

Mitigating Enterprise Architecture Adoption Challenges

Improved EA Adoption Method

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Abstract: During the last decades the interest towards Enterprise Architecture (EA) has increased among both practitioners and scholars. One of the reason behind this interest is the anticipated benefits resulting from its adoption. EA has been argued to reduce costs, standardise technology, improve processes, and provide strategic differentiation. Despite these benefits the EA adoption rate and maturity are low and, consequently, the benefits are not realised. The support of top-management has been found to be a critical success factor for EA adoption. However, EA is often not properly understood by top-management. This is problematic as the value of EA depends on how it is understood. This paper aims for minimising the effect of this deficiency by proposing Enterprise Architecture Adoption Method (EAAM). EAAM improves the traditional EA adoption method by introducing processes helping to secure the support of top-management and to increase EA understanding. EAAM is built using Design Science approach and evaluated using Delphi.

1 INTRODUCTION

Enterprise Architecture (EA) has received a lot of attention during the last decades. For instance, the ICEIS conference have had a dedicated EA track for some years now. One of the reasons for the increased interest is the anticipated benefits resulting from its adoption. EA has been argued to provide cost reduction, technology standardisation, process improvement, and strategic differentiation (Schulman, 2003). Using a set of case-studies, Ross *et al.* (2006) demonstrated how these benefits could create value to organisations. Despite these benefits to be gained, EA is not widely adopted in organisations (Schekkerman, 2005; Computer Economics, 2014). Top-management support has been found to be a key success factor for adopting EA (Kaisler *et al.*, 2005). However, EA is not often understood correctly (Hjort-Madsen, 2006; Sembiring *et al.*, 2011; Lemmetti and Pekkola, 2012; Hiekkänen *et al.*, 2013). Business managers regards EA as an IT issue and IT managers as too big effort (Bernard, 2012). This equation is problematic as the value of EA to organisation depends on how it is understood by top-management (Nassiff, 2012).

In this paper, we propose an improved EA adoption method to address the aforementioned

issues. The proposed method helps organisations to adopt EA and, consequently, realise the EA benefits.

The structure of the paper is as follows. First we introduce the key concepts of EA, the traditional EA adoption process, and some adoption challenges. This is followed by the introduction of the research methodology of the paper. Next the proposal for improved Enterprise Architecture Adoption Method (EAAM) is introduced. Finally, discussion and directions for future research are provided.

1.1 Enterprise Architecture

Enterprise Architecture has many definitions in the current literature. Vague definitions are confusing for both practitioners and scholars (Hjort-Madsen, 2006; Sembiring *et al.*, 2011; Valtonen *et al.*, 2011; Lemmetti and Pekkola, 2012; Pehkonen, 2013). EA can be seen as a verb, something we do, and as a noun, something we produce (Fehskens, 2015). From the various definitions in the literature (i.e., Zachman, 1997; CIO Council, 2001; TOGAF, 2009; ISO/IEC/IEEE, 2011; Gartner, 2013; Dietz *et al.*, 2013) we adopt the synthesis by Syynimaa (2013): “Enterprise Architecture can be defined as; (i) a formal description of the current and future state(s) of an organisation, and (ii) a managed change between

these states to meet organisation’s stakeholders’ goals and to create value to the organisation”. As such, we accept the dual meaning of EA as a noun and verb.

With this definition in mind we can identify three processes related to EA development cycle. These are illustrated in Figure 1 using ArchiMate notation. The first process (P1) is describing the current state of the organisation and the second process (P2) the future state of the organisation. Difference between these two is that P1 is merely a description of the current state of the organisation, whereas P2 includes also elements of planning. The third process (P3) is the managed change where the (planned) future state of the organisation is implemented. There is also a fourth process related to EA, the adoption (P0), which precedes the other three processes. During the adoption, the state of the organisation is changes from the state where EA is not adopted to the state where it is adopted.

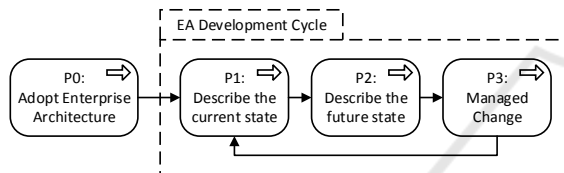


Figure 1: Enterprise Architecture Processes.

1.2 Enterprise Architecture Adoption

Enterprise Architecture adoption is a process where an organisation starts using EA methods and tools for the very first time. It is an instance of teleological organisational change (see van de Ven and Poole, 1995) aiming for the realisation of EA benefits.

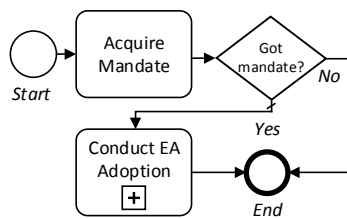


Figure 2: Traditional EA Adoption Process (P0).

The traditional EA adoption process is illustrated in Figure 2 using BPMN 2.0 notation. It is a high level process consisting of two activities. The mandate for the EA adoption is seen crucial by both scholars and practitioners (North *et al.*, 2004; Kaisler *et al.*, 2005; Shupe and Behling, 2006; Gregor *et al.*, 2007; Iyamu, 2009; 2011; Liu and Li, 2009; Carrillo *et al.*, 2010; Mezzanotte *et al.*, 2010; Vasilescu, 2012; Struijs *et al.*, 2013). Therefore the first activity is to *acquire a mandate* for EA adoption. If the mandate is not given

the adoption process terminates. If the mandate is given the process continues to the next activity called *Conduct EA adoption*. This collapsed sub-process is expanded in Figure 3. The first task in the *Conduct EA Adoption* process is to *select EA framework*. EA frameworks, such as TOGAF, usually consists of a development method and a governance model which are distinctive to the framework. Therefore the remaining tasks of the process depends on the selected framework. As it can be noted, the remaining tasks are same than the processes P2, P3, and P4. This is because during the adoption these steps are executed once before entering the normal EA development cycle.

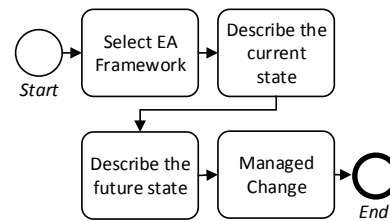


Figure 3: Conduct EA Adoption Process (P0.2).

1.3 EA Adoption Challenges

As stated, EA adoption is an organisational change aiming for the realisation of EA benefits. According to several studies, about 70 per cent of organisational change initiatives fail (Hammer and Champy, 1993; Beer and Nohria, 2000; Kotter, 2008). This is also the case with EA adoption. Consequently, the anticipated benefits of adopting EA are not realised.

For instance in Finland, EA is made mandatory in public sector by legislation (Finnish Ministry of Finance, 2011). The Act of Information Management Governance in Public Administration requires public sector organisations to adopt EA by 2014. In 2014 the EA maturity in the state administration was 2.6 or below in the 5 level TOGAF maturity-model (Finnish Ministry of Finance, 2015). Several studies has found that EA is not well understood in Finnish public sector (Hiekkanen *et al.*, 2013; Lemmetti and Pekkola, 2012; Seppänen, 2014; Syynimaa, 2015). According to Seppänen (2014) and Syynimaa (2015), the lack of EA knowledge is one of the main reasons hindering EA adoption

2 RESEARCH METHODOLOGY

In this paper we have adopted Design Science (DS) approach (see Hevner *et al.*, 2004) to improve the

traditional EA adoption method. DS is a research approach aiming to create scientific knowledge by designing and building artefacts (van Aken, 2004). As such, DS is concerned about the utility value of the resulting artefacts (Vaishnavi and Kuechler, 2013). There are three types of artefacts to research: (i) a technology artefact, (ii) an information artefact, and (iii) social artefact (Lee *et al.*, 2015). In this paper we are building a method, which according to Lee *et al.* (ibid.) is a technology artefact.

This paper follows the Design Science Research Model (DSRM) by Peffers *et al.* (2007). DSRM process consists of six phases: (i) problem identification and motivation, (ii) defining objectives for a solution, (iii) designing and developing an artefact, (iv) demonstration of the usage of the artefact, (v) evaluation of artefact's utility, and (vi) communication.

Typical outcome of DS is a tested and grounded Technological Rule (TR), which can be defined as "a chunk of general knowledge, linking an intervention or artefact with a desired outcome or performance in a certain field of application" (van Aken, 2004, p. 228). The form of a TR is "if you want to achieve Y in situation Z, then perform action X" (ibid., p. 227). Tested TR means a rule which has been tested in the context it is intended to be used (Houkes, 2013). Grounded TR (GTR) is a rule which reasons for its effectiveness are known (Bunge, 1966; Houkes, 2013). In this paper, we will seek for GTRs which would improve the traditional EA adoption method to address the adoption issues related to the lack of EA knowledge.

EA adoption is a process where the current state of the organisation is changed. This is comparable to the DS problem-solving situation illustrated in Figure 4. The desired state of EA adoption is the organisation where EA is adopted and embedded to organisation's processes. However, it is possible to end up with a final state where the desired state is not achieved or it is achieved only partially. In order to evaluate whether the improved EA adoption method works as intended, we should perform the adoption using the method in a real-life setting. Given the time and resources required by EA adoption, real-life evaluation is practically not possible. Therefore, we will adopt a Delphi method to evaluate the utility of the method.

Delphi method is a research process where experts' judgements about the subject are iteratively and anonymously collected and refined by feedback (Skulmoski *et al.*, 2007). It is typically used in forecasting but can be used also when developing methods (Päiväranta *et al.*, 2011).

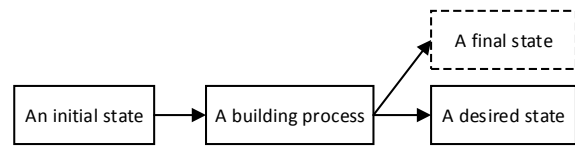


Figure 4: DS problem-solving situation (Järvinen, 2015).

As stated earlier, various studies have noticed the lack of EA knowledge in organisations. For instance Lemmetti and Pekkola (2012) argues that current definitions of EA are inconsistent and thus confusing both practitioners and scholars. Indeed, EA is underutilised due to lack of understanding it properly (Hiekkänen *et al.*, 2013). Therefore, our problem definition for EAAM is as follows: *How to minimise the effects of the lack of understanding EA concepts to EA adoption process?* This leads to the objective of EAAM, which is *to improve the traditional EA adoption method to minimise the effect of lack of understanding of EA concepts.*

3 ENTERPRISE ARCHITECTURE ADOPTION METHOD

In this section we will introduce the Enterprise Architecture Adoption Method (EAAM) and describe its building and evaluation. First we introduce and discuss on various organisational learning and change theories affecting EA adoption. Based on these, we will introduce GTRs to form a descriptive model. This is followed by the introduction of our emerging prescriptive method, EAAM. EAAM consists of the traditional EA adoption method with additional processes implementing the GTRs. Finally, the evaluation of EAAM is described.

3.1 Readiness for Change

Besides organisation culture (Burnes and James, 1995), the readiness for change has an impact on successful change (Jones *et al.*, 2005). According to Holt *et al.* (2007) the most influential factors of change readiness are (i) *discrepancy* (the belief that a change was necessary), (ii) *efficacy* (the belief that the change could be implemented), (iii) *organisational valence* (the belief that the change would be organizationally beneficial), (iv) *management support* (the belief that the organisational leaders were committed to the change), and (v) *personal valence* (the belief that the change would be personally beneficial). (Holt *et al.*, 2007). This implies that the content, context, and process of EA

adoption together with individual attributes affects the readiness for EA adoption. More specifically, individuals should believe that EA adoption is necessary, possible, beneficial to organisation, and supported by top-management. They should also feel that EA adoption would be beneficial to themselves. Similarly, managers who understand the change efforts are less resistant to change (Washington and Hacker, 2005).

Communication has an important role in organisational change. Communication has a positive effect to the readiness for change (Elving, 2005). On the other hand, uncertainty has a negative effect to readiness for change. This can also be influenced by communication. This implies that the readiness for EA adoption can be increased by communication, either directly or by decreasing uncertainty.

General technology acceptance models (see for example Venkatesh *et al.*, 2003) suggests that individual acceptance of information technology (IT) is influenced by beliefs and attitudes, which in turn is influenced by *Managerial interventions* and *Individual differences*. Individual acceptance is conceptually similar to the readiness for change. Both are influenced by beliefs and attitudes. These beliefs can be influenced by managerial intervention, e.g., communication. Therefore, in order to increase the likelihood of EA adoption success, the readiness for change needs to be increased by a proper communication by managers.

3.2 Individual and Organisational Learning

Learning can be defined as a transformation where “the initial state in the learner’s mind is transformed to the new state which is different from the initial state if learning has occurred.” (Koponen, 2009, p. 14, italics removed). *State of mind* consists of following cognitive beliefs; *beliefs (knowledge)*, *values*, and *know-how* (including skills). If learning occurs, the state of mind is transferred to a new state of mind with different cognitive beliefs. Learning can occur through acts in reality or by learner’s own thinking. The former learning mode means learning by perceptions, by having new experiences, or by acquiring information. (Koponen, 2009).

The current position of IS research is rooted in methodological individualism, which sees organisations as collection of individuals (Lee, 2010). This theoretical point of view is problematic, as it suggests that if the new people are coming in to the organisation, a new organisation would emerge (Lee, 2004). Therefore, according to Lee (2004), the better

conceptualisation would be that the organisation stays (somewhat) the same, and the people moving in would change towards the organisation’s culture.

Organisational learning can be explained using *AI framework*, where learning occurs on individual, group, and organisational levels. These levels are linked by four processes; *intuiting*, *interpreting*, *integrating*, and *institutionalising*. “*Intuiting* is a subconscious process that occurs at the level of the individual. It is the start of learning and must happen in a single mind. *Interpreting* then picks up on the conscious elements of this individual learning and shares it at the group level. *Integrating* follows to change collective understanding at the group level and bridges to the level of the whole organization. Finally, *institutionalising* incorporates that learning across the organization by imbedding it in its systems, structures, routines, and practices” (Mintzberg *et al.*, 1998, p. 212).

Individual learning is in a crucial part on the organisational learning, as organisations are “after all, a collection of people and what the organisation does is done by people” (March and Simon, 1958). Also, “change is not just about how people act, but it is also about how they think as well.” (Kitchen and Daly, 2002, p. 49). It can said that organisational learning has occurred, when EA concepts are understood on individual level, and processes and methods adopted and embedded to organisation’s routines.

Individual and organisational learning has direct implications to EA adoption. Organisational level learning occurs only through individuals. Similarly, individuals learn from the organisation. However, organisation is not the only source of learning for individuals. Learning may occur whenever the individual is interacting with reality (i.e., communicating, perceiving, observing) but also by barely thinking (Koponen, 2009). In order to adopt EA in an organisation, individuals needs to learn EA.

3.3 Effects of EA Training and Understanding EA Benefits

Hazen *et al.* (2014) studied why EA is not used to a degree which realises its benefits. The study is based on the UTAUT by Venkatesh *et al.* (2003). The study is especially interested in which *performance expectancy* drives organisational acceptance of EA. Performance expectancy is defined as “the degree to which an individual believes that using the system will help him or her to attain gains in job performance” (ibid., 2003, p. 447). According to findings, *partial mediation* model explains the EA use significantly more than *full* or *no mediation*

models. The partial mediation model implies that in order to increase EA knowledge, individuals' performance expectancy of EA needs to be increased along with proper EA training.

Nassiff (2012) studied why EA is not more widely adopted by analysing how organisation's executives value EA. According to findings, EA has four meanings among executives; *Business and IT alignment, a holistic representation of the enterprise, a planned vision of the enterprise, and a process, methodology, or framework enhancing enterprise decision making*. Also 16 unique benefits of EA were identified. Value of EA is directly influenced by how the EA is understood in the organisation. Regardless of the meaning of EA, three common benefits were expected; alignment between business and IT, better decisions making, and the simplification of system or architecture management. Findings implies that in order to increase the individual's performance expectancy of EA adoption, EA benefits needs to be communicated according to what EA means to the individual. This implication actually means also adopting *andragogy* instead of *pedagogy* as an assumption of learning; individual learning is depending on and occurring on top of the past experiences of the individual (Knowles, 1970). These past experiences and existing "knowledge" can have a negative effect to learning EA adoption, as individuals "have a strong tendency to reject ideas that fail to fit our preconceptions" (Mezirow, 1997, p. 5).

3.4 Role of Managerial Intervention and Leadership Style

Makiya (2012) has studied factors influencing EA assimilation within the U.S. federal government. EA was adopted gradually, starting from adoption (as defined in this paper) ending to assimilating EA as an integral part of organisation. The research was divided in to three three-year phases. During the first phase (e.g., adoption) factors like parochialisms and cultural resistance, organisation complexity, and organisation scope had a significant influence. According to the findings, parochialisms and cultural resistance did not exist in phase two, likely due to coercive pressure by organisation. This can be interpreted so that by using a force mandated by organisational position, one can greatly influence EA adoption. This is conceptually similar to *managerial intervention*, but also to *situational* and *social influence*. It should be noted that this approach had no effect in the phase three, so it should be utilised only during the adoption phase. According to study,

labelling EA as an administrative innovation instead of a strategic tool could help in value perception and adoption of EA.

Vera and Crossan (2004) has expanded the model of organisational learning by Crossan *et al.* (1999). They added the concept of *learning stocks*. Learning stocks exists in each level of organisational learning, namely individual, group, and organisation levels. These learning stocks contains the inputs and outputs of learning processes, taking place between layers. They argue that different leadership styles (transactional or transformational) needs to be used based on which type of organisational learning (feed-forward or feedback) needs to be promoted.

There are some behavioural differences between transactional and transformational leadership styles. These styles are not exclusive but should be used accordingly based on the situation (Vera and Crossan, 2004). Transactional leadership is based on "transactions" between the manager and employees (Bass, 1990). They are performing their managerial tasks by rewards and by either actively or passively handling any exceptions to agreed employee actions. Transformational leadership style aims to elevating the interests of employees by generating awareness and acceptance of the purpose of the group or initiative (Bass, 1990). This is achieved by utilising charisma, through inspiring, intellectual stimulation, and by giving personal attention to employees. Thus it can be argued that transactional leadership style suits better in a situation where *status quo* should be maintained. Similarly, transformational leadership style works better in a situation where organisation faces changes.

The feed-forward learning allows organisation to innovate and renew, whereas the feedback process reinforces what has already learned. There can be two types learning; learning that reinforces institutionalised learning and learning that challenges institutionalised learning. Transformational leadership have a positive impact to learning when current institutionalised learning is challenged, and when organisation is in a turbulent situation. In turn, transactional leadership have positive impact to learning when the institutionalised learning is reinforced, and when organisation is in a steady phase. (Vera and Crossan, 2004).

The role of managerial or leadership style to organisational and individual learning is significant. The key is the current organisational learning stock or institutionalised learning regarding to EA adoption. If EA adoption conflicts with the current institutionalised learning, the transformational leadership should be used in order increase the feed-

forward learning. Vice versa, if EA adoption does not conflict with the current institutionalised learning, the transactional leadership should be used to increase feedback learning.

Espinosa *et al.* (2011) have studied the coordination of EA, focusing on increasing understanding how coordination and best practices lead to EA success. According to study, cognitive coordination plays a critical role in effectiveness of architecting. Their model consists of two models, static and dynamic models. Whereas the static model affects the effectiveness on “daily basis”, a dynamic model strengthens group cognition over the time. There are three coordination processes in the model: *organic*, *mechanistic*, and *cognitive*. Mechanistic coordination refers to coordination of the routine aspects with minimal communication by using processes, routines, specification, etc. Organic coordination refers to communication processes used in more uncertain and less routine tasks. Cognitive coordination is achieved implicitly when each collaborator have knowledge about each other’s tasks, helping them to anticipate and thus coordinate with a reduced but more effective communication. As it can be noted, the term “cognitive” is not referring to term cognition, which is usually defined as a “mental action or process of acquiring knowledge and understanding through thought, experience, and the senses” (Oxford Dictionaries, 2010). Instead, they are referring to the *shared cognition* of a high performance group of individuals having similar or compatible knowledge, which can coordinate its actions without the need for communication (Cannon-Bowers and Salas, 2001).

According to the findings by Espinosa *et al.* (2011), cognitive coordination plays a central role in strengthening the other two coordination mechanisms. Therefore, in order increase the effectiveness of EA adoption, the shared cognition of individuals within the organisation needs to be strengthened. This can be achieved by providing similar level of EA knowledge to all individuals

3.5 Emerging EA Adoption Method

In this sub-section, we first sum up the concepts presented in previous sub-sections and form a list of propositions based on these concepts and their interrelations (Table 1). Based on these proposition, six Ground Technological Rules (GTRs) are presented, and finally EAAM process descriptions are introduced.

Table 1: Propositions of EA Adoption Method.

ID	Explanation	Source
P1	Understanding EA Benefits influences Performance Expectancy	Nassiff (2012)
P2	Executive’s understanding of EA meaning influences benefits	Nassiff (2012)
P3	Performance Expectancy influences EA training	Hazen <i>et al.</i> (2014)
P4	Individual’s and organisation’s learning stocks influences each other	Crossan <i>et al.</i> (1999)
P5	Performance Expectancy influences EA adoption	Hazen <i>et al.</i> (2014)
P6	Managerial Intervention influences feed-forward and feedback learning	Crossan <i>et al.</i> (1999)
P7	Individual’s learning stock influences EA Adoption	Agarwal (2000) Elving (2005) Espinosa <i>et al.</i> (2011) Hazen <i>et al.</i> (2014) Holt <i>et al.</i> (2007)
P8	Executives Individual Attributes influences leadership style	Bass (1990) Crossan <i>et al.</i> (1999)
P9	Managerial Invention influences EA Adoption	Agarwal (2000) Makiya (2012)

By *EA Benefits* we refer to all those benefits that may result by adopting Enterprise Architecture. These benefits influences *Performance Expectancy (PE)*, which refers to individual’s expectations towards EA adoption (P1). *Individual’s Learning Stock* refers to all individual’s current knowledge, know-how, values, and processes related on changing these (i.e. learning). *Performance Expectancy* influences *Individual’s Learning Stock* (P3) by giving some meaning to EA’s performance properties. *Performance Expectancy* also has a direct influence to *EA Adoption* (P5). *Individual’s Learning Stock* influences *EA Adoption* (P7), as it contains all individual’s knowledge, know-how, and values related to Enterprise Architecture. Managers’ and executives’ *Individual Learning Stock* influences *EA Benefits* (P2) in terms of his or hers capability to comprehend possible benefits related to EA adoption. Similarly, managers’ and executives’ *Individual Learning Stock* influences how they are capable in using *Managerial Intervention* to increase EA adoption success (P8). *Organisation’s Learning Stock* refers to the current organisation’s institutionalised knowledge (i.e., patents), know-how (i.e., processes, instructions, rules), and values (i.e., culture). Feed-forward and feedback learning occurs

between *Organisation's Learning Stock* and *Individual's Learning Stock* (P4). As organisations are composed of its members, changes in *Organisation's Learning Stock* (i.e., organisational learning) may only occur through *Individual's Learning Stock*. *Organisation's Learning Stock* however is only one of many sources that influences *Individual's Learning Stock*. *Managerial Intervention* refers to those actions which organisation's managers and executives may use to increase the success of EA adoption. *Managerial Intervention* has a direct influence on *EA Adoption* (P9), as managers and executives may provide coercive pressure to "force" EA adoption. *Managerial Intervention* influences also organisational learning (P6) taking place between *Individual's* and *Organisation's Learning Stocks* where managers and executives may promote learning by choosing their leadership style accordingly.

Based on the propositions six GTRs are provided in Table 2. As suggested by propositions P1, P2, P3, P4, P5, and P7, understanding EA benefits influences the EA adoption indirectly through performance expectancy and individual's learning stock. In order to acquire the mandate for EA adoption from the top-management, GTRs R1 to R4 are provided. As suggested by propositions P6 and P9, managerial intervention influences EA adoption both directly and indirectly by influencing organisational learning. To influence this learning, GTRs R5 and R6 are provided.

Based on the propositions and the GTRs provided above, three process descriptions are formed using BPMN 2.0 notation. First description, *EA adoption* process, can be seen in Figure 5. The process consists of four tasks; *Explain EA benefits*, *Acquire Mandate*, *Organise EA learning*, and *Conduct EA adoption*. When compared to the traditional EA adoption process seen in Figure 2 two tasks are added (illustrated in grey in Figure 5). The first new task, a collapsed sub-process of *Explaining EA Benefits* is expanded in Figure 6. The second new task, a collapsed sub-process of *Organising EA Training* is expanded in Figure 7. The logic of the process is as follows. A mandate from top management of the organisation is a requirement for EA adoption. In order to increase the likelihood of getting the mandate, one needs to explain the benefits of EA to management. If mandate is given, the next task is to organise EA training to increase the understanding of EA concepts. After these tasks are completed, the actual EA adoption can be started.

Table 2: Grounded Technological Rules.

ID	Explanation
R1	If you want to acquire a mandate for Enterprise Architecture adoption from top-management, explain <i>Common EA Benefits</i> .
R2	If you want to acquire a mandate for Enterprise Architecture adoption from top-management in a situation where manager's <ul style="list-style-type: none"> view to EA is more business oriented, rating of the organisation's EA maturity is low, or EA experience is low, explain <i>Alignment Specific Benefits</i>.
R3	If you want to acquire a mandate for Enterprise Architecture adoption from top-management in a situation where manager's <ul style="list-style-type: none"> EA experience is high, perception of EA complexity is low, or current EA authority is low, explain <i>Planned Vision Specific Benefits</i>.
R4	If you want to acquire a mandate for Enterprise Architecture adoption from top-management in a situation where manager's <ul style="list-style-type: none"> current EA authority is high, explain <i>Decision Making Specific Benefits</i>.
R5	If you want to improve organisational learning during EA adoption in a situation where <ul style="list-style-type: none"> EA challenges the <i>current organisational learning</i>, use <i>Transformational Leadership Style</i>. Otherwise use <i>Transactional Leadership Style</i>.
R6	If you want to improve EA adoption, use <i>Coercive Organisational Pressure</i> .

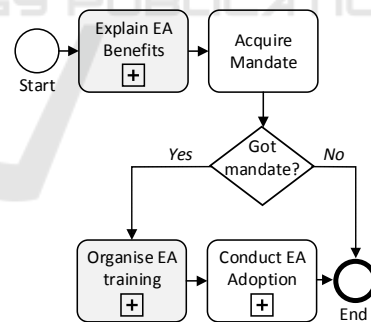


Figure 5: Improved EA Adoption Process.

The *process of explaining EA benefits* can be seen in Figure 6. This process has two actors, the *EA responsible* and *Manager*. The manager refers to the manager or executive whose support to EA adoption is seen as important.

The first task of the process is to *explain common EA benefits*, such as alignment of business and IT. Next task is to *assess manager's views to EA* in terms of EA business orientation, organisation's EA maturity, EA experience, perception of EA's complexity, and current EA authority. Based on the

assessments, one should explain the *more specific EA benefits* accordingly. For example if the manager's EA experience is low, one should explain the benefits specific to alignment, such as increased operational effectiveness and process improvements.

The *process of providing EA training* can be seen Figure 7. This process has also two actors, *EA responsible* and *Employees*, which represents organisation's personnel. First task is to *assess organisation's current learning stock*, i.e. what is organisation's current knowledge, know-how, and values related to Enterprise Architecture. As we are in the adoption phase, the level of EA specific knowledge is ought to be low, but one should assess capabilities and practices such as project management, change management, and internal communication. Second task is to *assess employee's learning stock*. Based on these two learning stock assessments, one should choose a proper leadership style. If *EA adoption challenges institutionalised learning*, i.e. it is different than *status quo*, one should choose to *use transformational leadership style*. If the learning does not challenge institutionalised learning, one should choose to *use transactional leadership style*. By using the chosen leadership style, next task is to *promote learning* accordingly. Next task is to *provide EA learning* based on assessments of current learning stocks. The last task is to *use coercive organisational pressure*.

3.6 Evaluation

Purpose of the evaluation of our Enterprise

Architecture Adoption Method (EAAM) is to assess whether it has the intended affect. The evaluation design follows the guidelines by Venable *et al.* (2012). Target of the evaluation is the product, EAAM, and evaluation takes place *ex-post*. The audience of EAAM is mainly EA responsible, i.e., EA champions, project managers, EA architects, etc.

Delphi method was selected as an evaluation method. For the evaluation, a panel of top Finnish EA experts was carefully selected from both industry and academia. Panel consisted of 11 members of different roles; professors (2), CIOs (3), consultants (2), EA architects (2), and development managers/directors (2). Evaluation consists of three rounds.

For the first round, using open-ended questions, experts were asked to read the EAAM method description and compare it to the traditional adoption method. For the second round, first round answers ($n=31$) were transformed to claims and sent back to experts for rating (disagree-neutral-agree). The scale (-3,-2,-1,0,1,2,3) was formed so that it could be treated as an interval scale as defined by Stevens (1946) which allowed us to calculate mean and standard deviations. For the third round, claims were sent to experts for rating including the average opinion of the panel. This allowed experts to re-assess their opinions to each claim.

The purpose of the evaluation is to have an unanimous opinion of the experts about EAAM. Thus the interest lies in the claims having a high mean and low standard deviation. Claims were ordered by their z-scores calculated with the formula $z=(x-\mu)/\sigma$

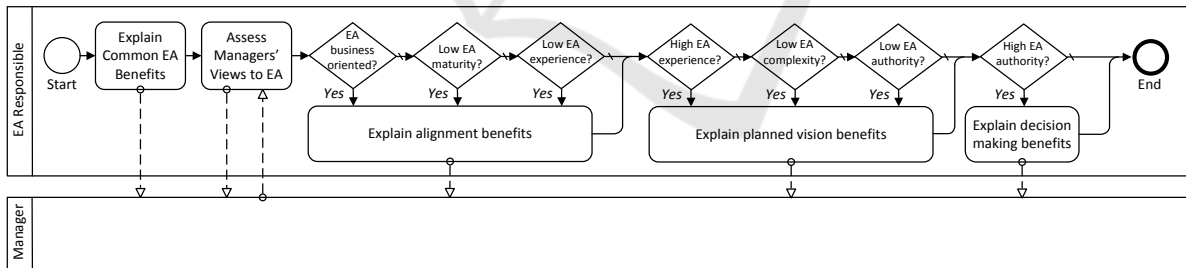


Figure 6: Explain EA Benefits Process.

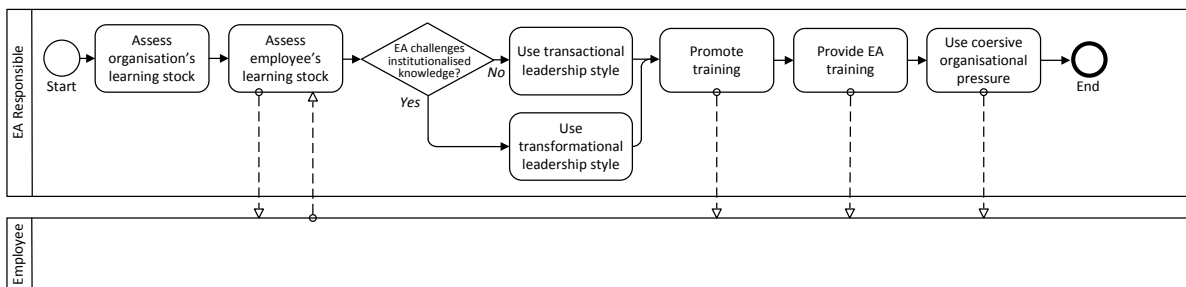


Figure 7: Organise EA Training Process.

where x is the mean value of the particular claim, μ is 0 (the centre of the scale), and σ is the standard deviation of the particular claim. The higher the z -score is, the more unanimous are the experts. To include only the most unanimous claims, a critical z -value for 0.95 significance was used as a threshold. The critical value for 0.95 is 1.65 as calculated by Excel 2007 NORMSINV function. Claims with the z -score less than 1.65 are thus rejected, which leaves us 16 statements of EAAM seen in Table 3.

Table 3: Evaluation Statements.

z	Statement
5.33	Considered and appropriate leadership style helps in adoption because it is all about changing the way to perform development.
4.64	Benefits of the adoption and the temporal nature of the resulting extra work is understood better, because the benefits are communicated using the target group's comprehension and point of view.
3.77	The meaning of the top-management's own example for the organisation is becoming more aware, because by the commitment of the top-management also the rest of the organisation is obligated to the EA adoption.
3.33	IM department's estimates of change targets are improved, because the anticipation of changes are improved and visualised.
2.83	The average of organisation's individuals' willingness to change will change to more positive, because the communication of benefits increases the formation of positive image and the acquirement the mandate from top-management.
2.67	The reasons for actions will be communicated.
2.67	Top-managements support to EA as a continuous part of organisation's normal management and operational development increases, because the recognition of the purpose and justification of EA-work, and communication of benefits, builds the foundation to acquire the mandate of top-management.
2.36	The total development of organisational knowledge would be improved in general, because also other actors beside the top-management are taken into account.
2.36	The leadership point of view is correct because the communication of EA is shaped according to the target group.
2.13	Setting the target and objectives of the adoption can be performed faster and in managed manner because the participants has a common picture of concepts, objectives, and methods before the actual execution phase.
2.04	The commitment and motivation to the adoption increases, because the understanding of reasons and objectives of EA increases.

z	Statement
1.85	Effects to the quality of results and to communicating them are positive, because the meaning of broad-enough knowledge is emphasised.
1.76	Documentation of QA system is improved, because method has a positive effect in the creation of basic documentation
1.76	Improves commitments and possibilities to acquire the mandate, because the person responsible for adoption is helped to improve targeting and content of the communication, and to considering the appropriate influencing methods and approaches.
1.76	Definitions of the roles and tasks are naturally forming according to the target, because the communication using the language of the target group affects the understanding of the benefits of each group.
1.67	Securing of top-management's commitment to adoption of EA and similar concepts increases, because the adoption is strongly based on top-management's commitment and communication of the adoption.

4 DISCUSSION

As stated in the problem definition, the purpose of the EAAM is to improve the traditional EA adoption process to minimise the effects of lack of understanding EA concepts. For this purpose, EAAM introduced two sub-processes: *Explain EA benefits* and *Organise EA learning*.

Goal of the *Explain EA benefits* process is to increase the likelihood of getting a mandate from top-management for EA adoption. This is achieved by explaining EA benefits based on each manager's characteristics. Experts' statements supports achievement of this goal strongly, as most of the statements are related to this process. This also indicates the importance of securing top-management mandate.

Goal of the *Organise EA learning* process is to increase the understanding of EA concepts. This is achieved by assessing the current learning stock and by providing appropriate training with a help of appropriate leadership style. Experts' statements supports also achievement of this goal.

According to March and Smith (1995, p. 261) "Evaluation of methods considers operationality (the ability to perform the intended task or the ability of humans to effectively use the method if it is not algorithmic), efficiency, generality, and ease of use". The first two criteria, operationality and efficiency is evaluated above; EAAM can be used to perform

intended task (e.g., adopt EA in an organisation) and it is efficient. The last two criteria, generality and ease of use, can be evaluated only by applying EAAM in other settings.

We cannot be argued that EAAM would be the best alternative solution to the traditional EA adoption method. However, as demonstrated in previous section, it can be argued that EAAM is better than the traditional EA adoption method.

4.1 Limitations and Future Work

As with all research this research is not without limitations. EAAM was evaluated with a panel of EA experts utilising the Delphi method. Therefore the first direction for future work is to evaluate it in a real-life setting by instantiation. The Canonical Action Research (CAR) by Davison *et al.* (2004) can be utilised as a research method during the instantiation. As suggested by Venkatesh *et al.* (2003), ease-of-use is important. In this paper, the ease-of-use of EAAM was not assessed. Therefore, the second direction for future research is to assess EAAM's ease-of-use in a real-life setting.

4.2 Conclusions

The EAAM method emphasises the importance of acquiring the mandate for EA adoption from the top-management and the importance of a proper EA training. EAAM helps in acquiring the mandate by formulating the argumentation of EA benefits according to the individual's interests. Moreover, EAAM helps in EA training by providing directions in choosing a proper leadership style to promote EA training. Thus by following EAAM, organisations can minimise the effects of the lack of EA knowledge.

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