



Measurement in Enterprise Architecture Work – the Enterprise Architecture Team Viewpoint

AISA Project Report

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Summary

Currently, many organizations develop their enterprise architecture (EA) processes. One aspect in this development work is the planning of the EA work related measurement work and the definition of the EA team's responsibilities in the measurement. However, it currently seems that it lacks a holistic view of measurement work that could or should be carried out relating to EA work.

This study contributes to this question by identifying EA work related measurement aspects and activities. The responsibilities of EA team in measurement are also discussed.



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1 Introduction

Enterprise Architecture (EA) is a holistic view of an organization [5, 9, 11]. It is defined as a coherent whole of principles, methods and models that are used in the design and realisation of an enterprise's organisational structure, business processes, information systems, and infrastructure [13].

Because of expectations to yield multiple business and IT-related benefits to organizations, EA has recently become highly interesting approach for both practitioners and academic researchers. Expected benefits of EA approach are, for example, that EA delivers insight and overview of business and IT, it is helpful by mergers and acquisitions, it supports (out/in) sourcing and systems development as well as it manages IT portfolio and delivers roadmaps for change [17]. In addition, EA is expected to be helpful in decision making and managing complexity, as well as in business and IT budget prioritization [17]. Because of these sought benefits, many public and private sector organisations develop currently their EA processes and activities.

Measurements and evaluations are common part of organisations' work and those are carried out including in many different processes and activities (e.g. in process development, performance measurement and quality assurance). Enterprise architecture processes are not exception. Thus, it has to be decided what measurement and evaluation work and tasks will be carried out in enterprise architecture work and how this work will be performed. EA team take quite often partly or totally the responsibilities of this planning work.

However, it seems to that it currently lacks a holistic view of measurement that should or could be carried out in EA work. Even though quite extensive research has been carried out in EA modelling and development frameworks, methods and tools (e.g.[3, 6, 7, 12, 13, 18, 21]), academic research has almost disregarded the area of EA work related evaluation and measurement thus far. The few contributions in this area include EA maturity models (e.g. [14, 16]) and evaluation methods, but the planning aspects of evaluation, including e.g. the definition of evaluation aims, activities and evaluators, seem to be omitted. In addition, roles of the EA team in measurement seem to be addressed very rarely.

This study contributes to the research on EA work planning by defining EA work related measurement aspects and activities. In addition, responsibilities of EA team in measurement are considered. This study aims especially to assist practitioners in their EA measurement planning.

This report is organized as follows. In the next section, the research method is described. Section 3 and 4 discusses measurement and enterprise architecture work in general. Section 6 presents the results of this study. These are analysed in section 7. Finally, section 8 concludes the report by including a discussion of the study's contribution and agenda for further research.



2 Research Method

Constructive study was chosen as the research method since the area of research lacks existing definitions of the measurement and evaluation aspects in EA work. In the study, the following steps were conducted.

Pre Study phases

Firstly, literature review and the identification of measurement needs were carried out to form a basis for identifying measurement work relevant for EA work and for identifying areas where the EA team could participate in this work.

1. *Needs for EA evaluations and measurements.* Before this study, we carried out studies in which we identified needs for architecture evaluations and measurements ([22],[8]). These studies included for example focus group interview on the EA evaluation and measurement needs in practitioners from collaborating companies in august 2006.

2. *Literature review.* Literature on evaluation and measurement was charted to identify why, how and where measurement and evaluation is carried out in organisations in general. In addition, the existing knowledge and views of EA related measurement work were gathered.

Construction phases

Secondly, the phases of the definition of EA work measurement aspects and activities were carried out.

3. *Definition of EA work measurement aspects and activities.* The findings of literature review and studies on evaluation needs were used as a basis to define the EA work measurement aspects and activities. A description of aspects and activities was produced.

4. *Focus group interview of practitioners.* A focus group interview of five practitioners from four collaborating Finnish or international organizations was organized in December 2006. The organizations represented different industries and employed from 14 to several thousand people. Interviewees are presented in the table 1. All of the organizations were initiating EA work and employed architecture specialists who could contribute to the study. The objectives of the interview were 1) to review the results of the preceding phases, and 2) to collect additional, experience-based information. The interview was moderated by one researcher, while the other took notes. In addition, the interview was audio-recorded.

Table 1. Interviewees in the focus group interview.

Companies	Number of interviewees	Viewpoints of interviewees
Architecture consultation company Number of personnel 10 (year 2005)	1	enterprise and software architecture consultation
Banking, finance and insurance company Number of personnel 11 974 (year 2005)	1	enterprise architecture



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Telecommunication company Number of personnel 4989 (year 2005)	1	enterprise architecture
Business & IT consulting and development organization A part of a large international company having 329 373 employees (year 2005) in total	2	software architecture, enterprise architecture, marketing, business

5. *Updating the description of EA work aspects and activities.* The findings from the focus group interview were analyzed and the description of EA measurement aspects and activities was modified and updated according to the experiences disclosed by the focus group.

3 Measurement in General

This section describes measurement in general. Measurement is carried out for many different purposes in companies. Purposes of measurement are especially the followings [2].

- Evaluate (how well is the organization/unit/team/people performing?)
- Control (how to ensure that the subordinates are doing the right thing?)
- Budget (on what programs, people or projects should resources be allocated?)
- Motivate (how to motivate e.g. line staff, middle managers, stakeholders?)
- Promote (marketing/public relations aspect; how to convince stakeholders that the organization/unit/team is doing a good job?)
- Celebrate (what accomplishments are worthy of the important organizational ritual of celebrating success?)
- Learn (why is what working or not working?)
- Improve (what exactly should who do differently to improve performance?)

Measurement has several application areas (e.g. company and project management, improvement of products and services). Therefore, many different evaluation aspects, practices and methods exist in companies. These exist for example relating to the:

- Performance measurement
- Operational/operations measurement
- Program evaluation
- Service quality evaluation
- Process measurement and capability assessment
- Product solution evaluation
- Project evaluation / measurement
- Software / system measurement
- Quality evaluation / measurement



- Impact evaluation
- Cost-Benefit, Cost-effectiveness analyses
- Benchmarking

Therefore, the responsibilities of measurement work are quite often spread out in companies. It lacks quite often a holistic view of measurement work carried out in an organisation.

The activities of measurement process are described, for example, by Juran and Godfray. These activities are described in the figure 1.

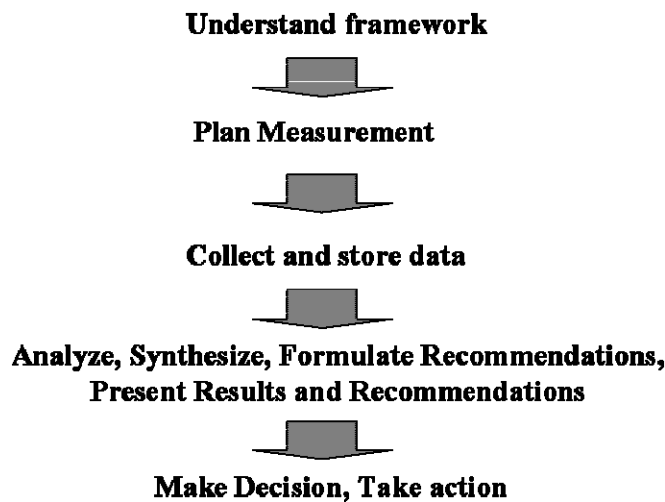


Figure 1. Measurement process acts [10].

In the development of new process in company, it has to decide and define, what kind of measurement work will be performed relating to it or included in it: what the purposes of measurement are, what measurement activities will be carried out and who the responsibility of measurement have. EA processes are currently developed in many organisations. Measurement in EA work is thus also needed to be defined in this development work.

4 Enterprise Architecture Work and Team

Enterprise architecture is typically used as an instrument in managing a company's daily operations and future development [13]. According to Lankhorst [13] management areas relevant to EA are strategic management, strategy execution, quality management, IT governance, IT delivery and support and IT implementation.

Organisations developing their EA activities establish quite commonly EA teams that are mainly responsible of EA work. Few definitions of EA team/group exist in literature, suggesting that the characteristics of the team – such as its role, composition, organization and tasks – are organization-specific to at least some extent. Briefly, the team is stated to be the stakeholder that creates, develops and maintains EA according to policies set by an architectural board of senior executives



[19]. As the skill set required in EA work is extensive, one suggestion is that the team could be virtual [15]. According to Paras [15], the virtual EA team consists of

- *Core EA Team* of no more than ten full-time enterprise architects with possible domain specialities (e.g. business, systems and technology architecture), led by a chief enterprise architect. The core team coordinates the EA effort through the extended EA team.
- *Extended EA Team* produces EA documentation and models. The members of this team work in the line of business and use only a small part of their time to EA work.
- *EA Community* includes persons who are not members of the core or extended EA teams, but use EA documentation and models.

Aziz et al. [1] and Syntel [19] have also presented similar views on EA team.

The responsibility of EA team is quite often to plan what measurement or evaluation work is carried out in EA work. EA team may carry out part of this work and part of this work can be carried out other staff or partners. However, we think that EA team should have the whole picture of measurement work carried out relating EA work and aims of it.

5 Measurement in Enterprise Architecture Work

This study identified what kind of measurement work may exist relating EA work. We identified that there exist

- 1) organisation's (general) measurement work,
 - a. which is needed to be carried out also in EA work and
 - b. of which planning and development EA team may participate.
- 2) EA work specific measurement and evaluation work.

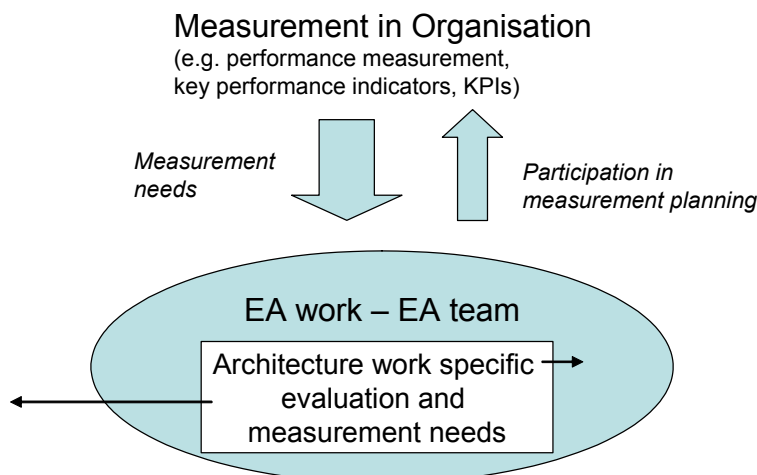


Figure 2. Measurement Needs affecting EA work



5.1 Organisation's general measurement work

In organisations, it exist general measurement needs which need to be taken account also in EA work (e.g. quality management, performance measurement etc.). EA team has thus to carry out measurement that is planned to be carried out in the company in general and report the measurement results. On the other hand, EA team may participate in the development of companies' general measurement practices and metrics.

Especially, performance measurement related key performance indicators KPIs are used in EA work. For example, Christiansen and Gotze have identified in their study that the forty-five percent of the governments with national EA program have and use key performance indicators in their work with the national EA programs [4]. The performance measurement needs were presented also by practitioners in the focus group interview.

The following performance measurement activities seemed to be relevant for EA work. Questions behind these measurement activities are also presented.

Performance measurement reporting

- To what extent have the company objectives been attained?
- Company Level Performance Measurement: Deriving EA team level metrics from company-level metrics, collecting data and reporting to company level

Company Performance Measurement Planning/Consulting

- How to improve the performance measurement system?
- Participating/consulting in the planning and definition of company's performance measures from EA perspective.

5.2 Enterprise Architecture Work Specific Measurement Work

In organisations, it exist evaluation and measurement needs also which relate especially to the EA work. These measurement aspects are followings.

EA work impact evaluation

- What impacts have been realized by EA work?
- Planning and carrying out the measurement and evaluation of the impacts of EA work in the company.

EA approach use evaluation

- To what extent is the EA approach used in the company?
- Evaluating the extent of the EA approach use in the company

EA Team operations evaluation

- How is EA work progressing toward pre-established goals?
- Ongoing operational monitoring and reporting of the EA team's and architects' accomplishments, particularly progress toward pre-established goals of the team.



Evaluation of EA work

- What is the quality of EA work and its results?
- Evaluating the quality of EA work, and its benchmarking

Evaluation of Architecture and Architectural Solutions

- Is the architectural solution suitable to the organization and situation?
- Planning criteria for architectures and architectural solutions, evaluating architectural solutions against criteria, and presenting results.

5.3 Measurement Aims and Activities

In Tables 2 and 3, enterprise architecture measurement aspects and activities relating to these aspects are presented. Each activity is defined in the terms of 1) its main aims and 2) the main tasks conducted in the activity.

Table 2. Performance Measurement Aims and Activities in Enterprise Architecture Work.

Measurement Aspect	Aims	Activities
Performance Measurement Reporting	<ul style="list-style-type: none"> ▪ To evaluate the performance of the EA work against company level objectives ▪ To report performance measurement results to company level 	<ul style="list-style-type: none"> ▪ To interpret and align company level business performance goals to the EA work ▪ To develop EA work level measures ▪ To define data collection and reporting methods ▪ To collect and store data ▪ To report results
Company Performance Measurement Planning/ Consulting	<ul style="list-style-type: none"> ▪ To participate (or consult) in the definition of company level performance metrics ▪ To demonstrate how well the company has achieved its (EA) objectives <p>(EA provides overall structural view of the company and thus provides a basis for structural improvement)</p>	<ul style="list-style-type: none"> ▪ To develop company level performance metrics related to the EA approach ▪ Potential solutions: <ul style="list-style-type: none"> ▪ To integrate EA work evaluation and measurement into the company level performance metrics ▪ To take the EA approach and EA work into account on the company level



Table 2. Measurement Aspects, Aims and Activities in Enterprise Architecture Work.

Measurement Aspect	Aims	Activities
Evaluating of EA Work Impacts	<ul style="list-style-type: none"> ▪ To evaluate the impacts caused by EA work ▪ To demonstrate the impacts and possible benefits to company level ▪ To aid decision making about e.g. the future and resources of EA work ▪ To improve EA work practices 	<ul style="list-style-type: none"> ▪ To evaluate the extent to which EA work causes changes in the company. ▪ Two methods exist <ol style="list-style-type: none"> 1) To evaluate the difference between a target (e.g. organizational function/units or whole company) where EA work has been carried out (treatment group), and a target where it has not (control/comparison group). 2) To evaluate the difference between the situation before and after carrying out EA work (reflexive comparison) ▪ To define data collection and reporting methods ▪ To collect and store data ▪ To analyze data, report results and formulate improvement recommendations
Evaluating of EA Approach Use	<ul style="list-style-type: none"> ▪ To evaluate the extent of EA approach use/adoption in the company 	<ul style="list-style-type: none"> ▪ To develop criteria and metrics for EA approach use ▪ To define data collection and reporting methods ▪ To collect and store data ▪ To analyze data, report results and formulate improvement recommendations
Evaluating of EA Team Operations	<ul style="list-style-type: none"> ▪ To support the management of the EA team ▪ To monitor and report the EA team's and architects' accomplishments, particularly progress toward pre-established goals 	<ul style="list-style-type: none"> ▪ To understand the company's needs and pressures and goals of EA work ▪ To develop evaluation criteria and metrics for the EA team and individual architects (e.g. process, product and impact criteria and metrics) ▪ To define data collection and reporting methods ▪ To collect and store data ▪ To analyze data, report results and make decisions
Evaluating of EA Work	<ul style="list-style-type: none"> ▪ To evaluate and monitor the quality of EA work and the artefacts produced ▪ To identify improvement needs of EA work ▪ To measure EA work against other companies (e.g. toughest competitors or industry leaders) 	<ul style="list-style-type: none"> ▪ To define criteria and metrics for EA work (e.g. process and product quality metrics and criteria) ▪ To define data collection and reporting methods ▪ To collect and store data ▪ To analyze data and formulate improvement recommendations for EA work <p>AND/OR</p> <ul style="list-style-type: none"> ▪ To benchmark EA work practices against other companies
Evaluating of Architectures and Architectural Solutions	<ul style="list-style-type: none"> ▪ To evaluate architectures and architectural solutions produced in projects 	<ul style="list-style-type: none"> ▪ To understand business needs and requirements for architectures and architectural solutions ▪ To develop criteria and metrics for architectures and architectural solutions (e.g. quality and financial criteria) ▪ To define architecture evaluation methods and practices ▪ To collect and store data ▪ To analyze data and report results and formulate architecture improvement recommendations



6 Discussion

In this section, the results of this study and the findings of focus group interview are summarized and discussed. In addition, limitations of the study are discussed. The focus group provided views on the responsibilities of the EA team, the measurement concerns, and the roles of the EA team in measurement and evaluation.

Generally, the focus group considered that the defined measurement aspects covered sufficiently the aspects and activities in practice. The focus group also provided a number of ideas on the basis of practical experiences. These are taken into account in the description of measurement aspects and activities.

Affect of Responsibilities and Status of the EA Team and EA work to the Measurement

Practitioners in focus group view discussed how EA team's responsibilities and objectives affect on the EA related measurement. According to the focus group, the following observations were made.

In summary, factors affecting EA measurement are:

- how clear the role and responsibilities of EA work and EA team are,
- does it exist also long-term goals for EA work and,
- what the status and maturity of EA process and practices are.

Enterprise architecture team's responsibilities and authority are not necessarily clearly defined in practice. Thus EA team may not have a clear role in the organisation. Moreover, EA team may not have clear objectives. In addition, EA team may not have direct authority or even resources budgeted to EA work in the early phases of EA development.

As practitioners' in interview brought out, the lack of clear role, responsibilities, objectives and authority means, that enterprise architecture work may be very difficult to evaluate or it cannot be evaluated reliable at all. In addition, these factors may cause that the organisation and planning of EA measurement may be challenging.

Role and responsibilities of EA team have an affect also for the role of EA team in measurement and measurement carried out relating EA work. It can be said that defining the role of EA team is one prerequisite for the defining its role in measurement.

A prerequisite for the measurement is also that EA team should have long-term objectives. However, short-term goals may also be needed to show quickly the achievement of the benefits of the EA work.

Status and maturity of organisation's EA work and practices also affect on what kind of measurement is useful to perform. For example, the impacts of EA work are not sensible to evaluate if EA process initialization is just started.



EA team's roles in measurement.

The EA work related measurement aspects and activities relating were presented in the previous section. In different measurement aspects, EA team may have different role. The role of EA team may be in measurement, for example:

- gathering information for pre-planned measurements and reporting the results (e.g. company's performance measurement),
- carrying out the whole measurement process from the planning the measurement work to the analysis of results (e.g. quality evaluation of architecture work results)
- supporting and consultation the measurement planning (e.g. supporting the planning of company's general measurement activities),

This study do not restrict that all evaluation aspects and activities identified by this study should be only carried out by EA team. For example, Syntel [20] presents that EA evaluation should not be carried out by the architects themselves, because of objectivity. If the problems in objectivity are expected, we recommend the using employees outside of EA team or reviewers from outsiders.

As the characteristics of the EA team, such as its organizational position, aims and resources differ in various organizations, measurement work carried out by EA team may differ.

Practices and challenges of EA measurement

The goals of measurement should be defined. As the practitioners in the focus group interview emphasized, measurement and evaluation without clear objectives should be avoided.

Moreover, frequencies for carrying out the evaluation and measurement tasks should be defined as suggested by the focus group. In practice, it is typically carried out annually and is focused on receiving feedback on the work carried out by the team, and using it for improvement.

According to the group, it should be remembered that measurement is quite often part of the management system and thus affects the behavior of individuals, units and entire companies. Therefore, the aims of measurement should be identified well as well as used measures and evaluation targets should be correct. The planning of measurement is thus a critical phase for the success of measurement.

Limits of this study

Measurement concerns and needs for enterprise architecture work are organization-specific to at least some extent. Therefore, the presented measurement aspects and activities are suggestive on what kind of EA measurement could or should carried out in companies.

The focus group included practitioners from organizations initiating and supporting the initiating EA work, which may have affected the results.



7 Conclusion

In this report, EA work measurement aspects and activities were defined by constructive research, including a literature review and a focus group interview of practitioners. EA team's roles in measurement were also considered.

This study identified that means of EA measurement are the supporting the management of EA work, the improvement of EA work practices and products and the evaluation of impacts and benefits of EA work. In addition, the measurement may be executed as a part of architecture work. For example, evaluations of architecture alternatives can be used to support architecture planning and decision making. In addition, organisation's common measurement programs affect also on EA work. Measurement needs of those are also needed to taken into account in EA work. The EA team may act in various roles in both EA measurement planning and the actual measurement in the company. EA team may perform measurement work and support the data gathering and planning of measurement work.

Contributions to Research

The presented EA measurement aspects and activities contribute to the literature on EA evaluation. They can be used as a basis for further research on measurement methods, metrics and criteria suitable for these measurement aspects.

Contributions to Practice

Practitioners may use the results of this study to assure that all relevant evaluation aspects and related activities have been considered in the planning of EA measurement, and thus make sure that the most important evaluation concerns are addressed. Moreover, the experiences of the focus group may help practitioners in initiating the EA evaluation.

Agenda for Further Research

The results of this study can be used as a basis for further research in for example in the following ways. Firstly, evaluation and measurement methods, criteria and metrics could be developed relating to these measurement aspects and activities. Secondly, the role of EA team in measurement could be studied.

Future of EA measurement

Currently, a limited effort is done to measure for example EA progress and value in organisations [4]. For example, evaluation and measurement is only a small part of EA teams' work in the companies represented by the focus group members in this study.

Being able to measure, in the meaning of having the skills and capability to measure, is essential at all stages of the EA adoption [4]. As soon as the maturity of EA processes will be increased and the role of EA work in companies will be stabilized, more and more EA measurement efforts can be expected to be carried out. Thus, significance of EA measurement will increase in the future and it will be actual part of daily enterprise architecture work.

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References

- [1] Aziz, S.;Obitz, T.;Modi, R. and Sarkar, S., Enterprise Architecture: A Governance Framework - Part I: Embedding Architecture into the Organization, 2005.
- [2] Behn, Why Measure Performance? Different Purposes Require Different Measures. Public Administration Review 63, 5 (2003), 586-606.
- [3] Bernus, P.;Nemes, L. and Schmidt, G., Handbook on Enterprise Architecture, Springer-Verlag, 2003.
- [4] Christiansen, P. E. and Gotze, J., Trends in Governmental Enterprise Architecture: Reviewing National EA Programs - Part 1. Journal of Enterprise Architecture 3, 1 (2007), 8-18.
- [5] de Boer, F. S.;Bosanque, M. M.;Groenewegen, L. P. J.;Stam, A. W.;Stevens, S. and van der Torre, L., Change Impact Analysis of Enterprise Architectures, 2005.
- [6] Fatolahi, A. and Shams, F., An investigation into applying UML to the Zachman Framework. Information Systems Frontiers 8, 2 (2006), 133-143.
- [7] Greefhorst, D.;Koning, H. and van Vliet, H., The many faces of architectural descriptions. Information Systems Frontiers 8, 2 (2006), 103-113.
- [8] Hämäläinen, N.;Ylimäki, T. and Niemi, E. (2007) The role of architecture evaluations in ICT-companies Proceedings of HAAMAHA.
- [9] Jonkers, H.;Lankhorst, M.;ter Doest, H.;Arbab, F.;Bosma, H. and Wieringa, R., Enterprise architecture: Management tool and blueprint for the organization. Information Systems Frontiers 8, 2 (2006), 63-66.
- [10] Juran, J. M. and Godfrey, A. B., Juran's Quality Handbook, McGraw-Hill Companies, 2000.
- [11] Kaisler, S. H.;Armour, F. and Valivullah, M., Enterprise Architecting: Critical Problems, 2005.
- [12] Krueger, R. A. and Casey, M. A., Focus Groups. A Practical Guide for Applied Research, Sage Publications, 2000.
- [13] Lankhorst, M., Enterprise Architecture at Work. Modelling, Communication, and Analysis, Springer-Verlag, 2005.
- [14] NASCIO, NASCIO Enterprise Architecture Maturity Model, v. 1.3, 2003.
- [15] Paras, G., Building & Managing the Virtual EA Team, 2006.
- [16] Schekkerman, J., Extended Enterprise Maturity Model (E2AMM), 2003.
- [17] Schekkerman, J., Trends in Enterprise Architecture 2005 - How are Organizations Progressing? Web-form Based Survey 2005, 2005.
- [18] Sowa, J. F. and Zachman, J. A., Extending and Formalizing the Framework for Information Systems Architecture. IBM Systems Journal 31, 3 (1992), 590-616.
- [19] Syntel, A Global Vision for Enterprise Architecture, 2005.
- [20] Syntel, Evaluating Your Enterprise Architecture, 2005.
- [21] The Open Group, The Open Group Architecture Framework version 8.1.1, Enterprise Edition (TOGAF 8.1.1), 2006.
- [22] Ylimäki, T. and Niemi, E., Evaluation Needs for Enterprise Architecture, 2006.

