

A GOAL-ORIENTED WAY TO DEFINE METRICS FOR AN ENTERPRISE ARCHITECTURE PROGRAM

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ABSTRACT

Metrics are becoming more and more important in the development of enterprise architecture (EA) programs. Therefore, guidelines and support to define metrics for EA programs are needed. A goal-oriented approach for defining metrics for EA program and the measurement aspects for EA program are presented in this article. This approach was developed and tested during the development of proposals of EA program metrics for two companies.

KEYWORDS

enterprise architecture program, metric, measurement, GQM, measurement program, iterative

INTRODUCTION

Measurement and metrics are more and more concerns of EA groups in the development of EA programs. Metrics are seen to be crucial to both managing the development of Enterprise Architecture and to justifying its existence. Value and significance of measurement and metrics for enterprise architecture work is commonly recognized: *“Being able to measure, in the meaning of having skills and capability to measure, is essential at all stages of the EA adaptation.”* (Christiansen and Gotze 2007) In addition, consultation companies have stated, for example, *“We will begin to see metrics become an integral part of EA and SOA programs”* (Cutter Consortium 2007).

However, currently there is very little guidance on metrics that can be captured to help the assessment of EA (Kaisler, et al. 2005). One consequence of this may be that metrics for EA programs are not defined at all. *“A recent Forrester survey of more than 50 European enterprise architects revealed that while many enterprise architects were working to achieve specific goals, metrics related to those efforts often did not exist or were not clearly defined”* (Wollmer 2007).

Goal-oriented way has been suggested as an approach to define metrics for EA programs (Cullen 2005; Weiss 2006). However, unclearly defined goals for EA programs are recognized to be an obstacle in the actual definition of metrics (Hoppermann 2007). There seem to be no public guidelines or processes how to carry out the goal-oriented definition of metrics for EA program or these guidelines are very roughly described. Public guidelines or solutions how to handle the problem of unclearly defined goals for EA program in the measurement planning seem not exist.

This article supports the planning of metrics for EA programs by presenting measurement aspects and phases of iterative and goal-oriented metrics development process. In addition, experiences of metrics definition are presented. These were developed and tested during the development of proposals of EA program metrics for two companies.

The remainder of this article is structured as follows. Firstly, measurement program success factors, goal-oriented approach of defining metrics and use of measurement aspects are discussed. Secondly, the research phases are presented. Thirdly, the measurement aspects and metric planning process is presented.

Finally, some experiences of developing metrics for EA program are described and the summary of paper is presented.

GOAL-ORIENTATION IN MEASUREMENT PROGRAMS

Factors affecting the success of measurement programs have been studied previously, especially in the software engineering domain by (Gopal, et al. 2002), (Jeffery and Berry 1993), (Hall and Fenton 1997), (Rifkin and Cox 1991). Factors affecting the success include goal-oriented approach and incremental development of metric program, transparency of metric program (practitioners know and understand what data is collected, why it is being collected, and how it is being used), usefulness of metrics data, metric data gatherers' and users' participation in designing metrics program, and metrics integrity (the collected data sensible to collect, accurately collected, and not being "fiddled"). In addition, it is important that practitioners' get feedback on data that is collected and practitioners are trained to carry out measurement and to collect data. Automated data collection, using gurus and champions as examples and dedicated metric team that has responsibility of metric program are also important (Hall and Fenton 1997).

One well known approach to measurement plan definition is the Goal Question Metrics (GQM) (Basili, et al. 1994). The main idea behind GQM is that the measurement should be goal-oriented and based on context characterization (Ardimento, et al. 2004). The approach is based on the assumption that for an organization to measure in a purposeful way it must first specify the goals for itself and for its projects, then it must trace those goals to the data that are intended to define goals operationally, and finally provide a framework for interpreting data with respect to the stated goals (Basili, et al. 1994). Thus, it is important to make clear, at least in general terms, what information needs the organization has, so that these needs can be quantified whenever possible, and the quantified information can be analyzed to whether or not the goals are achieved (Basili, et al. 1994). GQM-approach uses a top-down approach to define metrics and a bottom-up approach for analysis and interpretation of measurement data (Ardimento, et al. 2004). GQM is highly iterative

process (e.g. goals are identified during working with questions (Berander and Jönsson 2006).

Metrics often represent different dimensions and are collected for different purposes (Berander and Jönsson 2006). Measurement aspects (categories) can be used to support the definition of metrics (Berander and Jönsson 2006). These measurement aspects allow one to consciously take into account several dimensions and they provide guidance and context. In addition, they minimize the risk for ending up with questions and metrics covering a few dimensions and make sure that some dimensions are not missed when eliciting measurement goals and metrics.

The aspects used in the categorization can, roughly speaking, come from two sources. Either they have been defined before the GQM-work, or they are defined during the work based on the elicited questions (Berander and Jönsson 2006). In this study, pre-defined measurement aspects are suggested to be used for the basis of planning the metrics for EA program.

RESEARCH METHOD

This study consist of two parts: 1) identifying measurement aspects for EA program and 2) construction of metric definition process for EA program and testing while developing proposals of EA program metrics for two companies.

Measurement aspects for the EA program include:

1. *Needs for EA evaluation and measurement.* Before this study, studies were conducted where needs for architecture evaluation and measurement were identified (Hämäläinen, et al. 2007; Ylimäki and Niemi 2006). These studies included, for example, a focus group interview on EA evaluation and measurement needs of practitioners from collaborating companies.
2. *Literature review.* Literature on evaluation and measurement was charted to identify why, how and where measurement and evaluation is carried out in organizations in general. In addition, the existing knowledge and views on EA related measurement work were gathered.
3. *Definition of measurement aspects.* The findings of literature review and studies on evaluation needs were used as a basis to define

measurement aspects. A description of the aspects was produced.

4. *Focus group interview of practitioners.* Measurement aspects were evaluated in a focus group interview. Interviewees are presented in Table 1.

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

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
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

Table 1. Focus Group Interviewees

CONSTRUCTION OF MEASUREMENT PLANNING PROCESS

At the next stage, proposals of metrics for two companies' EA programs were produced. These companies were the telecommunication company and banking, finance and insurance company mentioned in Table 1. During this activity a process for the metric definition for EA program was developed because no public process for this was available. In this development, the measurement aspects developed during part one and GQM-approach was utilized. Measurement aspects were updated on based experiences during this development. The development of metric proposals for companies included two iterations.

- *Progress and Operations of EA program:* EA team's and architects' accomplishments, particularly progress toward pre-established goals
- *Quality / Maturity*
 - Maturity of EA program capabilities
 - Quality of results produced by EA program
- *Architecture structures in organization:* evaluation of architecture alternatives and solutions

These aspects can be used to support the identification of company's measurement needs and derivation of related metrics.

MEASUREMENT ASPECTS FOR THE ENTERPRISE ARCHITECTURE PROGRAM

Based on literature review and identified measurement and evaluation needs, the following measurement aspects for enterprise architecture program were identified:

- *Benefits of EA program for organization*
- *Impacts and use of EA program and its results*

METRICS DEVELOPMENT PROCESS FOR EA PROGRAM

The research process allowed use to identify that the basis for the EA program's metric definition is the understanding of 1) company's business and IT goals, 2) company's rationale and goals for EA program, 3) information needs related to EA program and 4) measurement context and possibilities in company. This information is used as basis for the definition of

metrics and in the evaluation of metrics' suitability for the company. Figure 1 below and Table 2 on the next page describe the goal-

oriented definition approach of metrics for EA program.

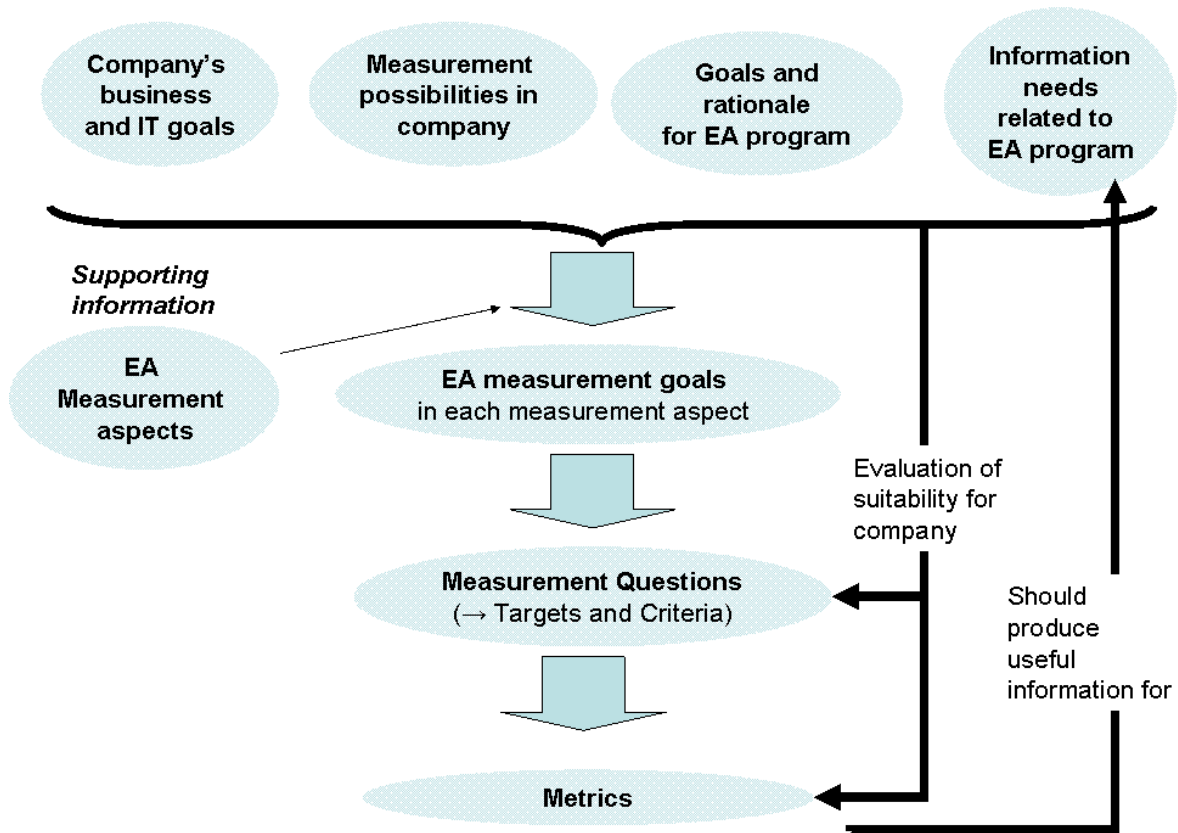


Figure 1. Information Gathered, Used and Produced in the Definition of Metrics for EA program

In the development of metrics, the tables produced with Microsoft Office Word were utilized in the gathering and planning metrics and in discussion with companies concerning Phases 3-6. The columns of tables were from left to right: *Measurement aspect*, *Measurement*

goal (What is the goal of measurement?), *Targets* (What is the focus?), *Metrics/Criteria* and *Comments*. Target-column was used in the same meaning as the question-aspect in GQM-approach.

Phase	Tasks and results
Phase 1. Company's Goals, EA Goals, and Information Needs	<ul style="list-style-type: none"> • Identifying and documenting information and EA program's stakeholders' conceptions about goals and rationale for company's EA program and team • Identifying company's business and IT goals from EA program point of view • Identifying information needs related to EA program (what information should metrics produce?).
Phase 2. Measurement Possibilities	<ul style="list-style-type: none"> • Identifying company's and EA group's resources and capabilities for the measurement (e.g. existing practices and metrics, resources for measurement).
Phase 3. EA Measurement Goals	<ul style="list-style-type: none"> • Defining EA goals that are decided to be measured.
Phase 4. Measurement Questions	<ul style="list-style-type: none"> • On based measurement goals, identifying measurement questions including measurement targets and criteria which will be measured.
Phase 5. Metrics	<ul style="list-style-type: none"> • Choosing metrics suitable for measurement questions (for target & criteria) • Choosing only few critical metrics • Choosing useful metrics that: <ul style="list-style-type: none"> ○ Produce information that is useful in current situation, and ○ Suitable for the goals of organization and for the goals of architecture work (in the short and long term).
Phase 6. Feedback	<p>The feedback gathering from stakeholders about:</p> <ul style="list-style-type: none"> • Used measurement goals: Are metrics suitable for goals? • Defined measurement questions, targets, criteria and metrics: Are metrics possible to be used in company? • Utilization feedback in the next development iteration of metrics.
Phase 7. Use Metrics	<ul style="list-style-type: none"> • Defining responsibilities in measurement (Who will collect the metrics? Who will analyze the metrics? Who will use the information gathered? To whom will the results be reported?). • Timetable (When and how the metrics should be collected and analyzed?) • Change needs (What needs to be done before it is possible to collect and analyze metrics (e.g. changes in processes and tools)?) • Do the measurement. Collect metrics and analyze them and report results. • Update measurement goals, questions and metrics when needed. Start thus a new development iteration of metrics.
Phase 8. Utilization of Results	<ul style="list-style-type: none"> • Making decisions or planning actions based on measurement results. • Achieving benefits of measurement by utilizing information produced by it.

Table 2. The Phases of One Iteration of Metrics Defining Process for an EA Program

EXPERIENCE OF DEVELOPING METRICS

Proposals of metrics and evaluation criteria developed for two case companies included the following types of metrics. Examples related to these are based on suggestions are given by Aziz et. al. (Aziz, et al. 2006) and Leganza (Leganza 2002):

- *Activity-oriented metrics* which track the performance of the EA group (e.g. number of architects certified, number of designs reviewed, consulting hours booked).
- *Acceptance-oriented metrics* which describe the perception of EA with the company (e.g. percentage of compliant projects, feedback surveys (qualitative), number of software development team members in business units who look for EA for mentoring).
- *Quality-oriented metrics* and criteria which support the identification of development needs of architecture processes and products.
- *Value-oriented metrics* which guide the EA work towards producing value to the company and show EA work's value to the company:
 - Metrics that aim *to guide the activities towards* producing business or IT value.
 - Metrics that aim *to prove* the amount of achieved business and IT benefits (e.g. cost savings through re-use of software components, time to market improvements).

EXPERIENCES OF DEVELOPING A METRICS PROGRAM

Following observations were made during the development of this approach and developing EA metrics for two companies.

Iterative approach and feedback session was found essential in the development of metrics. Understanding goals for EA program and information needs about EA program become deeper during the process. Therefore, it is essential to go through several development iterations to fully utilize this knowledge. The problem of unclearly defined EA goals was treated in case studies by using the

predetermined measurement aspects and iterative approach.

To some areas useful metrics were difficult to develop (e.g. quality of architecture processes). In this case, evaluation criteria and practices for these areas were defined instead of metrics.

CONCLUSIONS

This paper presented an iterative and goal-oriented approach to define metrics for EA programs. Measurement aspects were utilized to handle the problem of unclearly defined goals for EA programs and to support the definition of metrics. The approach was developed and tested during the development proposals of metrics for EA programs for two companies.

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