used within an organization. EA should actively strive for decreasing the number of environments or systems in the long haul instead of building new systems only. One implication of this can also be the decreased overlap in systems.
- Another possibility is to analyze the support the (system development) project group received from EA.
- One problem in evaluating e.g. an architectural decision is the fact that the effects and consequences may not be seen beforehand or right after the decision has been made, but it may take years before the implications can be measured.

In the later phases of the AISA project metrics and tools for EA measurement and evaluation will be studied in more detail.

3.10 Skilled Team

Enterprise Architecture development requires *teamwork* between representatives from all key stakeholder groups; business domains, senior management, business partners, customers (Schekkerman 2004). Key stakeholder groups may vary from one line of business to another. For example in the paper industry, presence of the production equipment developers may be required. Many requirements have been set for the team, e.g. the team must understand the importance of strategic information, be capable of analyzing and documenting the business requirements in business language, must be dedicated to the project, must have sufficient resources, must practice effective project management, must be skilled and experienced (Perkins 2003). In order to have a team full of proficient people experienced external consultants can be hired or internal staff can be trained (Al-Mashari and Zairi 1999; Sumner 1999; Perkins 2003). Additionally, the need for a *chief architect* has been

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acknowledged (Akella and Barlow 2004; Passori and Schafer 2004). He/she should have (a strong) business perspective or *business skills* in addition to technical knowledge (Boster, Liu et al. 2000). Business skills are seen important also for other team members (Al-Mashari and Zairi 1999; Bredemeyer Consulting 2000; Nah, Lau et al. 2001). An architect needs to be able to work in *various roles* as follows (Rehkopf and Wybolt 2003):

- *Visionary*: envisioning what is possible and creating the future state, along with transition plans to get there

- *Translator*: matching the business objectives and business needs to technology and vice versa

- *Engineer/system designer*: creates specific instances of the architecture

- *Auditor*: ensuring the compliance with current and future architecture and the overall integrity of the system

- *Consultant*: consulting and educating on the use of the architecture, advising and coaching on system and infrastructure design and implementation.

In the AISA workshop the following skills were also regarded as important for an architect:

- *Be able to criticize* even his/her own thoughts, be able to identify both strengths and weaknesses in his/her own suggestions for solutions, as well as to identify the assumptions he/she has made.

- *Be capable of abstract thinking*, conceptualizing and finding the most relevant issues. Architect acts as a funnel that filters the most essential facts from the large information pool.

- *Has the courage to question things*, to bring up different point of views, to ask if he/she does not understand something and to discuss and debate with different stakeholders.

- Even though the architect is not an actual sales person, he/she should *be able to sell thoughts and ideas*. But still, a certain amount of humbleness and modesty is required; it is more important to get things done and improved than to get personal credit and glory.

- *Architect is the interpreter* between the different stakeholder groups trying to achieve a common view to EA issues, and still taking every one's opinions into account. Also diplomatic skills are valuable in this task.

- Finally, an architect should *be capable of expressing himself both in writing and visually* (ability to draw clear graphic pictures).

Skills of an architect are also discussed in (Ylimäki and Halttunen 2005).

3.11 Training & Education

"Without adequate training and with unrealistic expectations, many of these new projects will
ultimately fail."
(Pinto and Kharbanda 1996)

Training has been acknowledged as an important part of enhancing quality (Luftman 2000; Industry Advisory Council 2005; Kaisler, Armour et al. 2005) See also (Badri, Davis et al. 1995; Quazi, Jemangin et al. 1998; Nah, Lau et al. 2001; Somers and Nelson 2001; Claver, Tarí et al. 2003). Training and education also provide one way of gaining EA awareness and acceptance. Training is needed at least in the following levels:

1. *General EA education* should be provided for all stakeholders
2. Architects should have training in *best-practices, methods, tool usage* etc. (Coronado and Antony 2002; Basu 2004; Curran 2005)
3. Business managers should be educated about IT, and IT managers should be educated about business (Morganwalp and Sage 2004)

In addition, according to the discussion in the AISA workshop the following aspects of training should be noticed:

- Education related to the new technologies, e.g. what are the possibilities offered by them, what are the costs of utilizing them, and how compatible are they with the existing technologies?

- Architects should be provided education related to the strategies of the organization, the common EA framework, the EA vision and objectives, the target architecture, as well as the modelling techniques.

- Training is not only about teaching architects, but it is also about the things that architects teach to other stakeholders.

- Training and education are terms that should actually be avoided when communicating with the top management. A more successful approach is to ask the management how they feel and think about these issues and to discuss with them to figure out how they perceive EA. Usually this requires interpersonal communication.

Finally, training should be viewed as a *continuous process* where people receive appropriate courses at appropriate level of detail for their need (Porter and Parker 1993; Al-Mashari and Zairi 1999; Dale 2003; Tarí 2005).

3.12 Organizational Culture

*"Developing a thorough understanding of an enterprise's architecture capability increases the
potential and value of an EA program."*
(META Group Inc. 2000)

In addition to many other things the Enterprise Architecture development should take the organizational culture into consideration aiming at good organizational and cultural fit (Sumner 2000; Lam 2005). An essential issue is the ***organization's readiness to develop and use Enterprise Architectures***. Cultural readiness is about the integration of EA and company culture. It also includes aspects like ***attitudes towards change*** both by the management and employees, ***communication environment, risk management*** etc. (Mann and Kehoe 1995; Rudawitz 2003; Motwani, Prasad et al. 2005). It should be noticed that in many cases EA implementation and deployment requires cultural changes (Coronado and Antony 2002). Organizational support for EA development and deployment depends e.g. on the following variables (Luftman 2000; Rudawitz 2003; van der Raadt, Soetendal et al. 2004; van der Raadt, Hoorn et al. 2005):

- Organization's ability to accept and adapt to changes in general, and organizational acceptance of architecture-driven changes
- Trusting environment (both socially and politically)
- Open communication
- Organizational involvement in the architecture program
- Flexibility of an organization in adjusting to its environment.

These issues were found important also in the AISA workshop. Moreover organization culture, especially the ***organizational structure***, has impact on the success of EA; if the EA issues are discussed only within a department or other profit center the perspective is too narrow to accomplish good and sustainable solutions. Also the communication culture within the organization should encourage the architects to challenge each others' views and opinions, to debate the possible architectural solutions with each other. Architects should have the courage to question things without being branded as troublemakers. In other words, "an organizational culture which is conducive to continuous improvement and in which everyone can participate" should be created (Dale 2003).

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3.13 Project Management

"In the continuing quest for better project management skills and techniques, experience plays a crucial role."
(Pinto and Kharbanda 1996)

Enterprise Architecture development is usually conducted though projects and project management skills play a crucial role as cited above. Project management and project success are areas where a lot of research has been done. The following ***critical factors in project management*** should be kept in mind also in EA projects (Belassi and Tukel 1996; Al-Mashari and Zairi 1999; Nah, Lau et al. 2001; Coronado and Antony 2002; Westerveld 2003; Lam 2005; Motwani, Subramanian et al. 2005; Turner and Müller 2005):

- realistic scope, size and value, plans
- realistic scheduling
- requisite financial and human resources
- risk management
- uniqueness of project activities
- density of a project
- life cycle
- urgency (project prioritization and selection)
- project organizational structure
- project champion, sponsor
- top management support
- project management skills
- continuous measures of project success (quality).

Also in project management the leadership is an important factor helping to conduct a successful project. Project leader is the one to motivate the team, marshals resources, negotiates with stakeholders, cheerleads the development process, and constantly keeps an eye on the ultimate goal: the successfully completed project (Pinto and Kharbanda 1996). Leadership style and competence, personality, inner confidence and self-belief are elements that help the project leader in his/her job (Turner and Müller 2005).

In the AISA workshop project management was the only issue that was suggested to be dropped out from the list, or that it would be renamed to be ***Program Management*** instead including issues needed in managing various development programs conducted in the organization. However, it was acknowledged that it is vitally important that the project objectives, tasks, schedules, resources, budgets etc. are set right. The issue that project management in practice is lacking are the ***milestones***; the check points when the steering group can ascertain whether the project is doing the right things and the intermediate objectives are reached. If not, the group should decide what to do and how to continue. Finally, the organization should be able to learn from the past projects; e.g. how realistic were the schedules and budgets, what went wrong and what went right. ***Lessons learned*** should be gathered, analyzed and stored to be available for later projects.

4   Conclusions

In this report we presented the potential CSFs for EA derived from EA and related domains. The CSFs are the things that need to be done exceedingly well in order to succeed in EA efforts and in order to gain an EA of high quality. Literature review gave us a set of candidate CSFs, which were reviewed and discussed in the workshop participated by the representatives of the co-operating organizations.

The quality of EA is a concept that has not an established definition. We suggested a preliminary definition for an EA of good quality: it is the one that is understood, accepted and used in every day business functions; and the EA is measured in order to ensure that the quality requirements are met. The quality of EA could be measured e.g. to the extent it supports 1) the information system development projects, 2) the top management's business decisions, and 3) ICT enhancement in the organization (from the CIO's point of view).

The success of EA is influenced by several various – and to some extent interrelated – factors. The workshop participants were asked to prioritize the CSFs. Even though the prioritization is preliminary, it supports the expectation we had beforehand – communication, common language, commitment and EA model/artifacts are critical issues in EA success. A little surprising is the fact that development methodology and skilled team were not considered that critical factors, and also the governance and assessment are considered less critical factors. This may result from the fact that the EA development in the participating organizations is in its early phases, and therefore, it is more important, and even vital, to gain understanding and commitment through effective communication and common language, utilizing the EA models and other artifacts in this effort, than to figure out the governance structures or evaluation metrics. These issues will gain more attention when the EA development advances. Hence, it seems that prioritization of the CSFs for EA depends on the organization's EA maturity level. However, further research is needed to clarify 1) the concept of EA of good quality – can quality be dynamic indicating that the interpretation of good quality changes in the course of time, 2) how the EA maturity level, or other organizational changes, acquisitions or mergers affect the prioritization of the CSFs, and 3) the dependencies or interactions between the potential CSFs for EA.

Some changes to CSFs were also suggested: 1) Project management should not be on the list at all, or it should be titled program management instead, and 2) EA model & Documentation (see Figure 4) should be renamed as EA model & Artifacts, because the connotation of the term documentation may be too narrow if understood as written documentation only.

Compared to the critical success factors for software architecture (Hämäläinen, Markkula et al. 2006) a lot of common issues were found, only the emphasis of these issues will vary. In EA more stress is laid e.g. on commitment and communication, whereas in the software architecture level the e.g. role of requirement management is

underlined. A good EA can be seen as an umbrella supporting both the software architecture work and the system development work.

Based on the workshop and the literature review we suggest that the most critical success factors for EA dressed up in the form of principles are the following:

- *Communicate, communicate and communicate*. Use the language the audience can comprehend. Let the enterprise architect act as an interpreter between different stakeholder groups. Give people time to think, discuss and understand what EA is all about.

- *Keep the EA models and artifacts simple enough* (limit the number and type of EA outputs you develop and use). Use the architect to explain and teach the models to stakeholders.

- *Get business involvement and organizational buy-in*. Make EA attractive to the stakeholders, let them perceive the value of EA.

- *Define the business requirements*. Develop an EA that enables business-IT alignment. Ensure that the business requirements are met.

- *Aim at good organizational and cultural fit*. Take the organization's ability to accept changes and its readiness to develop and implement EA into consideration.

- *Train both the architects and the stakeholders*. Discuss the EA issues with the top management.

- *Define the EA scope clearly*. Find the business case and formulate the "declaration of will"; what the organization really wants and where it is heading to. Start small and grow the EA slowly.

- *Set up supporting governance infrastructure* (e.g. a key set of business-oriented projects, metrics, marketing the architecture, processes and policies), be prepared to future changes and assess the EA impact and value.

- *Build your own framework*. Build the EA iteratively and incrementally. Utilize existing methods and tools.

- *Assign the architecture team members full time* if possible. Give the team time to establish their concepts, frameworks, ways of working and communicating.

- *Make realistic schedules and budgets*. Use the available resources effectively.

Finally, **enthusiasm** is also needed (Carbone 2004). EA development does not happen overnight. If the team can not work full time, it will take a lot longer than six months to have any concrete results. Also the turbulence within the organization (mergers, outsourcing etc.) prolongs the time frame. Likely, it will take two or more years before the effects are to be seen. And still, even if all these issues are considered and an EA of good quality has been reached, it does not guarantee the business success, it only enables it.

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Appendix 1. References in the Enterprise Architecture (EA) related areas for potential critical success factors for EA.

(Total) Quality Management	Business-IT Alignment	Project Management	Software Architecture/ Software Engineering	Other domains (e.g. BPR, EAI, ERP)
(Badri, Davis et al. 1995)	(D'Souza and Mukherjee 2004)	(Belassi and Tukel 1996)	(Bredemeyer Consulting 2000)	(Al-Mashari and Zairi 1999)
(Basu 2004)	(Henderson and Venkatraman 1993)	(Belout and Gauvreau 2004)	(Dikel, Kane et al. 1995)	(Chapurlat, Kamsu-Foguem et al. 2003)
(Braa and Øgrim 1994)	(Luftman, Papp et al. 1999; Luftman 2000)	(Clarke 1999)	(Hilliard, Kurland et al. 1996)	(Lam 2005)
(Claver, Tarí et al. 2003)	(Motjolopane and Brown 2004)	(Pinto and Kharbanda 1996)	(Reel 1999)	(Motwani, Subramanian et al. 2005)
(Coronado and Antony 2002)	(Teo and Ang 1999)	(Pinto and Mantel 1990)		(Nah, Lau et al. 2001)
(Dale 2003)		(Saleh and Alshawi 2005)		(Somers and Nelson 2001)
(Erder and Pureur 2003)		(Turner and Müller 2005)		(Sumner 1999), (Sumner 2000)
(Lecklin 2002)		(Westerveld 2003)		
(Mann and Kehoe 1995)				
(Motwani, Prasad et al. 2005)				
(Porter and Parker 1993)				
(Quazi, Jemangin et al. 1998)				
(Tarí 2005)				

Appendix 2. Main discussion topics in the AISA workshop I.

- What kind of characteristics does an EA of good quality have?

- Are the potential CSFs relevant and valid in practice? Are all issues taken into consideration?

- Can the CSFs be prioritized? How?

- Is there co-operation or integration between IT management and business management?

- What kind of characteristics does a good communication have? Do business and IT people understand each other? If not, why not?

- What kind of organization culture helps gaining a successful EA?

- What kind of frameworks, methods and tools are used in EA design, implementation and governance?

- What kind of characteristics does a good EA model/descriptions/documentation have?

- How to involve, motivate and commit different stakeholder groups to EA approach?

- Is the EA success measured somehow in the organizations? What is measured and what kind of metrics is used? What should be measured? What kind of metrics should be used?

- What kind of skills is needed from the architects/architecting team?

- What kind of education/training is needed for different stakeholder groups?

- What would be the most important piece of advice for an organization that is about to start the EA development?

Appendix 3. Evaluation form for critical success factors for Enterprise Architecture

Evaluate how critical you consider each potential factor.
Use the following scale:
1 = not at all critical, 2 = somewhat critical, 3 = very critical.

Potential CSFs	1	2	3
Scoping and Purpose			
Business Driven Approach			
Communication			
Common Language			
Organizational Culture			
Development Methodology (and Framework)			
EA Model / Documentation			
Tool Support			
Commitment			
Governance			
Assessment			
Project Management			
Skilled Team			
Training / Education			