THE ENTERPRISE ARCHITECTURE VALUE FRAMEWORK

Research in Progress

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Abstract

Enterprise Architecture (EA) is a discipline aimed at managing the complex interrelationships of business processes and IT in the continuous changing environment of organizations. Despite this ambitious agenda of EA, it is not clear what exactly constitutes the value of EA for an organization or which activities architects should initiate to maximize their effectiveness.

In this paper, we present the Enterprise Architecture Value Framework (EAVF). The EAVF is a framework for classifying benefits and costs of EA along the dimensions of organizational goals and EA-related activities. It is derived from definitions of its underlying concepts and is independent of methods, techniques and tools used by architects. The framework is validated both theoretically and by mapping other frameworks on the EAVF. Results support the hypothesis that it offers a framework on which all EA benefits and costs can be mapped uniquely, thus providing a means to unite previous and future research on EA benefits.

The development of the EAVF is a first step in creating a measurement instrument for EA benefits and costs. It can be used in practice to align the activities of architects with the goals of the organization, thereby optimizing their effect on the performance of the organization.

Keywords: Enterprise Architecture, Benefits of Enterprise Architecture, Costs of Enterprise Architecture, Classification Scheme, Enterprise Architecture Activity.

1 Introduction

Enterprise Architecture (EA) is a means to translate the strategy of an enterprise into execution by providing a holistic view of the business processes, systems and technologies of the organization (Ross, Weill and Robertson, 2006). In this view, EA strongly influences the strategic and tactical decision-making in organizations (Simon, Fischbach and Schoder, 2014). The proliferation of EA in organizations started just before the turn of the century (Zachman, 1997), followed by an increasing interest from the scientific community from 2003 onwards (Simon, Fischbach and Schoder, 2013). With the growing implementation of EA in organizations, the interest in the question of its value for the organization has increased as well. One of the first authors publishing on this theme is Buchanan (2001). Since then, many more researchers have published on the benefits of EA from various perspectives, reporting benefits like: *business-IT alignment, better decisions, lower (IT) costs, improved business processes, improved IT systems, better collaboration, better integration* and *re-use of resources.* However, Boucharas et al. (2010a) conclude that though many research papers assume EA benefits, only a small percentage provides empirical proof of EA benefits and most authors do not define concepts like goal and benefit nor do they make explicit how they arrived at the benefits they present. This strongly limits the empirical as well as the theoretical foundation of their research

(Rodrigues and Amaral, 2010; Espinosa, Boh and DeLone, 2011; Lange and Mendling, 2011). Moreover, because no common classification of benefits exists (Niemi, 2008), the results of the various studies are difficult to compare. Lacking a commonly accepted classification, no agreed upon set of metrics to measure EA benefits exists either (Schelp and Stutz, 2007; Lange and Mendling, 2011; Kurek, Johnson and Mulder, 2017). Moreover, while the research on EA benefits continues, literature on the costs of EA is scarce and no classification of EA costs has as yet been proposed. These issues motivated us to start our research into establishing the value of EA in practice. As a first step, we have drafted a classification of benefits and costs of EA, deduced from definitions of these concepts. The research question we address in this paper is: *How can a classification scheme of benefits and costs of EA be constructed from definitions of these concepts?*

A classification scheme of benefits and costs of EA contributes to the scientific knowledge base by providing a common language and reference framework for other studies on the value of EA, thereby enabling the comparison and combination of results of EA benefit studies. The classification scheme presented in this paper can also be applied in practice by providing a more detailed view of the actual and potential contribution of EA to various types of organizational goals. Besides, it offers a strategy for the evaluation of EA activities and gives opportunity to (re-)align more precisely the activities of architects to the organization's strategic choices.

This paper is further organized as follows: in the next paragraph, we discuss related literature followed by an overview of the research method in paragraph 3. In paragraph 4 we define the various concepts related to the value of EA and the EA Value Framework (EAVF), our classification of benefits and costs of EA. In paragraph 5 the EAVF is theoretically validated and the paper ends with a short discussion and our plans for future research.

2 Theoretical Background

Goal, benefit, cost and value are concepts used in business literature for discussing the performance of an organization (Berghout, Nijland and Powell, 2011). In his classical book 'Modern Organizations', Etzioni (1964, p.6) defines a goal as: "*An organizational goal is a desired state of affairs which the organization attempts to realize*". In his vision, it follows that it can be established to what extent a goal has been reached, so goals are measurable by definition.

In order to reach the goals, organizations initiate activities. An activity is a generic term for work that a company or organization performs to create a certain output (BPMN, 2011). An activity can be thought of as a series of actions, executed by humans and/or machines. The consequences of activities can be valued by relating their outcome to the desired state of affairs, as expressed by the goals. Renkema and Berghout (1997) call the positive consequences of such activities benefits and the negative consequences sacrifices. In this paper, we will use the more commonly used term 'cost' for the negative consequences (financial and non-financial) instead. An activity may generate both benefits and costs, and it is not uncommon that activities may have positive consequences towards some goals while at the same time having negative consequences to other goals. For example, the benefit of an activity may be an increase in market share and the cost a decrease in customer satisfaction due to longer delivery times. It follows that benefits and costs can be related to goals by assigning the benefits and costs of activities to the goals they contribute to. Following this line of thought a *benefit* is the positive (financial and/or non-financial) contribution of (one or more) activities towards the desired state of affairs for an organization as stated by some goal. In the same vein, a *cost* is the negative (financial and/or non-financial) contribution of (one or more) activities towards the desired state of affairs for an organization as stated by some goal. The difference between the benefits and the costs related to the same goal (the net contribution) is defined by Schuurman, Berghout and Powell (2009) as the value reached for that goal. It follows that value is a derived concept and as such not necessary for a classification scheme.

Since Buchanan (2001) many researchers have published on the benefits of EA from various perspectives. Though most authors present some classification of the benefits found, quite often these

classifications are directly derived from their results and not founded in a theoretical framework. Foorthuis et al. (2010), Tamm et al. (2011) and Lange et al. (2012a) are representatives of this approach, resulting in different classifications which makes it difficult to compare these studies. Other authors use a more theoretical approach in classifying the benefits. Van der Raadt (2011) distinguishes benefits for the organization aimed at external factors (agility benefits) and at internal factors (alignment benefits). While not independent of each other, "*due to the abstract and multi-level characteristics of these concepts*" (van der Raadt, 2011, p. 98), all benefits may be classified in one of these categories (and sometimes in both). More recent, Jusuf and Kurnia (2017) have used the benefit framework for enterprise systems of Shang and Sheddon (2002) to classify their identified EA benefits in five classes: operational, managerial, strategic, IT infrastructure and organizational benefits.

Some authors use performance frameworks, particularly the balanced scorecard (Kaplan & Norton, 1992) - commonly abbreviated to BSC - to classify EA benefits. For example, Schelp and Stutz (2007) combine the four perspectives of the BSC with the organisational scope of the benefits. Boucharas et al. (2010a) conducted a structured literature research on EA benefits. Based on their literature review they distinguish 100 mutually exclusive benefits of EA, which they categorize in the strategy map (Kaplan and Norton, 2001), an extension of the original BSC. This decision is grounded on a review of five different frameworks for classifying benefits in terms of organizational goals from which they conclude that the BSC and its derived forms fit their requirements best. However, the choice for the BSC as a classification model for organizational goals is disputed. In a critical analysis of the assumptions underlying the BSC, Norreklit (2000) states that one of the more conspicuous shortcomings of the BSC is its underlying focus on financial results as the ultimate outcome. In a paper on the foundations of the BSC, Kaplan (2008) counters this by stating that - as financial success is not the primary objective of non-profit and public-sector enterprises - their accountability to society is the rationale for their existence and should supplement the financial outcome category. Other critics (Mooraj, Oyon and Hostettler, 1999) point out that the BSC is not complete as it does not include categories for the contribution of suppliers and employees to the organization. This criticism seems to be based upon a rather literal interpretation of the BSC and is in line with the fact that despite many publications, there is little agreement on what a BSC essentially is (Cobbold et al., 2002; Soderberg et al., 2011). According to Norton and Kaplan (1993) a BSC can (and must) reflect the actual organization and categories may be subdivided if the need arises. In other words: the BSC may be seen as a mold from which an organization can develop its own scorecard for developing and classifying its goals.

With the exception of the model by Schelp and Stutz (2007), all these classifications are one-dimensional. However, organizational scope and the perspectives of the BSC are not mutually independent. A genuine two-dimensional model is introduced by Niemi (2008), who conducted an in-depth literature review on EA benefits and interviewed a focus group on the results. His conclusion from the literature research is that: "*While the literature focuses on listing a multitude of benefits, it does not clearly define and describe them. Furthermore, there does not seem to be an established model for classifying the benefits in the EA context, ...*" (Niemi, 2008, p. 2). Next, he identifies 27 types of EA benefits and uses the IS classification model of Giaglis, Mylonopoulos and Doukidis (1999) to classify these along two axes: the measurability of the benefit and its attributability to EA, thereby producing four categories: hard, intangible, indirect and strategic benefits. Another two-dimensional classification is proposed by Wan et al. (2013), who performed a follow-up on the work of Tamm et al. (2011). They distinguish eight types of EA benefits, that they classify further on the basis of two attributes: their desirability and their realizability. However, it can be argued that both these classifications can be seen as lenses through which to view EA benefits rather than as generic dimensions and they can be used in combination with any classification scheme.

As these classifications are not based on clear definitions of EA benefits (Niemi, 2008; Boucharas et al., 2010a; Niemi and Pekkola, 2016), they all seem rather arbitrary chosen. In contrast, Lange and Mendling (2011) provide a list of EA goals derived from literature and expert interviews. They define four classes of goals: create baseline, manage complexity, drive transformation and support

innovation. As they define EA benefits as the degree to which the goals of an organization are met, these classes can be used as a classification of EA benefits as well.

Research on benefits has resulted in several EA benefit models – explanations of how EA may lead to benefits for the organization. As this paper is about the classification of benefits (and costs), we will not cover this topic but refer to the literature (Delone and MacLean 2003; Kluge et al., 2006; Steenbergen and Brinkkemper 2010; Espinosa et al. 2011; Lange et al., 2012a, 2012b; Frampton et al., 2015; Foorthuis et al., 2016). A meta-study on the various models proposed has recently been published by Niemi and Pekkola (2016) and their results indicate that none of the existing models fully explains how EA benefits are created.

Discussions on the costs of EA are very scarce in literature. If costs are discussed, it is in terms of reduction of costs by virtue of EA, which by all authors is considered a benefit of EA. Classifications of the costs of EA have to the best of our knowledge never been proposed and already in 2006 Lindstrom et al. pointed out that even the main EA frameworks lack in support for estimating and managing costs. We have no indication that this has improved since then. A possible explanation might be that benefits and costs of EA are made at different times so there is no direct relation between the benefits and the costs of EA in a given period.

3   Research Method

The research as described in this paper is part of an ongoing research into the value of EA that started with Slot (2010) and can be considered as a first step into the construction of a measurement instrument for benefits and costs of EA.

This research started with an exploratory literature review by using Google Scholar and Hugo, the search engine of the University of Applied Sciences Utrecht that indexes many databases including ACM Digital Library, AIS eLibrary, ScienceDirect, Springer, Taylor and Francis and Wiley Online. Search terms used were 'benefits', 'cost', 'value', 'contribution', 'expense' and 'consequence' in combination with 'enterprise architecture'. From the results, besides an overview of reported benefits and costs of EA to be used in further research, literature studies from roughly the last 10 years that included some kind of classification of EA benefits were selected for this paper. The observation that these classifications did not rely on definitions of the concepts of benefits and costs and classes were not properly outlined (Niemi, 2008; Boucharas et al., 2010a; Niemi and Pekkola, 2016), led us to an analysis of what exactly is meant with these terms. From definitions of these concepts, we derived a value framework, that has been validated theoretically against the criteria as formulated by Nickerson, Varshney and Muntermann (2013) and against existing classifications by asking four experts to map exisiting classifications into the framework. The usability of the framework in practice will be evaluated as part of our planned future research (see paragraph 6).

4   The Enterprise Architecture Value Framework

EA - with its focus on the long-term development of an organization - contributes to the performance of an organization as expressed by its goals. Benefits and costs can be attributed to EA if the contributing activities are related to EA, i.e. either creating or implementing the EA or resulting from the EA. We will call those activities: *EA activities* and the resulting benefits and costs: *EA benefits* c.q. *EA costs*, thereby defining EA benefits and EA costs the contribution towards the goals of the organization by EA activities. Summarizing, we use the following concepts underlying our classification scheme:

- *(Organizational) Goal*: A desired state of affairs which an organization attempts to realize (Etzioni, 1964).

- *EA Activity*: Activity (the work that a company or organization performs to create a certain output; BPMN, 2011) that is related to the EA, i.e. either creating or implementing the EA or resulting from the EA.

- *EA Benefit*: The positive contribution from (one or more) EA activities towards the desired state of affairs for an organization as stated by some goal of that organization (based on Renkema and Berghout, 1997).

- *EA Cost*: The negative contribution from (one or more) EA activities towards the desired state of affairs for an organization as stated by some goal of that organization (based on Renkema and Berghout (1997) who call this a sacrifice).

In using these concepts, we have to distinguish between *types* and *instances*. In literature we do not find a benefit such as: "Company X has reached in the last year an increase of its market share for product Y with Z percent", but rather the more general "increase in market share" is presented as a benefit. This is the classical distinction between an instance and a type as used in other disciplines as well. We will rely on context for the difference, but when necessary, we will distinguish between the two with a suffix: *-instance* and *-type*.

From the definitions given, it directly follows that EA benefits and EA costs can be classified by organizational goal and by EA activity. To classify EA benefits and EA costs in terms of organizational goals, we use Kaplan and Norton's (1992) Balanced Scorecard (BSC) as – despite its previously discussed shortcomings - the BSC has widespread use (Hasan and Chyi, 2017) and is supported by the research of Boucharas et al. (2010b). With the four perspectives of the BSC Kaplan and Norton (1992) introduce four different points of view in which goals, measures and activities for an organization can be classified. In their original paper on the BSC they state that these perspectives "*should provide answers to four basic questions: How do customers see us (customer perspective), what must we excel at (internal perspective), can we continue to improve and create value (innovation and learning perspective) and how do we look to shareholders (financial perspective)*" (Kaplan and Norton, 1992, p.72). More precise definitions of these perspectives have – to the best of our knowledge - never been given. In practice, this poses no problems as every organization may use the BSC as a mold to develop its own scorecard (Norton and Kaplan, 1993; Soderberg et al., 2011). However, in order to report on benefits in a uniform way, it is necessary to develop a classification scheme that can be used to unambiguously decide in which category a given EA benefit or cost belongs. We thereto define the four perspectives as follows:

- *Financial and Accountability*: goals that concern financial outcomes and/or the accountability of the organization to external stakeholders (shareholders, government, or – in the case of non-profit and public-sector organizations – members and contributors).

- *Customer*: goals that concern the market, the customers or the supply chain to which the products and services of the organization are targeted.

- *Internal*: goals relating to the current internal (business) processes, such as production, logistics and IT – including their support and management processes. In short: the processes necessary for the value proposition of the organization.

- *Learning and Growth* (also known as *Organizational Capacity*): goals that are targeted to improvements in the long run. Examples here are the development of employees, the culture, communication, alignment and agility of the organization as well as the willingness to use and deploy information and technological savviness in the organization.

To relate EA benefits and EA costs to EA activities we have categorized these activities in accordance with the three main outcomes of the EA process (TOGAF, 2011; SAFe, 2016), the creation of the EA, the implementation of EA and the results after implementing the EA:

- *EA Development*: EA activities in which an Enterprise Architecture for the organization as a whole is developed and maintained.

- *EA Implementation*: EA activities in which the implementation of (parts of) the Enterprise Architecture is carried out in the organization, usually via projects.

- *EA Exploitation*: EA activities when changes in the operations corresponding with the EA have been implemented and are in operational use. This category is called *EA Adaptation* by Dang and Pekkola (2017)

We call this classification the Architectural Lifecycle (ALC) as it comprises all EA activities in a more or less 'natural order'. However, with the ALC, EA activities can be classified regardless of the order in which the actual work is organized. For example, in an agile environment, implementation decisions may give rise to the (further) development of the EA while in a linear way of working the development of the EA will precede its implementation. While the EA activities in an agile environment may take place in any order, they are still recognizable (Abrahamsson et al., 2003). So, the transition from organization-wide EA work to projects is clearly recognizable - see for example SAFe (2016). The same holds true for the change from implementation activities to the activities that take place in the operations after implementation: the exploitation.

In the Enterprise Architecture Value Framework (EAVF) the perspectives of the BSC are combined with the classes of the ALC (figure 1). This results in twelve cells to which we will refer as the *EAVF-categories* in which the benefits and costs of EA can be classified.

BSC ⟍ ALC	Financial and Accountability	Customer	Internal	Learning and Growth
EA Development				
EA Implementation				
EA Exploitation				

Figure 1.   The Enterprise Architecture Value Framework (EAVF).

5   Validation of the EAVF

The EAVF has been derived directly from our definitions of EA benefits and EA costs. To verify if this framework is in accordance with scientific quality criteria, we follow Nickerson, Varshney and Muntermann (2013). Based on an extensive literature study, the propose five necessary conditions for a taxonomy: it should be comprehensive, concise, robust, explanatory and extendible. As we want every instance of an EA benefit or EA cost to be placed in one cell of the EAVF and in one cell only, we require the EAVF to be unambiguous as well. We tested the EAVF against these conditions:

- *Comprehensive:* by using the BSC, the EAVF covers fully the domain of organizational goals (Cobbold et al., 2002; Boucharas, 2010b). By its definition, the ALC covers all EA activities. It follows that, as EA benefits and EA costs are defined in terms of organizational goals and EA activities only, all instances of EA benefits and EA costs can be classified in the EAVF.

- *Concise* and *robust*: the EAVF has twelve cells in two dimensions making it easy to understand while at the same time it offers enough detail to differentiate between various kinds of EA benefits and EA costs.

- *Explanatory* and *extendible*: by their nature, the EAVF-categories combine instances of EA benefits and EA costs based on corresponding organizational goal and EA activity, bringing

together instances with common properties. When necessary however, both axes can be subdivided further to show more detail.

- *Unambiguous:* to fulfill this condition, it is necessary to define every EAVF category precisely, including the 'borders' between the cells. This will be addressed in our further research (see paragraph 6).

Besides the five necessary conditions posed by Nickerson, Varshney and Muntermann (2013), they also state that to be sufficient, a sixth condition should be added: a taxonomy should be useful and used in practice. As it is not possible to apply this last condition beforehand, we plan to evaluate in our further research how the EAVF can be used in practice.

From the comprehensiveness of the EAVF, it follows that it should at least be possible to map other classifications into the EAVF. By lack of existing classifications of EA costs, we have restricted our exercise to EA benefits as presented by Niemi (2008), Tamm et al. (2011) and Boucharas et al. (2010b). In our mappings, we had to deal with the fact that EA benefits are not always clearly defined by the authors, leaving them open to different interpretations. So, we asked four EA experts to do the mappings and compared their results. For some benefits, e.g. 'reduced costs', all agreed on the mapping. Differences in the mapping of other benefits could be explained by vagueness in the description of the benefit and the fact that in some cases the effects of the benefits were mapped as well. All in all, we could explain the differences in the mappings by the four experts and we conclude that all of the EA benefits considered can be placed in the framework. Any vagueness in how to map an EA benefit seems attributable to the way the benefit has been formulated and not to the classification scheme of the EAVF. Rather, we found it an advantage of using the EAVF as a generic framework that it forces a more precise formulation of goals, EA benefits and EA costs.

6   Discussion and Further Research

The EA Value Framework is a frame of reference for discussions on organizational goals, EA activities, EA benefits and EA costs. The EAVF is inferred from definitions of these concepts and provides a two-dimensional classification framework to categorize EA benefits and EA costs, relating these concepts to organizational goals and EA activities. We have used the BSC and the ALC as classification schemes for its axes and substantiated these choices.

An issue that needs some attention is the attribution issue (Espinosa, Boh and DeLone, 2011): what exactly is the contribution of EA activities to benefits claimed, especially in the Implementation and Exploitation categories. A way to overcome the attribution issue is to refine every goal in a part that can be influenced by EA activities and a part which is not, based on the metrics defined for that goal. Another way to deal with the attribution issue is to start with the EA activities and their outcomes and relate these to the organizational goals, using the Architecture Effectiveness Model (Steenbergen and Brinkkemper, 2010).

As it stands, the EAVF is independent of methods, techniques and tools used to develop and implement EA, and neither is the organization of the EA function relevant for the application of the EAVF. The EAVF essentially classifies the outcomes of EA and can be used in a classical setting, as well as in a more agile environment. However, to determine what exactly is the contribution of EA activities to the organizational goals, the EAVF has to be supplemented with a measurement instrument. The construction of such a measurement instrument is the aim of our further research that includes the following steps:

- We are engaged in collecting a set of indicators and accompanying metrics based on EA benefits and EA costs as reported in literature. We classify these indicators using the EAVF. As an added benefit, by deciding where an instance is classified, the borders between the cells of the EAVF become clear-cut, making the EAVF unambiguous. This step will result in a first version of a measurement instrument. The research question to be answered in this step is: '*Which indicators*

as reported in literature can be used in a measurement instrument for EA benefits and EA costs based on EAVF'?

- This first version of the measurement instrument will be tested in several case studies. After each case study, we will evaluate the results and, if necessary, adapt and extend the measurement instrument, so these case studies can be characterized as improving (Runeson and Host, 2009). While some EA benefits and EA costs may be recognized by specific organizations only, we expect that most EA benefits and EA costs as reported in literature are recognizable in every organization and can be included in a benchmark. The research question to be answered in this step is: '*Which indicators and accompanying metrics constitute a sufficient base to define a measurement instrument for EA benefits and EA costs based on the EAVF'?*

- As a third step, in order to test the usability of the instrument, we will ask architects working in practice to use the final measurement instrument in their own practice and from the results, evaluate the effectiveness of their EA. We plan to use action research as the methodology in this step. The research questions for this step are: '*Are results of measuring the value of EA with the measurement instrument independent of the measurer'?* and: '*How can the EAVF be used to optimize the effectiveness of the architectural practice'?*

This research has the ambition to create an instrument that can be used in practice by architects to decide on the best 'course of action' for the EA in their organization.

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