

On the Categorization and Measurability of Enterprise Architecture Benefits with the Enterprise Architecture Value Framework

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Abstract. With the development of Enterprise Architecture (EA) as a discipline, measuring and understanding its value for business and IT has become relevant. In this paper a framework for categorizing the benefits of EA, the Enterprise Architecture Value Framework (EAVF), is presented and based on this framework, a measurability maturity scale is introduced.

In the EAVF the value aspects of EA are expressed using the four perspectives of the Balanced Scorecard with regard to the development of these aspects over time, defining sixteen key areas in which EA may provide value. In its current form the framework can support architects and researchers in describing and categorizing the benefits of EA.

As part of our ongoing research on the value of EA, two pilots using the framework have been carried out at large financial institutions. These pilots illustrate how to use the EAVF as a tool in measuring the benefits of EA.

Keywords: enterprise architecture, EA benefits, value, measurability.

1 Introduction

It has been 25 years since Zachman [1] introduced the concept of architecture as a new approach in reducing the complexity of the information function within an organization. Since those days, the complexity of the IT-landscape has increased manifold and IT has become an integral part of many business processes. To control, or at least to understand, the current state of affairs in an organization and to be able to manage transformations of the business, Enterprise Architecture (EA) plays an important role nowadays as demonstrated by Ross et al. [2] for example. EA can play an important role in decision making as well: Johnson et al. [3] describe how (under certain conditions) EA can clarify and rationalize the decision process.

EA has been defined by the IEEE [4] as “*the fundamental organization of a system embodied in its components, their relationships to each other and to the environment and the principles guiding its design and evolution*”. Following Lange et al. [5] we prefer to emphasize its transformational nature by stating that EA has to “*translate the*

broader goals and principles of an organization's strategy into concrete processes and systems enabling the organization to realize its goals", thereby contributing to the organization's continuity and profit.

In recent years, the question if EA can do what it promises has become relevant. Stated differently: what exactly are the benefits of EA and which activities contribute to its value? A comprehensive and recent overview of the literature on this topic has been given by Tamm et al. [6] who give the following classification of EA benefits, based on a systematic literature review of 50 studies:

- (1) increased responsiveness and guidance to change;
- (2) improved decisionmaking;
- (3) improved communication & collaboration;
- (4) reduced (IT) costs;
- (5) business-IT alignment;
- (6) improved business processes;
- (7) improved IT systems;
- (8) re-use of resources;
- (9) improve integration;
- (10) reduce risk;
- (11) regulatory compliance;
- (12) provides stability.

By the definition given above, EA is active on the tactical and strategic level of an organization, rather than on the operational level. It has many characteristics in common with the policies of the organization and as such is generally deemed valuable, but not measurable. Hence, as summarized in [7], the literature on EA value tends to focus on the benefits of EA, rather than on value itself: the (quantifiable) result of benefits and costs involved. In our ongoing research we are interested in the value of EA as the EA should direct its efforts on maximizing this value and thereby its contribution towards the goals of the organization. More authors support this position, see for example [8] and [9]. One of the authors of this paper has demonstrated in previous work a positive correlation between Solution Architecture and project results [10]; the effect of EA on the performance of an organization is however still an open question.

As business goals are unique to an organization, so are the (possible) benefits from EA for that organization and a lot of research has gone into classifying these benefits. So far, proposed classifications are mainly one-dimensional. Examples, apart from the one given above, are the classification into the categories of the strategy map by Boucharas et al. [9] and that of van der Raadt [11] using agility and alignment as principal categories. Foorthuis et al. [12] focus on the mutual interference between a dozen or so categories of benefits, an approach that has been extended by Lange et al. [5] into a benefit realization model and by Tamm et al. [6] in an EA benefits model. There are some multi-dimensional approaches toward the value of architecture as well. For example, Schelp and Stutz [13] use the perspectives of the balanced scorecard on one

dimension and organizational scope on the other one. However, organizational scope is not necessary independent from the perspectives of the balanced scorecard. Our approach is similar to theirs, but – following Wideman’s suggestions for improving project management [14] - we use the time as a second dimension, thereby ensuring two independent axes in our model.

From these two dimensions, we have created an EA value framework which, as we will show in the next paragraph, covers the entire “value-universe”. A further contribution, based on the framework, is the development of a measurability maturity scale to express the level of measurability of EA benefits.

This study results from the research question: “*How can EA benefits be classified and how can these benefits be measured?*” This question is part of our broader research on measuring the value of EA. To address our current research question we first conducted a review of EA benefits as outlined before. From there we used the approach of design-science research [15], [16] in developing the framework and its derived questionnaire (see par. 3).

Closely related to our research is the work of our colleague Pruijt on the effectiveness of EA [17].

In this paper, we present in par. 2 the framework and the design decisions behind it. In the next paragraph, additional instruments for assessments are introduced followed by an overview of the results of the assessments in two pilot organizations in par. 4. In par. 5, we summarize and discuss our findings and give an outlook to our future research.

2 The Enterprise Architecture Value Framework

As stated before, the final goal of EA is to create value (financial and non-financial) for the organization. To assess if the EA function in an organization succeeds in creating value, it is necessary to state exactly what we mean by value. Bowman and Ambrosini [18] distinguish between (perceived) *use value* (subjective, defined by the customers based on their perception of usefulness; the price the customers are prepared to pay) and *exchange value* (objective, the price actually paid). For our purposes the use value, i.e. the value as perceived by the clients (here: the organization) in relation to their needs (here: the organizational goals) seems most appropriate. As this is a perceived concept, an assessment of this use value is subjectively related to the individual organization and care should be taken in generalizing results to other organizations.

To be able to measure value, we adopt an operational definition of value: “*value is the contribution to the goals of the organization*”. By this definition value can be a contribution to the profit of the organization, but also a growth in customer satisfaction or in agility of the organization. It may even be a decrease in productivity (which, when the goal is to increase productivity, is an example where value is negative).

From this definition it follows that organizational goals should be included in measuring value. For our model, we decided to use the original classification of Kaplan & Norton’s balanced scorecard [19], [20], [21]. Our rationale behind this choice is that it

is not too complicated (only four categories or perspectives) and generally well known to decision makers in organizations. Hence, our value measurements will be carried out in respect to the following four perspectives:

- *Financial*: the financial perspective can be characterized as the shareholders' view on the organization. The keywords here are money (revenues as well as costs), risk and compliance.
- *Customer*: the customer perspective is the externals' view on the organization. Customer satisfaction and market share are generally important questions here.
- *Internal*: the internal perspective is the way the organization is perceived by its managers and employees. The focus is normally on internal efficiency and productivity, but work satisfaction or sustainability may be taken into account as well.
- *Learning & growth*: the perspective of learning and growth is the long-term view. The central question is the continuity of the organization in the long term. Typical keywords here are innovation and change.

As explained in the introduction of this paper, it is very difficult, if not impossible, to measure directly the contribution of EA to the organizational goals. So we decided to use a detour (as sketched in figure 1) and first establish to what extent the EA is able to implement its goals in the operations of the organization, followed by an assessment of the difference in value stemming from these changes (in terms of the organizational goals).

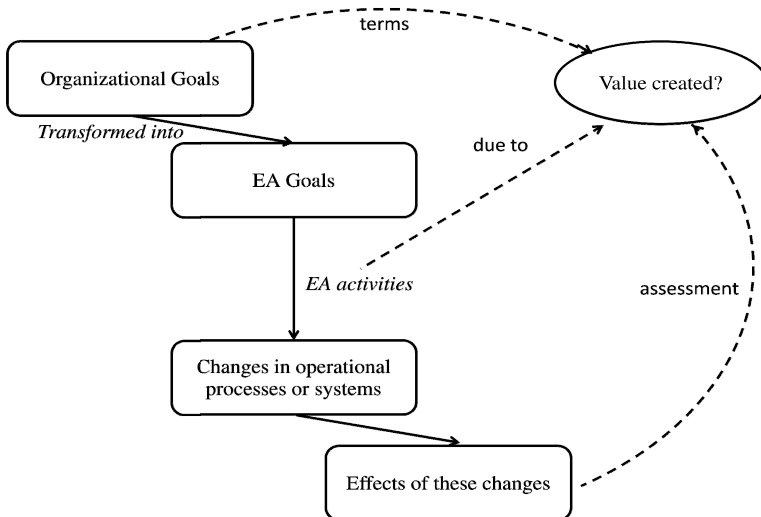


Fig. 1. Measuring the value of EA in an indirect way

In practice these changes in the operations result from EA goals from the past, so we have to go back in time and 'follow' the goals which were important some years

back towards their implementation now and derive the difference in value of the resulting products as created by EA activities.

So, apart from being related to the goals of the organization, value evolves in time. As we are interested in value as created by EA activities, figure 1 suggests that this can take place during the development and implementation of EA in the operations (step 1) as well as after the operational changes are implemented (step 2). For the first step – towards the implementation of the EA – two logical phases can be discerned: the architecture development process, resulting in the target architecture, and the realization process aimed at implementing this target architecture. In the second step, when (parts of) the target architecture are implemented in operational processes and systems, we differentiate, based on reported benefits¹, between the value resulting from plain use of the results and the re-use of these results, as stimulated by the EA, in different environments.

These considerations have resulted in four phases in our model, which below are summarized and related to the familiar phases in the Architecture Development Method (ADM) of TOGAF-9 [22] as well:

- *Development*: in the development phase, the EA is developed and maintained. This phase corresponds with the ADM phases Architecture Vision, Business Architecture, Information Systems Architectures and Technology Architecture.
- *Realization*: the realization phase is where programs are defined and projects are carried out to implement the changes defined in the EA. This phase corresponds with the ADM phases Opportunities and Solutions, Migration Planning and Implementation Governance.
- *Use*: After the implementation, changes have been implemented in the organization and the time to collect the promised benefits has come. Monitoring the new architecture (Architecture Change Management in ADM) is a continuing activity in this phase.
- *Re-use*: the Re-use phase is a seamless continuation of the Use phase and as such part of the phase Architecture Change management in ADM. However, after implementing parts of a new architecture, re-use of these parts may have a big influence on the next parts and thus yield value.

While the second axis of our model is defined by time, it is loosely coupled with organizational responsibilities as well. In general, the architecture function in an organization is responsible for the development phase while for the realization phase the change function (program and project leaders, portfolio managers, etc.) has the responsibility. In the use phase, the operational function takes over the responsibility and for the re-use phase the architecture and change function should both be responsible.

Since in our model the two dimensions (perspectives and phases) are mutually independent, we can combine them in a framework: the *Enterprise Architecture Value*

¹ As an example see benefit #8: re-use of resources, in the classification from Tamm et al. as quoted in the Introduction of this paper.

Framework (EAVF) as shown in figure 2. In the framework, we use a dashed line between the phases Use and Re-use to emphasize that these phases are not strictly separated.

As has been shown by various authors (see for example [5], [9], [13]), every value-construct, i.e. every construct that contributes to the goals of the enterprise, can be placed in one of the columns (perspectives of the Balanced Scorecard) of the framework. Moreover, whenever a change in value occurs in a value-construct, it can be attributed to one of the rows (the phases) of the framework. This guarantees that our framework is complete and covers all of the “value-universe”. It follows that it is possible (but not always trivial) to map another categorization into the framework; an example has been given in figure 2 where three of the categories of Tamm et al. (see the Introduction of this paper) have been placed in the framework.

<i>Perspective Phase</i>	Financial	Customer	Internal	Learning & growth
Development	(10) Reduce risk	(2) Improved decision making		
Realization				
Use			(6) Improved buss proc	
Re-use				

Fig. 2. The Enterprise Architecture Value Framework with horizontal the four perspectives of the Balanced Scorecard and vertical the four phases where value may be created

The primary strength of a complete framework is that it subdivides the value-universe. For example, in our framework each cell is focused on a specific aspect and timeframe which makes it easier to identify where benefits and costs may originate and who are the stakeholders. The difficult question remains however if the changes in value are (at least partly) the result of the EA. We will discuss this “traceability of EA” later on in this paper (see par. 5).

3 Instruments Based on the EAVF

3.1 The Questionnaire

As discussed in the introduction of this paper, many authors have published about the benefits of EA. Therefore, in our research on the value of EA, we decided to build on the work of others and focus on the benefits of EA as a first step.

In order to measure these benefits, enough data must be gathered and made available in the organization. To identify which data sources are available and appropriate in an organization, we decided to conduct structured interviews [23] with stakeholders in the organization. For these interviews we developed, based on the EAVF, a questionnaire. The questions in this questionnaire are constructed using a cascade of universal questions (as depicted in figure 3) and we made certain that the benefits as reported in the literature (see [5], [6], [7], [8], [9], [11], [12], [13]) were covered by mapping these benefits into the EAVF.

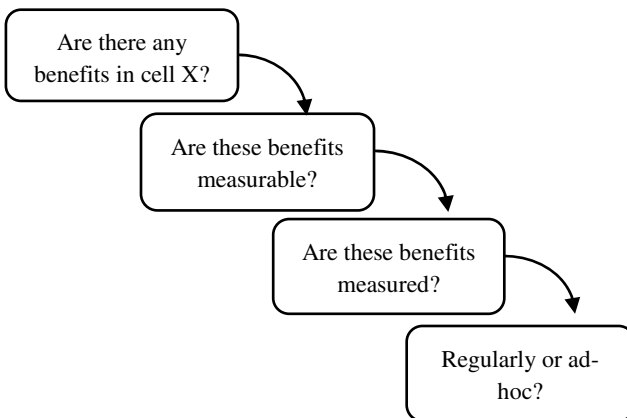


Fig. 3. A cascade of universal questions for measuring, used in the construction of a questionnaire for the EAVF

For example: in the Customer perspective we focus on the interaction between the organization and the outside world. This may be done regarding individual external entities (customers) or a group of external entities: a market. In the Use-phase, benefits therefore may be found in increased customer satisfaction and/or a greater market share, both of which are measurable. To support in maximizing these benefits, market research or usability testing can be carried out in the Realization phase² to reduce uncertainty, likely leading to better decisions and from there to a better implementation and to the intended benefits.

With our questionnaire, we assess the actual situation in an organization: are all relevant benefits measured and if so, how and to what extent. As an illustration some questions from the questionnaire as used in interview sessions, have been depicted in table 1.

² The importance of this testing should of course be determined in the Development phase.

Table 1. Part of the questionnaire (not all question from the Customers' perspective shown)

<i>Phase</i>	<i>Customer's Perspective</i>
Development	In developing the architecture, have the consequences for the customers and the market been taken into account? Where? How is this translated to the realization phase?
Realization	Has the impact of the migration on the customers and the market been established? Are there any analyses and/or scenarios developed and if yes, what were the expected results?
Use	Has the market share increased as a result of the changes? How is this measured? Has the customer satisfaction changed as a result of the changes? How is this measured?
Re-use	Has a strategic advantage in the market been reached by virtue of the architecture? How is this evaluated? Has the ability of the organization to react on changes in the environment (like market changes, changes in customers' needs, etc.) increased? How is this evaluated?

Along with the questionnaire, we developed a measurability scale for assessing the measurability of the benefits and a set of indicators to evaluate the actual value of the benefits as perceived by the organization. Both the questionnaire and the set of indicators are available via the authors.

3.2 Measurability

From a first pilot with the framework (as described in [24]) we learned that it is important to establish if there is enough factual documentation to quantify the benefits of EA. In order to do so, we defined a “*measurability maturity scale*”. This scale informs the organization about its value-awareness and makes a comparison with other organizations possible. This scale is developed in accordance with the familiar stages used by most maturity models (see for example the work of Kohlegger et al. [25]) and should be applied to every cell of the matrix. The scale consists of four levels:

1. *Ad-hoc*: measuring relevant aspects of value is sometimes done, but not systematically; information comes in the form of examples
2. *Measurable*: systematic measurements of value aspects are available, but not every relevant aspect is fully covered.

3. *Measured*: systematic measurements are made to such an extent that a value can be derived.
4. *Managed*: value is used as an instrument in managing the EA activities.

The measurability level is assessed by scoring what is documented for the benefits in every cell of the EAVF. Only in cells where the measurability is at least “*measured*”, quantitative statements on the value of the benefits can be made. When this level is not reached, only qualitative statements can be made, which by their very nature are subjective so different interviewees may give different answers, depending on their viewpoint.

3.3 Evaluating Benefits

To be able to evaluate the benefits of EA even when the measurability is low, we developed a set of indicators for the benefits in every cell of the EAVF. With these indicators, we assess the opinion of the interviewees on the benefits. As these indicators ask for a judgment, they are scored by the researchers on a 5-point Likert scale (table 2), where possible supported by examples or data.

Table 2. 5-point Likert scale used in the evaluation of benefits

score	1	2	3	4	5
meaning	totally disagree	disagree	neutral	agree	agree totally

In table 3 some of these indicators are shown as an example. Note that in these indicators the traceability of architecture is taken into account.

Table 3. Example of indicators used in evaluating the benefits of EA (not all indicators from the Customer’s perspective are shown)

<i>Phase</i>	<i>Indicators in the Customer’s perspective</i>
Development	The role of the market in the architecture is in accordance with the importance of the market for the organization The role of the customer in the architecture is in accordance with the importance of the customer for the organization
Realization	Due to the architecture analyses and/or scenarios of the impact on the market are made Due to the architecture analyses and/or scenarios of the impact on the customer are made
Use	The market share increased due to the architecture The customer satisfaction increased due to the architecture
Re-use	Due to the architecture the ability to react on external changes has increased

4 Pilots with the EA Value Framework

Before any actual assessment can take place we have to make a decision on the scope of the assessment as measuring every goal over longer timeframes will in most cases be practically impossible. We have to choose: will the assessment represent a certain period or will the focus be on a couple of representative EA goals which will be followed throughout? To answer questions like this, we start an assessment with a preparation phase. In this preparation phase, we determine with the head of the architectural department the scope of the assessment, which stakeholders will be interviewed and we collect relevant documentation. After the preparation phase, we carry out the interview sessions with the identified stakeholders, using the questionnaire. In these interviews, we usually focus on one or two rows in the framework and we emphasize the importance of measurements and documentation. In this way, a complete as possible picture can be build showing where benefits are realized in the architectural process.

We have applied the EAVF and the derived questionnaire in two pilot organizations. In both organizations, we set out to measure the benefits realized by the EA function. The first organization that we assessed is a governmental institution. For that organization, we established that the measurability of the benefits created by EA was low. This case has been extensively reported in [24].

The second pilot organization is a large non-governmental financial company. This organization started some 3 years ago with EA and developed a target architecture around a central data warehouse. The implementation of this data warehouse was not very fortunate and only a small part of the intended data warehouse was implemented at the time of the assessment (spring 2012). In this organization, the measurability of EA benefits was low too, but, using the indicators described in the previous paragraph (par 3.3), we were able to evaluate the benefits of EA as perceived by the stakeholders. Figure 4 shows, based on the evaluation of the interviews and the documentation gathered, the summary of the results in the EA Value Framework. In figure 4a the measurability level is given, showing that in this organization reliable data (i.e. a score of at least 3) are available almost only in the realization phase. In the Re-use phase and in the Learning and Growth perspective hardly any documentation is available which explains the low scores in the figure.

<i>Measurability</i>	Finan- cial	Cus- tomer	Inter- nal	Lear- ning
Development	1,7	2,4	2,2	2
Realization	3,2	3	3,1	1,3
Use	2,9	3	2,6	1
Re-use	2	1	1,2	1

Legend:
 1 – Ad-hoc
 2 – Measurable
 3 – Measured
 4 – Managed

Fig. 4a. Results of the assessment of the measurability level in the pilot organization

<i>Evaluation of benefits</i>	Finan- cial	Cus- tomer	Inter- nal	Lear- ning
Development	3,3	3,4	3,3	2,5
Realization	1,2	2,5	3,4	2,4
Use	2,2	1,6	2,1	2
Re-use	3,4	2	2,7	2,3

Legend:
1 – totally disagree
2 – disagree
3 - neutral
4 – agree
5 – agree totally

Fig. 4b. Results of the assessment of the benefits in the pilot organization

In figure 4b, the scores on the perceived benefits are plotted. Due to the low scores on measurability, the scores on these benefits are based on the interviews mainly. Figure 4b shows there is a slight ‘plus’ (score above 3) in the Development phase which can be traced back to the increased maturity of the EA function. In the Realization phase the scores are low, with the exception of the Internal perspective (from the interviews we learned that this was by virtue of the insight created by the architecture), meaning that hardly any benefits of EA were perceived by the stakeholders. However, a much more serious cause for concern for the architects is that “the business” hardly did perceive any value from EA (low scores in the Use-phase): “it has cost too much and [results] came too late”. In other words, the architecture function has a major credibility problem with the operational function in that organization. Finally, re-use just started and higher scores may be expected here in time.

Based on the framework and the more detailed results from the interviews and the documentation, we were able to advise this organization which direction their EA should take: more business, less IT-oriented.

5 Discussion and Future Research

In this paper, we presented a framework, the Enterprise Architecture Value Framework (EAVF), which can be used to categorize the value aspects of EA. The EAVF builds on earlier research in this field as shown in the introduction of this paper. The framework covers the value universe of EA and it supports researchers to understand what types of value may be discerned in EA and when value is created.

Based on the framework we developed a questionnaire to assess the measurability and the benefits of EA. The framework and its derived questionnaire have been tested in a couple of pilot organizations. From these pilots we learned that the EAVF can be used in assessing the benefits of EA, but some reserve should be taken in this conclusion as the measurability level in both organizations was low and as a consequence the scores on the benefits as realized by EA were quite subjective. But these scores do reflect the general opinion on EA (perceived use value) in those organizations and as such give important feedback to the architecture function.

A key finding of the pilots is that we were able to assess, in a short period of time, the level of measurability of EA in the organization. The pilot organizations were

interested in measuring the benefits of architecture, but did not have a clear understanding of the type of information that was needed to measure it. Because of the results achieved in the pilot, we were able to provide the organizations with a clear overview of the information that is needed to assess this value and to help them understand which part of the required information is already available. Following our assessment, we were able to express the availability of information on a measurability maturity scale, linked to the cells of the EAVF. This result allows the pilot organizations to start initiatives for acquiring the required information, in order to improve the measurability of the benefits of EA in the future.

In the second pilot, we were able to give an evaluation of the benefits stemming from EA as well, albeit that this evaluation reflects strongly the (subjective) judgments of the stakeholders. In this organization the EA did not succeed in delivering what was promised so very little real benefits for the daily operations were created, which is clearly reflected in the EAVF (as shown in fig. 4).

It is quite difficult to establish without doubt the traceability of EA. Changes in business processes and IT are started to deliver value to the organization. Our aim is to understand if we can trace back (part of) this value to results which are based upon, or initiated by, EA principles and guidelines. We found that benefits created in the first two phases of the EAVF (Development and Realization) can well be traced back to the EA, as these phases are closely related to the work of the architects. Traceability is more difficult in later phases as in most organizations many of the projects are started on initiative of the business and architectural principles are applied afterwards. Therefore, benefits can be accredited to the business departments as well as to the EA. We consider introducing a scope-factor in future pilots to express the proportion of EA in the measured value. In this way, it would become possible to express that a certain result can be attributed to the activities of the EA for say 40%.

In the second pilot organization, the followed project was quite clearly “EA induced”, but the results in the Use-phase were not very convincing to the business.

The results presented in this study are based on two pilots only. To validate our findings, more organizations need to be considered, preferably with a higher measurability level resulting in more demonstrable benefits due to EA (or lack thereof). However, considering the first results obtained with the value framework as presented in this paper and although a lot of research still has to be done, we expect that the EAVF will become a central tool in our research.

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