

**Agile traits for Enterprise Architecture**

How an EA practice can be adjusted to improve its value in an organisation that adopted an agile way of working

**Author:**  
Arthur Blackstone

**Supervisor:**  
Ir. Henk Plessius

**Date:**  
H1/2022

HU University of Applied Sciences  
P.O. box 182  
3500 AD UTRECHT  
The Netherlands

# Table of Contents

<b>1. Introduction and background .....</b>	<b>7</b>
1.1. Problem statement.....	8
1.2. Research question .....	9
1.3. Reading guide.....	9
<b>2. Literature Review .....</b>	<b>10</b>
2.1. General.....	10
2.2. Benefits as a result of EA.....	11
2.3. Mechanism of realisation of benefits of EA .....	13
2.4. Perception studies on EA value .....	15
2.5. EA in agile organisations.....	16
2.6. Conceptual model.....	18
<b>3. Research method and process.....</b>	<b>20</b>
3.1. Quantitative study.....	20
3.1.1. Sample .....	20
3.1.2. EAVF questionnaire .....	21
3.1.3. Statistical analysis .....	21
3.2. Delphi study.....	23
3.2.1. Best practices of EA in agile settings.....	23
3.2.2. Rounds.....	24
3.2.3. Consensus.....	26
3.2.4. Sample.....	26

3.2.5.	Questionnaire design .....	27
3.2.6.	Data analysis.....	28
3.2.7.	Constraints and risks .....	28
3.3.	<i>Ethical considerations</i> .....	28
<b>4.</b>	<b>Findings and discussion.....</b>	<b>30</b>
4.1.	<i>EAVF survey findings</i> .....	30
4.1.1.	Descriptives and representatives.....	30
4.1.2.	Differences between departments .....	31
4.1.3.	EAVF reliability test .....	32
4.1.4.	Populated EAVF.....	33
4.1.5.	Goals of the organisation .....	35
4.1.6.	Comments from the EAVF survey .....	36
4.2.	<i>Agile traits and best practices</i> .....	36
4.2.1.	Analysis of publications.....	36
4.2.2.	List of best practices.....	37
4.3.	<i>Delphi study</i> .....	38
4.3.1.	Delphi first round .....	39
4.3.2.	Delphi second round .....	41
4.3.3.	Delphi third round.....	43
4.3.4.	Observations and discussion.....	45
<b>5.</b>	<b>Conclusions and recommendations .....</b>	<b>48</b>
5.1.	<i>Revisiting the research questions</i> .....	48

5.2.	<i>Conclusions</i> .....	49
5.3.	<i>Constraints &amp; limitations</i> .....	50
5.4.	<i>Academic Contribution</i> .....	51
5.5.	<i>Practical Contribution</i> .....	52
5.6.	<i>Recommendations and future research</i> .....	52
5.6.1.	General recommendations .....	52
5.6.2.	Recommendations to the organisation of this case study .....	52
5.6.3.	Future research .....	53
5.7.	<i>Lessons learnt</i> .....	53
6.	<b>References</b> .....	<b>55</b>

## List of tables

Table 1 - (sub)research questions .....	9
Table 2 - search items .....	10
Table 3- Clustering of agile traits .....	19
Table 4 - distribution of targeted responders .....	21
Table 5 - composition of Delphi participation.....	27
Table 6 - distribution of responses.....	31
Table 7 - Results of Mann-Whitney U test .....	31
Table 8 – Cronbach's alpha and Spearman-Brown internal reliability test results .....	33
Table 9 - populated EAVF.....	34
Table 10 – Significance levels for differences between the test results of the responses of the architectural activity types.....	34

Table 11 – Scores of EAVF aspects that were mapped to the goals of the organisation .....	36
Table 12- Clustering of agile traits .....	37
Table 13 - Final set of best practices and their respective sources .....	38
Table 14 - Delphi round 1: medians.....	39
Table 15 – Delphi round 1: statistics.....	39
Table 16 - Delphi round 1: Statements considered irrelevant. ....	41
Table 17 – Delphi round 2: Median scores.....	42
Table 18 - Delphi round 2: statistics .....	42
Table 19 - Best practices that received consensus and their practical handles .....	43
Table 20 - Relevant practices linked to EAVF aspects .....	45
Table 21 – EAVF topics and sub-categories .....	64
Table 22 - EAVF survey questions and topic description.....	68
Table 23 - results of Kruskal-Wallis test to compare the results per architectural activity types .....	69
Table 24 - Average and median scores per perspective/aspect EAVF.....	70
Table 25 - Organisation's spearheads mapped against EAVF aspects.....	71
Table 26 - Binomial test results .....	73
Table 27 - free format comments from EAVF survey .....	75
Table 28 - Normalisation efforts best practices .....	78
Table 29 - Practical handles on best practices.....	82

## List of figures

Figure 1 - EAVF .....	12
Figure 2 - EAVF refinement of BSC perspectives as per Plessius et al.....	13
Figure 3 - research model of Duijs et al.....	18
Figure 4 - Conceptual model .....	19
Figure 5 – Planned steps for Delphi study.....	25
Figure 6 - screenshot of the Delphi study instructions for the participants.....	79

## 1. Introduction and background

A large universal bank in the Netherlands has adopted an agile way of working throughout its organisation. While the transformation has been widely spread and deemed a success (Peter Jacobs and Bart Schlatmann 2016; Schotkamp and Danoesastro 2018), the Enterprise Architecture (EA) practice of the bank has been struggling to adjust to the agile way of working and consequently with its role and value in the organisation. Other organisations face similar struggles (Canat et al. 2018; Hendriks 2018; Lankhorst 2016; Salameh and Bass 2021). In repositioning the EA function to fit the needs of the changing organisation, differences in value perception on EA in the bank compared to before the organisational change may have occurred.

The bank, one of the largest financial institutions in the world, measured by asset size (S&P Global 2020), has undergone an enterprise-wide transformation and, since 2015, has re-organised its overall operations in the Netherlands following the Spotify model (Kniberg and Ivarsson 2012), placing focus on customer journeys, culture and simplicity (Barton, Carey, and Charan 2018). The model in itself is not a framework, rather than a way of organising the whole organisation. The model encourages autonomy and creativity in development teams on the basis of trust. Today, the bank employs more than 450 cross-functional teams, organised in *tribes*, *chapters* and *squads*.

The value that EA can bring to enterprises, has been researched by many. Kluge et al. (Kluge, Dietzsch, and Rosemann 2006) describe the need for EA to use its tools for the benefit and success of the enterprise, introducing the enterprise architecture value realisation model. Kaisler & Armour (S. Kaisler and Armour 2017) revisited their critical problems from their 2005 research (S. H. Kaisler, Armour, and Valivullah 2005) on EA and identified, in their study among 93 published papers, a number of additional challenges, including the uncertainty on the value of EA. Other studies have made claims on the benefits that EA provide for organisations (Hazen et al. 2017; Ross, Weill, and Robertson 2006; Shanks et al. 2018; Tamm et al. 2011), although unclarity still exists how EA business value is realised (E. Niemi & Pekkola, 2020). Considering the various benefits of EA without an ubiquitous view on how benefits can be realised one cannot provide an appreciation of the benefits of EA (E. I. Niemi and Pekkola 2016). Several authors (Boucharas, van Steenberg, et al. 2010; Gong and Janssen 2019) described that many researches claim benefits of EA without a base of empirical evidence. Rodrigues and Amaral (Rodrigues and Amaral 2010) argue that a lack of a clear understanding of the concept of value and the difficulty in identifying the key aspects that contribute to the value, are the key issues in assessing the value of EA.

Studies to actual benefits in practice, or at least the perception thereof, are limited in number. Lehong et al. (Lehong, Dube, and Angelopoulos 2013) suggest a perception study where benefits from existing literature combined with expert opinions are positioned towards EA stakeholders. Plessius et al. (Plessius et al. 2018) introduced the Enterprise Architecture Value Framework (EAVF), which combines different types of enterprise architectural activities with organisational goals which they

classify in Kaplan's Balance Scorecard (Kaplan and Norton 1992). Their research aims to offer a framework that establishes the value of EA in practice, independently on how this value is reached. Plessius and van Steenberg (Plessius and van Steenberg 2019) created and validated a further refinement of the classification of benefits of EA, that is used to further enhance the EAVF. Based on the EAVF and existing literature on benefits of EA, a questionnaire has been developed that can be used to identify perceived benefits towards the goals of an organisation

We could not find much research on the practical value of EA in agile organisations. Shirazi (2009) recognised a common thread in the problem that enterprise architecture often focuses on processes and tools over individuals and interactions, which directly opposes the values of the agile manifesto (Beck et al. n.d.). Duijs et al. (Duijs, Ravesteijn, and van Steenberg 2018) described the need for enterprises to adapt the EA efforts to an agile environment, offering a number of propositions to agile organisations. However, referred studies do not provide insight in the best practices that help the EA practice in connection to an agile way of working.

## 1.1. Problem statement

There are indications that organisation in the Netherlands that adopted an agile way of working struggle to continue to see value from their EA practice. While we see this in practice at an organisation close to us (the large bank in the Netherlands as per the introduction), there are similar sounds in various publications (Canat et al. 2018; Hendriks 2018; Lankhorst 2016). Agile teams and their product owners have different expectations and needs from EA practice than EA practitioners provide. Similar results are found in the research of Salameh et al. (Salameh and Bass 2021), specifically for the use of the "Spotify-model". They note, that the inherent encouragement of teams to use a "Lean Startup" together with the finding that the model "lacks practices addressing Agile architecture governance", can be considered ground for revising the (Spotify) model.

The impact is that the EA practice may not fulfil its potential value towards the goals of the organisations. Earlier work provided insight into the apparent gaps between EA and agile teams (Duijs, Ravesteijn, and van Steenberg 2018; Shirazi, Darvish Rouhani, and Shirazi 2009) and the roles of EA in agile organisation (Uludag et al. 2017) but a link between value perception of EA and practices to further connect EA to agile teams is, to the best of our knowledge, not researched.

In this research, we plan to demonstrate the use of the EAVF to improve the connection between the EA practice and an agile way of working. We will conduct the EAVF survey to identify areas where this connection can be improved and use a Delphi technique to identify which agile best practices, extracted from literature, can be adopted to address the problems in these areas.



## 1.2. Research question

The research question is: How can the Enterprise Architecture practice be adjusted to improve its value in organisations that adopted an agile way of working, using the EAVF? Sub-questions are described in below table 1

ID	Sub research question	Function	Method	Deliverable
SQ 1	Which models exist to describe value of EA?	Descriptive	Literature review	Examples
SQ 2	What are the best practices for EA practice in agile organisations?	Descriptive	Literature review	Overview of best practices
SQ 3	What is the perceived value of EA in a large organisation that adopted agile way of working?	Explanatory	Survey and analysis	Statistical analysis of perception on EA including the overview of areas where the perceived value of EA is low
SQ 4	What best practices extracted from literature can help address the low perceived value of EA	Explanatory	Delphi study	Analysis

Table 1 - (sub)research questions

## 1.3. Reading guide

Chapter 2 describes the findings from literature review on the value of EA, perception studies towards the value of EA and the usage of EA in organisations that adopted an agile way of working. It concludes with the conceptual model for this research and its context.

Chapter 3 discusses the research methods, describing the quantitative aspect (survey), the qualitative part (using a Delphi technique) and its required input. The chapter includes a section on ethical considerations as the data provided and possible conclusions may be sensitive in nature and could have impact on persons and the corporation of this case study.

Chapter 4 contains the findings of the research: the results of the EAVF survey including the statistical analysis, the finite list of agile traits and best practices derived from literature for EA practice in organisations that adopted an agile way of working and finally the outcome of the Delphi study among experts of the organisation of this case study.

In chapter 5, conclusions and recommendations are shared as well as some thoughts on the lessons learnt and eventual future research.

The appendices to this document contain additional, often expanded, details on the research as referred to in the text.

## 2. Literature Review

### 2.1. General

This section describes the findings from literature study to provide insights to sub questions 1 and 2.

For this research, the following academic search engines were used: HUGO (library.hu.nl), ResearchGate (www.researchgate.net), AIS (www.aisnet.org) and Google Scholar (scholar.google.com). Search terms and keywords include (table 2):

Inclusion criteria	Type
+“enterprise architecture” OR “EA” AND “benefits” OR “contribution” OR “value”	Content
+“enterprise architecture” OR “EA” AND “value” AND “Agile” AND “organisation” OR “organization”	Content
+agile AND Framework AND “SAFe” OR “scrum” OR “Kanban” OR “DAD” OR “spotify” OR “Lean” OR “extreme programming”	Content
+“enterprise architecture” OR EA AND +agile AND (“best practices” OR “principles” OR “traits” OR “success”)	Content
Exclusion criteria	Type
Articles without peer-reviews	Content
Articles not in English or Dutch language	Language

Table 2 - search items

The relevancy of the articles was determined by their titles, their abstract and whether they were subject to academic peer-review. We excluded articles that were not written in English or Dutch as we didn't want to take the risk of misinterpretation of the content of the articles due to a lack of proficiency in other languages. While we used some non peer-reviewed articles in our research (a.o. for the introduction), we did focus on peer-reviewed publications, ensuring us that the quality of the content as well as the methodological rigour and reliability is of the highest standard possible (Ali and Watson 2016). Finally, considering that agile software methodologies is a relatively young subject – the Agile Manifesto dates from 2001 (Beck et al. n.d.) – we applied a publication date 2001 and greater for articles that discussed agile methodologies.

## 2.2. Benefits as a result of EA

The term EA was first introduced by John Zachman at IBM in the 1980's as a practice to improve the functioning and management of complex enterprises and their information systems (Zachman 1987). Lankhorst et al. describe EA as a “coherent whole of principles, methods and models that are used in the design and realisation of an enterprise's organisational structure, business processes, information systems, and infrastructure” (Lankhorst et al. 2005). For the purpose of this research, we use the term EA in the latter sense; it also matches the definition used in the organisation of this research. The organisation defines enterprise architecture management (EAM) following the publication of Ahlemann et al. (Ahlemann, Legner, and Lux 2021), who describe EAM as a “management practice that establishes, maintains and uses a coherent set of guidelines, architecture principles and governance regimes that provide direction for and practical help with the design and the development of an enterprise's architecture in order to achieve its vision and strategy”

There has been ample research done on benefits of Enterprise Architecture. In 2006, Kluge et al. (Kluge, Dietzsch, and Rosemann 2006) introduced their EA valuation model, using the model of information system success (Delone and McLean 2003). Triggered by their premise that existing work was focusing on the establishment and maintenance of EA, such as frameworks and methodologies, leaving actual use of the EA function aside. Kluge et al. showed that service quality and use, inspired by the aforementioned model from Delone and McLean, act as catalysts in EA's value realisation: EA service quality supports potential value to perceived value; actual use supports perceived value to realised value.

Niemi (E. Niemi 2006) confronted an expert focus group with the results of a literature review on EA benefits. He used the IS benefit classification model of Giaglis et al. (Giaglis, Mylonopoulos, and Doukidis 1999) and applied it to the domain of EA. The benefits that were used in this study, came from literature review which the focus group generally agreed with; it is unclear how the categorisation of the mentioned benefits was done. He asked the focus group to assign the benefits to the axes of the model: the measurability of EA benefits versus how benefits are attributable to EA. The quadrant that these axes result in, create 4 categories where the benefits can be mapped against: Hard (linked to EA), Intangible, Indirect and Strategic.

Boucharas et al. (Boucharas, Van Steenberghe, et al.. 2010) identified 100 tangible EA benefits as a result of a structured literature review, displayed in the so-called Enterprise Architecture Benefits Model (EABM). The EABM sets out to provide a structure on the benefits and their relationships using Kaplan and Norton's Strategy Maps (Kaplan et al. 2004). While Boucharas et al. found that there is evidence on the effectiveness of EA, they also highlight that there is a strong focus on IT and its effects and that there is limited evidence to support the claims made. The latter is underpinned by Gong and Janssen's SLR from 2019 (Gong and Janssen 2019).

Plessius et al. (Plessius, Slot, and Pruijt 2012) introduced the Enterprise Architecture Value Framework (EAVF) and provided new insights in later publications (Plessius et al. 2018; Plessius and van Steenberg 2019). They use Kaplan and Norton's Balanced Scorecard (Kaplan and Norton 1992), arguing this choice based on its wide-spread use (Hasan and Chyi 2017) as well as its support in Boucharas' earlier research (Boucharas, Van, et al. 2010). As no strict definitions have been provided since the original publication of Kaplan's BSC, Plessius et al. define the four perspectives into 30 aspects to allow for an unambiguous decision where EA benefits may be categorised under. They then use the three organisational processes to which EA activities are closely related, EA development, EA implementation and EA exploitation. They call this architecture activity type (we're naming this AAT) and together with the four perspectives of the BSC, the following model is composed (see figure 1):

	BSC	Financial and accountability	Customer	Internal	Learning and growth
AAT					
EA development					
EA implementation					
EA exploitation					

Figure 1 – EAVF from Plessius et al.

According to Plessius et al., the EAVF is a practical insight of the perceived view of how EA benefits the organisation towards its own goals, independent on how those benefits may be achieved. (Plessius, van Steenberg, and Slot 2014). Plessius and van Steenberg (Plessius and van Steenberg 2019) created and validated a further refinement to the benefits in the EAVF, by adding a refined perspective on the BSC following and adapting the breakdown provided by Kaplan and Norton in their strategy map (Kaplan and Norton 2001) see figure 2 and a detailed view in appendix A.

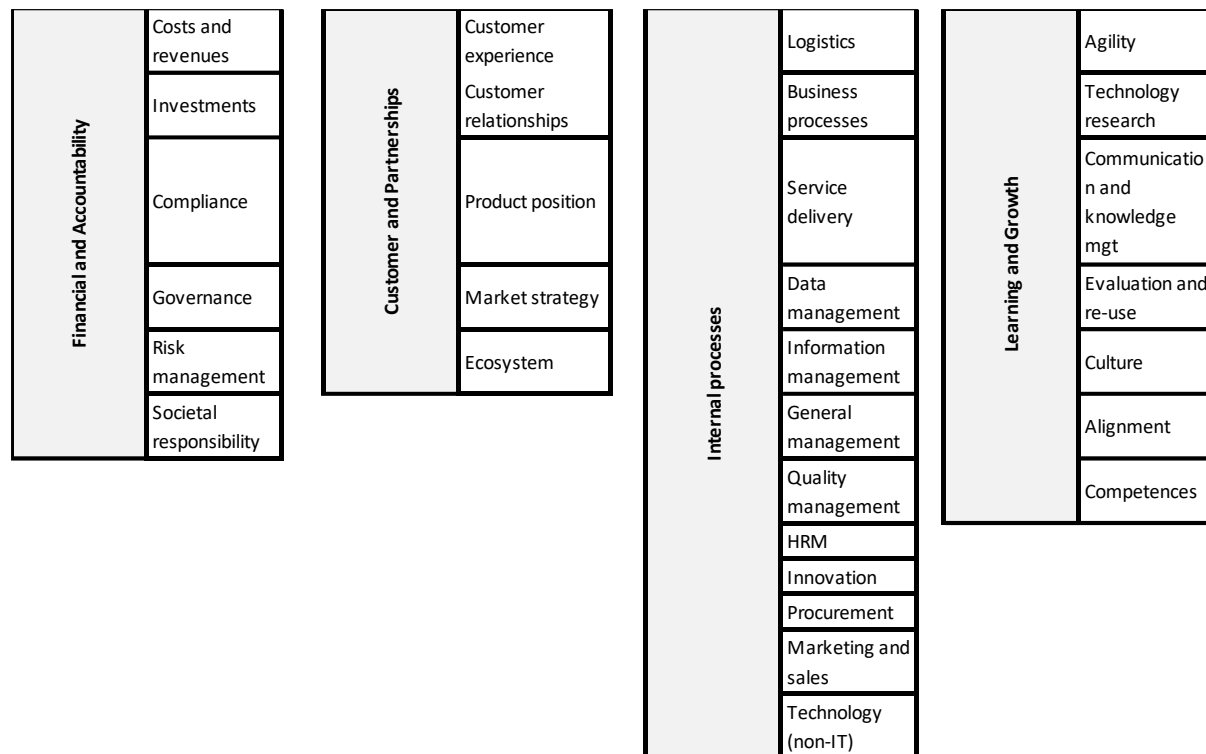


Figure 2 - EAVF refinement of BSC perspectives as per Plessius et al.

Many studies have provided alleged benefits of EA practice in organisations (Jusuf and Kurnia 2017; Shanks et al. 2018; Tamm et al. 2011; E. Niemi 2006; Boucharas, Van Steenberg, et al. 2010), however there seem to be no clear and agreed definitions of these benefits. In Niemi and Pekkola's research in 2016 (E. I. Niemi and Pekkola 2016), it is concluded that there is no single comprehensive EA benefit realisation model, despite introducing one of their own. It describes how benefits are realised but it also highlights that across existing models, the results are so profoundly different, that he calls for more research. The EA benefits realisation models that they refer to, largely discuss the same constructs, but in their respective conclusions, only use of EA is directly linked to direct contribution to benefits. In their 2020 article (E. Niemi and Pekkola 2020) on benefits of EA in organisational transformation, the authors identified 40 benefits, based on literature, though they do connotate that by stating that most of the underpinning studies do not back their findings with empirical evidence.

### 2.3. Mechanism of realisation of benefits of EA

Lange et al. (Matthias Lange, Mendling, and Recker 2015), like Kluge et al. (Kluge, Dietzsch, and Rosemann 2006) mentioned above, apply Delone and McLean's Success Model (DMSM) to prove that EAM organisational anchoring positively influence EAM organisational and project benefits. The constructs of the DMSM were adjusted to fit EA constructs, based on their own insight as described by Lange in 2012 (M. Lange, Mendling, and Recker 2012). The subdimensions were subsequently

added as result of literature review. They found that after creating the conceptual model, that the construct EAM product quality also has a strong positive influence on project benefits.

Tamm et al. (Tamm et al. 2011) also recognised the need for understanding the value of EA, based on a lack of explanations of why and how EA can add value to organisations. In their influential article, the authors introduce (another) Enterprise Architecture Benefits Model, which, they argue, shows that high quality enterprise architecture practice leads to organisation benefits, through 4 enablers: organizational alignment, information availability, resource- and portfolio optimisation. They define high-quality EA as “one that provides a vision for the future operating platform that is well-aligned with the organisation’s strategic goals, complemented by an optimal roadmap for moving towards that vision, based on an accurate understanding of the current operating platform”. Organisational benefits are described as “Outcomes that contribute directly to organisational performance, including lower costs, increased revenue, competitive differentiation, more accurate decisions, strategic agility, etc.”. Tamm et al. clearly focus on the improvements on the enablers of benefits from EA, but less so on the benefits themselves.

Van Steenberghe et al. (van Steenberghe and Brinkkemper 2010) introduced an Architectural Effectiveness Model (AEM) to express how EA can contribute to business goals of an organisation. The AEM is intended to be instantiated per organisation, based on three constructs, from architectural results, via organisational performance to the eventual business goals. Van Steenberghe et al. noted that there seems to be no direct relation between architectural results and business goals. The authors further describe that the AEM is not one ‘right’ model; the process of building the model for an organisation brings much of the benefits of the AEM. The AEM does not focus on the value of EA, rather it makes explicit how EA contributes to business goals at one point in time.

Foorthuis et al. (Foorthuis et al. 2010) mention the techniques used to reach conformance of EA practice and highlight that there is evidence that EA conformance leads to enterprise-wide benefits. Three of the techniques researched show particular influence on project conformance to EA, which in its turn have strong impact on 6 projects benefits. The authors claim, therefore, that project organisations can apply the techniques to obtain project and enterprise benefits, though the latter are not specified, other than that they result from project results.

Shanks et al. (Shanks et al. 2018) agree that project benefits lead to organisational benefits, but suggest that these are achieved by the use of EA services. They emphasize, however, that EA services enable other organisational processes that create organisational benefits. The authors discuss that both EA services in business-driven change as well as in IT-driven change have a positive effect on project benefits and support that with empirical evidence, Project benefits, in this study, comprise of a finite list of 4 components: improved decision-making, project management effectiveness, improved business capabilities and improved IT platform and systems, which find their source in existing documentation (including (Foorthuis et al. 2010; Ross, Weill, and Robertson 2006; C. Schmidt and Buxmann 2011; Tamm et al. 2011)), but no elaboration is provided as to why this list

is limited. Similarly, the organisational benefits are: agility, competitive advantage and value (for customers and employees). The model suggests that, building on earlier models, EA services are the essential aspect for reaching project benefits.

More recently, Alwadain (Alwadain 2020) adopted a 1995 model on business value creation by IT, to introduce his EA value realisation process, which consists of three iterative and related processes: EA conversion, EA use and EA competitive process. Niemi and Pekkola (2016) conclude that there is not one widely accepted and unambiguous EA benefits realisation model. Similar to Niemi and Pekkola (2016), Alwadain considers the EA benefits realization as a “complex process comprising interrelated processes and relationships”. Alwadain discovered that a few factors influence the processes from EA investment to organisational performance: management support, communication and collaboration, EA team capability, EA framework and tools, EA vision, and EA governance each influence the conversion process; the EA use process is, according to the author, influenced by representation and communication about EA assets, as well as the integration of those EA assets within the culture and way of working of the organisation. Common amongst all benefits models described and researched in the publications we found, is that benefits are realised indirectly, over time to improve the organisational IT platform (E. Niemi and Pekkola 2020; Tamm et al. 2011)

## 2.4. Perception studies on EA value

There have been many articles over the years describing value and/or benefits of EA. Many authors describe the benefits that may arise from EA practice, others focus on the mechanism how benefits are achieved as a result of an EA practice, as we set out in the paragraphs above. Not many authors have used a survey as a means to get empirical data on EA value. Shanks et al. (Shanks et al. 2018) found eight publications where a survey was used as the research method, but none of these measured the perceived value of EA irrespective of how these value is achieved.

Lehong (Lehong, Dube, and Angelopoulos 2013) published their findings on the perceived benefits of EA using Q-methodology, a widely accepted method from behavioural studies by William Stephenson. While the Q-methodology provides handles to measure perception based on pre-conceived personae (or ‘factors’), the authors’ choice for these factors is based on their own selection of the sampled population. The benefits that the authors used to confront their population with is, again, a selection that the authors derived from literature, their interpretation of them and a set of expert opinions drawn from non-specific discussions with EA practitioners (Lehong, Dube, and Angelopoulos 2013). The authors suggest a few recommendations as a result of their research, including one describing the need for benefits segmentation in the EA stakeholder definition. The results per ‘factor’ are significantly different, meaning that the expectations from benefits arising from EA, are different per segment (of stakeholders).

Contrary to Lehong’s research, Schmidt et al. (R. Schmidt et al. 2015) did not elaborate on the benefits themselves, defining them simply as a benefit when an EAM expert identifies them as one,

but researched instead whether different factors influence these benefits. They created a model of 5 factors, derived from literature, that influence the perceived benefits of EAM. The authors did not study the effects of these perceived benefits towards the goals of the organisation.

Based on the EAVF and existing literature on benefits of EA, a questionnaire has been developed that can be used to identify perceived benefits towards the goals of an organisation. The EAVF may be used in practice to identify areas that may need attention by EA in organisations, notably using the developed survey.

More recent studies towards the perceived value of EA, include constructs that link the value to EA's maturity in the organisation (Carugati et al. 2020) and the identification of critical success factors of the successful implementation of EA (Rouhani et al. 2019), but we have not found any new insights that can be used to attempt to resolve the RQ.

## 2.5. EA in agile organisations

Jason Bloomberg wrote that EA frameworks are not sufficiently prescriptive to reach agility (Bloomberg 2013), but methodologies are. He adds that frameworks provide tools, but they do not tell how to use them. He argues that EA, however, does not lend itself well to a methodological approach due to the fact that no organisation is the same (business processes, technology environment and cultural/political issues). He concludes that there is no room for EA frameworks, such as TOGAF and Zachmann, anymore in an era where agility is key.

Hosiaislouma et al. (Hosiaislouma et al. 2018) share this view as they see the classical EA frameworks as too heavy and rigid. They argue, like Hauder et al. did (Hauder et al. 2014) that the EA practice benefits from principles from Agile Software Development (ASD), such as velocity, lean, flexibility, learning and adaptability.

However, The Open Group as authors of TOGAF (TOGAF 2018), a detailed framework exposing numerous framework techniques, stresses that the framework is not a rigid one, but rather it encourages to adapt the model to suit the circumstances of the organisation. In that light, some of the TOGAF phases can be mapped out to agile processes; TOGAF suggests, for its framework to operate in an agile organisation, that architectural vision can be placed within backlog management, that business architecture would be part of iterative sprint planning and change management should be taken care of during the sprint review and retrospective process. This can be considered input for the governance and the artifacts delivery of EA.

The Open Group launched The Open Agile Architecture (O-AA) in 2020 (The Open Group n.d.) complementing TOGAF, enabling architecture in an Agile at scale environment. The authors address 16 'axioms' that must support the digital and agile enterprise or help enterprises reach that state.



Agile frameworks have vastly different views on the role of the wide array of IT architects. SAFe (Advanced Topic - Agile Architecture in SAFe n.d.) introduced the concept of “intentional architecture” to be balanced with “emergent design”, which should enable agile teams to work with the right amount of architecture to deal with the work at hand. SAFe also describes a number of artifacts that the architects are responsible for or at least co-authors. The “Spotify model” (Salameh and Bass 2021) describes little to no IT architecture roles, focusing largely on the self-sufficiency of agile teams to fulfil any IT architecture needs. While the authors suggest to tailor the Spotify model to include EA governance, there remains a lack of guidance on how and when to use Agile architecting practices (Yang, Liang, and Avgeriou 2016). Therefore, Agile practitioners are using such practices based on their experience and knowledge.

Recently, the studies from Hauder et al. and Canat et al. (Canat et al. 2018; Hauder et al. 2014) show that majority in the industry considers an agile approach in EA practice appropriate. Hauder developed a set of agile principles, such as cross-functional operations, iterative and incremental approach, self-organisation, which they derived from practitioners from several industries. The combination of EA and agile is recognised by EA practitioners, but limited research has been done on those practices. We will consider this publication as input for the governance, skills, principles and role of EA.

A multiple case study conducted by Uludag et al. (Uludag et al. 2019) showed a number of important responsibilities that EA has in large-scale agile transformations and the expectations what EA should do to support said work. We will use this as input for the role of EA.

Guo et al. (Guo et al. 2021) presented the results of their systematic mapping study of published scientific papers on Enterprise Architecture (EA) and agility. They found that by far most papers conclude that (business-IT) alignment, as a broadly defined concept, is the most important use of EA for improving organisational agility. They also researched which “agile trait” is mostly linked to making an EA practice agile. Both “Responding to changes” and “Being lean” scored high when talking about how to make EA agile and leveraging EA to achieve organizational agility. The authors advise that, while EA helps organisations to respond to change, it is even more important to improve EA processes to even better react to changes and similar to the point of “being lean”. Finally, from their research it appears that most publications see (business-IT) alignment as “the most significant value of EA in helping organizations become agile”.

In Duijs’ research (Duijs, Ravesteijn, and van Steenberghe 2018), the authors introduce 7 principles for (IT) architects that positively impact the overall acceptance of (IT) architecture in organisations where an agile way of working is adhered to (see figure 3). Next to these principles, they suggest a number of “instructions” for architecture practitioners “to further develop their architecture and agile development function”. We will adopt their principles and instructions as input for governance of EA, principles, role of EA, skills of EA and artifacts produced by EA

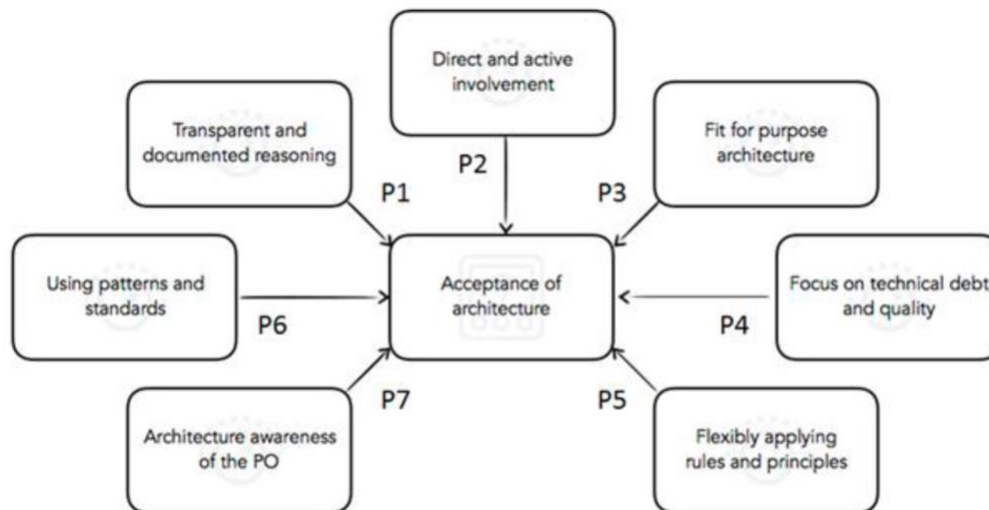


Figure 3 - research model of Duijs et al.

Cammin et al. described their research done to gain insight in implementation concepts on three agile requirements towards EA (Cammin, Heilig, and Voß 2021). They recognised that, in existing literature, there is little attention for tangible handles to implement an Agile Enterprise Architecture Management (EAM, sic) and identified the 3 most important agile requirements and their implementation suggestion for agile EA.

Veeresh Thummaddi et al. (Thummadi, Khapre, and Ocker n.d.) describe what organisations can do to adopt an agile way of working in EA. They focus on three principles and tested them in a case study. They found that the disruption caused by ‘pushing the organisation to the edges’ helped in constructing the agile EA organisation. They also noted that organising EA in a similar manner as an organisation’s agile teams, works beneficial in the cooperation with said agile teams, by creating ambiguous roles and therefor stimulating self-organisation of EA agile teams. They finally describe that even *very small* EA agile teams can be empowered for team-level decisions, despite SAFe warning for the opposite effect, according to Elssamadisy (Elssamadisy 2013)

## 2.6. Conceptual model

In this research, we adopted the EAVF (Plessius et al. 2018), which, as mentioned, combines the 4 pillars of the Balanced Scorecard (BSC) with the different types of enterprise architectural activities (AAT)

In the publications mentioned in 2.5, we found 87 agile traits and best practices. A complete overview of all best practices and agile traits used here can be found in appendix H. As we could not find a

categorisation of best practices in literature, we created our own, based on the characteristics of the statements found. In a first round of analysis, the 87 we have clustered in 6 categories (table 3):

Category	N
Governance of EA	18
(individual) role of EA	12
Skills of EA	7
Artifacts produced by EA	22
Principles of EA practice	25
Other	3

Table 3- Clustering of agile traits

A further elaboration of these agile traits and best practices is discussed in section 4.2

Combining the EAVF with the best practices for EA in an agile organisation, derived from literature, the following initial conceptual model can be composed (figure 4) which shows:

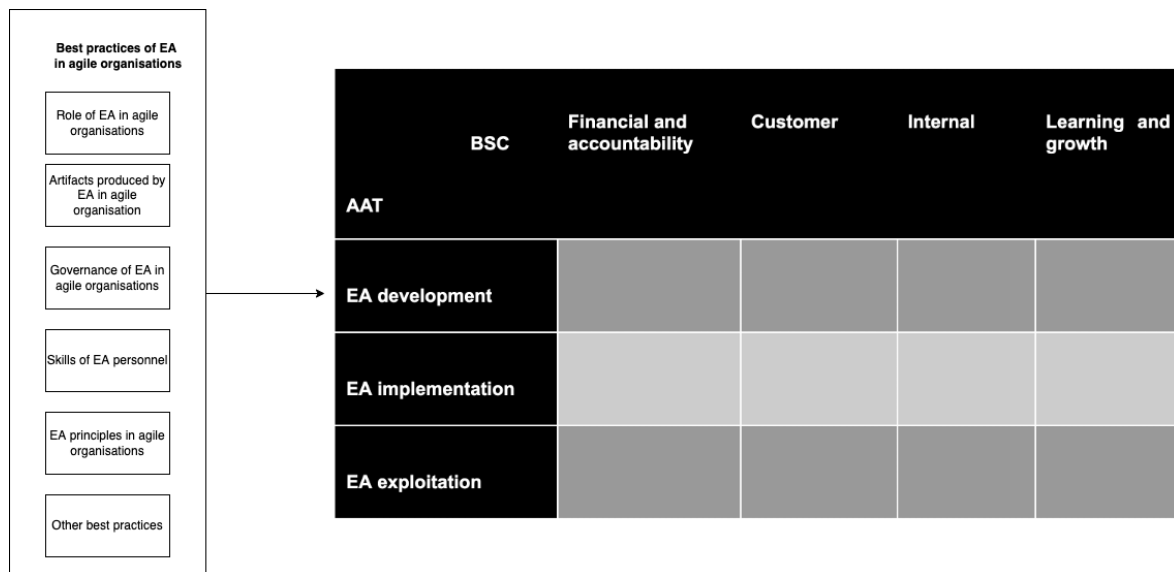


Figure 4 - Conceptual model

A general hypothesis is that we expect to find practices to improve the EA function that in time may improve the perceived value of EA

### 3. Research method and process

This research is conducted in a large financial institution in the Netherlands in the first quarter of 2022.

We have used the EAVF with the refined list of EA benefits to identify the perceived value of EA in a large Dutch bank in developing, implementing and exploiting products of the bank's EA in terms of the contribution towards the goals of the bank. Analysis of the results were confronted with the best practices in a Delphi study-setting to provide further insights how the practice of EA can improve its value in an organisation that has adopted an agile way of working.

This work can be classified as a theory-testing, exploratory sequential design therefore we have conducted a mixed method research. Mixed methods research enables the confirmation of an effect of a phenomenon by statistical analysis, followed up by exploration of the reasons behind this effect, for example by means of a case study (Tashakkori, Teddlie, and Teddlie 2003). We have used a quantitative research technique followed up by a qualitative analysis.

For the theory testing part, we have used quantitative techniques and the EAVF questionnaire. For the qualitative analysis, we used a Delphi study setting.

Below paragraphs describe our research design and usage of methods.

#### 3.1. Quantitative study

##### 3.1.1. Sample

We have used the EAVF and its questionnaire in a financial institution in the Netherlands to measure the perceived value of EA towards the goals of said organisation. The questionnaire has been sent out to representatives of the three architectural activity types in the 2 main departments of the financial institution. To reach a complete view, we have attempted to target an approximate equal number of representatives of each activity type and an equal number of representatives across the 2 main financial institution's departments. We used the details provided by the organisation which in reality showed large differences in population sizes between the activity types. These departments, respectively dealing with wholesale and retail clients, largely operate independently, and each have their own EA practice, albeit that they're both reporting into the same global EA office. The size of the population that received an invite to participate in this survey was 683. The details of the candidate participants were obtained from the human resource department of the financial institution and reflect the total population of representatives of the three activity types. The distribution of the targeted responders is described in table 4 below.

Architectural activity type	Department	Number
-----------------------------	------------	--------

EA development	dept_1	60
	dept_2	49
EA implementation	dept_1	125
	dept_2	115
EA exploitation	dept_1	187
	dept_2	147

*Table 4 - distribution of targeted responders*

### 3.1.2.EAVF questionnaire

The EAVF questionnaire consists of three parts, in accordance with the three architectural activity types distinguished in the EAVF: a part for EA development, a part for EA implementation and a part for EA exploitation. Each part consists of approximately 50 questions, divided over the 27 aspect areas in the four perspectives of the balanced scorecard. Respondents were asked to state the importance of the contribution of EA for each topic against a 5-point Likert scale whereby:

- 1 = Not important at all
- 2 = Slightly important
- 3 = Average important
- 4 = Important
- 5 = Extremely important
- 0 = Unknown

The questionnaire ended with an open question whether there are still aspects that have not been addressed.

Refer to appendix B for a full overview of the questions of the questionnaire

### 3.1.3.Statistical analysis

For the statistical analysis of the responses, we used IBM SPSS Statistics software version 28 (IBM 2021).

In SPSS, we have taken the following steps:

- 1) Import data

The data are captured in an online survey tool (LimeSurvey.com) which allows for direct export to SPSS, however with limitations on MacOS. To reduce possible negative effects (as reported in several online blogs) on the quality of the SPSS export, the export was first done to a MS Excel format, after which it was imported into SPSS.

2) Recoding of variables

Control questions were left as they were. The variables that indicated a score on a Likert scale are renamed to readable variables and an ordinal scale.

3) Analysis of provided data

In the LimeSurvey.com survey, none of the scoring questions were marked as required for the participants to fill in. Also, the tool stores un-submitted data. As a result, many incomplete responses were collected, which were disregarded for analysis, by selecting only those responses that finished the last question of the survey. Further, a smaller number of 'careless' responses were observed: answers with only 1's or only 5's and where the total time taken on the survey was under 2 minutes. These responses were removed from the dataset too as they're considered response bias (Meade and Craig 2012)

4) Reliability analysis

In the EAVF survey, several of the aspects in the model are covered by multiple survey questions. In order to determine how well the items in each of these questions go together, the most common statistical method to use is Cronbach's alpha (Urdan 2016)

5) Non-parametrical tests

- a. We used a Mann-Whitney U test to measure how much the variability in the scores is accounted for by the different architectural activity types. (MacFarland and Yates 2016)
- b. Non-parametrical test: we used an independent samples Kruskal Wallis test to identify if there is or are one or more significant differences between the scores of the different architectural activity types. As we are using a data set that is based on ordinal data comparing 3 samples, the most suitable test is the Kruskal-Wallis H test (McKight and Najab 2010).

There has been some controversy on the usage of a mean value in Likert-type items in statistical analysis as the data is considered as an ordinal measure (Jr and Boone 2012; Sullivan and Artino 2013). Boone et al. suggest that the use of median is preferred when the questions are unique and standalone, but when the questions combined measure a particular view, one can use the mean. Sullivan et al. describe that parametric tests can be used on Likert scale items (Sullivan and Artino 2013). We have used means to populate the EAVF and non-parametric tests to compare ranks.

The result of this analysis is a matrix of values, the populated EAVF, where the expectation is to observe differences in the value-perception of EA between the architectural activities. These differences can be an indication of the original problem statement. EA's struggle to continue to bring value to the organisation likely exposes itself in the results of the EAVF survey.

## 3.2. Delphi study

Next, a finite set of best practices and agile traits from existing literature was extracted. We used those best practices to confront a population of experts in a Delphi study setting as it's considered a powerful instrument "to seek out information which may generate a consensus on the part of the respondent group" and (Hsu and Sandford 2007). The Delphi method is a forecasting technique in which participants express their views on real-life topics and share these views with their colleague panellists.

The choice for a Delphi technique for this stage of the research was based on the need for rich data and creative outcomes to a possible problem. Skulmoski et al. (Skulmoski, Hartman, and Krahm 2007) advise that the Delphi method is particularly useful for research focusing on problems, opportunities, solutions and forecasts. They add that the technique deserves attention when there is incomplete knowledge about a phenomenon. This latter statement makes the Delphi method the choice of this research as it has become apparent that there is very little consensus among scholars on the subject of enterprise architecture in organisations that adopted agile ways of working.

We conducted the Delphi-study in an online setting. As the COVID-19 pandemic has changed the way how companies look at working from one office location, we considered the option of an online study more feasible and attainable in the period this research was held. There have been many studies describing the dynamics of an online Delphi study (MacEachren et al. 2006). Ellis and Hogard (Ellis and Hogard 2020) note that some limitations of a Delphi technique may be intensified when internet is used as the means to facilitate the technique, but "it must be acknowledged that the e-Delphi and other internet based approaches are simply tools to be used when appropriate." We assume the stance that an online Delphi study (or 'e-Delphi') has no other material difference from a 'regular' Delphi study than merely the fact that it's held over internet.

### 3.2.1. Best practices of EA in agile settings

We found several publications, as per section 2.4, that included best practices for organisations to practice EA in an agile way of working and interpreted 87 of them from said publications. We first clustered these traits as per section 2.5 in six clusters that we defined by our own judgement, after which we found that there was a great overlap in the content of these statements (best practices). For the purpose of a Delphi study, this would not be practical to confront the panel of experts. A process of 'normalisation' has been decided to:

- Remove double entries: when statements are clearly meaning the exact same thing
- Combine similar entries: to reduce overlapping statements, some of the entries are combined into one when they serve the same purpose, but with different words. Sometimes, the intention of the original statement has been deemed enough to combine statements

- Remove entries altogether: some entries lack the possibility to add practical handles to or require a substantial reorganisation in the organisation of this study. An example is one of the axioms described by the Open Group “Organizational Leveling (business architecture: Organizations shall be described at different granularity levels)”(The Open Group n.d.)

The result of this process is finite set of practices that we have confronted the Delphi panel members with as further described in section 4.2 of this document.

### 3.2.2. Rounds

The Delphi study's iterations are set for a maximum number of three rounds. We chose this limit for the following reasons:

- Hasson et al. (Hasson, Keeney, and McKenna 2000) indicate that 2-3 rounds are preferred
- There are constraints on time for this research, both for the author as well as for the participants in this part of the research

An schematic overview of the research steps is depicted in figure 5



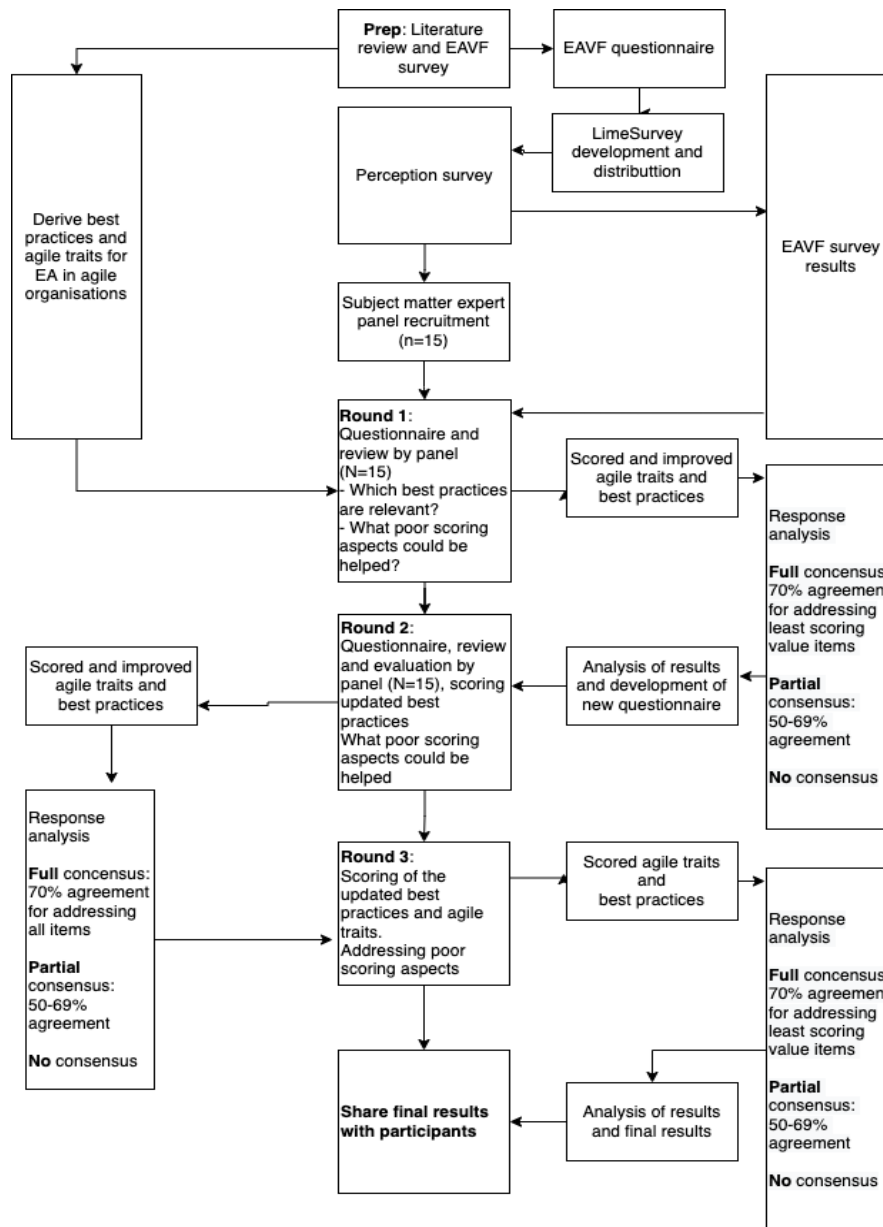


Figure 5 – Planned steps for Delphi study

The rounds were envisioned as follows:

In the first round, participants were confronted with the list of agile traits and best practices derived from literature. They were asked to score the relevance for their organisation and, for those practices that are deemed relevant, provide practical handles for them to be successful. Scoring was done on a 4-points Likert scale, whereby:

- 1 = Irrelevant
- 2 = Not relevant enough
- 3 = Relevant
- 4 = Very relevant

With a 4-point Likert scale, we rule out the ability to score neutral, hence a choice needs to be made on relevancy. Participants will also be asked to judge whether one or more of these practices may address one or more of the aspects of the EAVF, including the possibility to include comments to do so

In the second round, we sent out the results of the first round and have asked the experts to score again on the best practices where no consensus was reached in round 1.

In the third round we asked the participants to link best practices where consensus was reached on, to the poor scoring perspectives from the EAVF survey

### 3.2.3.Consensus

The goal of our study in Delphi setting was to seek consensus on how to address the possible value items -in the form of best practices- where (1) the difference between the scores from different architectural activities would be the highest and (2) the value items overall scored the lowest. Next, we looked for practical handles of these best practice

In a Delphi study, a number of questionnaires is distributed to a preselected group of experts in multiple iterations to collect data. It allows experts to reflect on the opinions of others and provide the ability to rethink their earlier answer, to eventually reach consensus (Adler and Ziglio 1996; Hsu and Sandford 2007). In available literature, several methods are applied for the determination of consensus as described by Diamond et al. (Diamond et al. 2014). While they advise that more uniformity in the definition of consensus should be attempted, it is important to state what constitutes consensus a priori. For our research, we have assumed that consensus is reached when at least 70% of participants rate best practices with a 3 or higher on a 4-point Likert scale and with the median at 3.25 or higher (Hsu and Sandford 2007).

### 3.2.4.Sample

According to Hsu et al. (Hsu and Sandford 2007) for the usage of a Delphi technique, researchers should use the minimal number of participants in order to reduce administration. They suggest that ten to fifteen experts can be sufficient provided that their background is homogenous. For the purpose of this research, we need experts from the three disciplines of Plessius' architectural activity types (Plessius and van Steenberghe 2019), hence we focus on enterprise architects, domain architects, platform architects, feature engineers, product owners and DevOps engineers with working knowledge of EA and with representatives from all business lines. Hsu et al. state that participants in the sessions should be highly trained and competent on the area of the target issue (Hsu and Sandford 2007).

We approached 24 professionals, 8 from each architectural activity type, to join the Delphi part of the research, of which 12 confirmed their participation. Based on practical suggestions from an

experienced researcher at the HU, we have invited an additional 3 experts in excess of the 12 to address the risk that participants may end their contribution to this study halfway through. The table 5 below depicts the composition of the team of experts.

ID	Role	AAT	Experience
1	Enterprise architect	EA development	15+ years
2	Feature engineer	EA implementation	15+ years
3	Product owner	EA exploitation	10-15 years
4	Enterprise architect	EA development	15+ years
5	Enterprise architect	EA development	10-15 years
6	Development lead	EA implementation	5-10 years
7	Enterprise architect	EA development	10-15 years
8	Platform architect	EA development	5-10 years
9	Product owner	EA expl	10-15 years
10	Feature engineer	EA implementation	5-10 years
11	Feature engineer	EA implementation	10-15 years
12	IT Lead	EA expl	15+ years
13	Infra architect	EA implementation	5-10 years
14	Customer Journey Expert	EA expl	2-5 years
15	Customer Journey Expert	EA expl	5-10 years

Table 5 - composition of Delphi participation

### 3.2.5. Questionnaire design

The questionnaire contains 5 parts:

1. Instructions for the participants
2. Participant information  
*For the purpose of identification during the Delphi rounds, the name of the expert. Also, their experience and education level.*
3. A normalised list of EA agile best practices and agile traits derived from literature  
*See section 4.2 for further details.*
4. The list of EAVF aspects that scored (relatively) poorly and are mapped to the organisation's spearheads, whereby we asked the participants which EA agile best practices may help in addressing these aspects.  
*The EAVF survey resulted in an outcome on aspects that may be helped with the highest scoring best practices and traits*

We added a list of sources where the best practices were derived from, for reference and being complete.

While for the EAVF survey, we used the LimeSurvey online survey tool, for this round, a bit more automation was required. A choice was made to compose and analyse the questionnaire in Microsoft Excel for the following reasons:

- During the first session using LimeSurvey, we noticed that un-finished surveys were difficult to pick up again, resulting in relative low numbers of responses.
- The complexity of the flow of the questions is arguably easier done in Excel
- Excel does not require online access and is easy to understand for its users.

### 3.2.6.Data analysis

For the statistical analysis of the responses, we used Microsoft Excel, for the reason that the questionnaires for this phase were sent out using Excel. Considering the limited complexity of the statistical analysis and the iterative characteristics of the technique, we concluded that it would benefit the time needed to perform the analysis if done in Excel .

In Excel, we take the following steps:

- 1) Using Excel functionality only, create a tool to import the recorded answers.
- 2) Analysis of provided data. Dynamically calculate the mean, variance and median of the scores with the intention to identify aspects that have reached consensus (either high scoring, or low scoring)

### 3.2.7.Constraints and risks

Conducting a Delphi study can be time consuming. Hsu et al. (Hsu and Sandford 2007) recommend 2 weeks for participants to respond and Diamond (Diamond et al. 2014) concluded that most Delphi studies take 2 or 3 rounds to reach some form of consensus. We have planned the Delphi setting to take 3 rounds, but with the connotation that if and when consensus is reached after 2 (or 1) sessions, the remainder of the sessions would not be held.

Other shortcomings and weaknesses of Delphi studies may occur and require close monitoring to prevent negative impact. Hsu et al. (Hsu and Sandford 2007) recognise that adequate response rates are very important for success in a Delphi study. We will adhere to their recommendation to ensure selected experts are motivated to respond (in time), by requesting management support.

## 3.3. Ethical considerations

The author of this thesis is, at the time of this research, active as a contractor in the EA department of the organisation's global core-bank program and has had access to critical personnel and experts in the organisation. The author did not receive emoluments for this research. Participants of the research are all, in some way, affiliated through employment with the financial institution and will be

informed about the usage of data spawning from this research. Any data collected in this research can be made available to the HU in the context of the MSc examination, but cannot be shared outside this setting.

Bryman et al. (Bryman and Bell 2015) highlight a number of ethical considerations prior to conducting any research, combined in 4 main areas outlined below. We included our vision how we will address these concerns in this research.

Bryman et al. note that harm, in this context, is not limited to physical harm, but also includes any negative conclusions as a result of participating in a research. We ensured that participation in the quantitative part of this research is anonymous. Participants were not asked for name or email address, but we have collected data such as department and role. While we did not publish individual records, we did inform all participants of this.

In the Delphi study, participation is equally anonymous in that the identity of the participants is not published and not shared with other participants. Anonymity stimulates a level playing field for discussions.

Informed consent, according to Bryman et al., is about participants in the research understand enough about the process to be able to make an informed decision prior to participating, including how data will be used and which parties will receive the findings. We addressed this concern by introducing the research as a master thesis and that the recipients of the results are the financial institution and the HU; we advised that collected data is non-personal or relatable to individuals. Bryman et al. provide a sample study consent form that we adapted and have included in the invite for the Delphi study.

Following Bryman et al., privacy is “very much linked to the notion of informed consent”, because participants acknowledge they surrender their right to privacy for the limited domain of the subject of the research, on the basis of their informed consent. We have addressed privacy concerns by confirming that data storage and usage is following GDPR regulations: all data is stored without ability to link responses to individual parties.

Deception occurs when a researcher depicts their research differently from the reality (Bryman and Bell 2015). To address this concern, we attempted to apply full transparency towards the goals and motives of the research and keep involved parties abreast of progress and results. Also, in the outline of the request to the participants, we provided the estimated time it will take to participate in the Delphi study as well as to complete the online survey to complete the EAVF.

## 4. Findings and discussion

### 4.1. EAVF survey findings

This section describes the overall findings from the survey that was held in January/February 2022 at a large bank in the Netherlands.

#### 4.1.1. Descriptives and representatives

The EAVF questionnaire was published on LimeSurvey.org (Schmitz 2021) in January 2022. A working LimeSurvey survey-file kindly shared by Henk Plessius was used to populate a large part of the survey questions. Participants were invited based on the following criteria:

- Working as employee or external consultant in the large bank of our case study
- Working in the role of (enterprise/IT) architect or product owner or IT development lead or feature engineer or IT management.
- Working in the Netherlands and for the business units in the Netherlands

Before approaching the participants, a selection was made of workers in EA, feature engineering, lead developers and product owners in the Netherlands. The bank provided the list of candidates, which tallied to a population of 683. Total number of received responses was 147, of which 88 we were able to use (12,9% response rate), which means that we may expect the results to be within  $\pm 10\%$  of the measured/surveyed value and a confidence level of 95%. We derive this figure from the formula provided by Israel (Israel 1992):

$$n = \frac{N}{1 + N(e)^2}$$

Whereby n is the sample size, N is total population and e is the level of precision, assuming a confidence level of 95% and  $P=0.05$ . As we know the n (88 respondents) and N (683) we can derive the e value using above rewritten formula:

$$e = \sqrt{\frac{1}{n} - \frac{1}{N}}$$

Which in our case means that  $e \approx 0,1$ .

We observed a rather large difference between the total responses versus the usable responses. This is largely due to incomplete answers (started surveys, but not completed) and 'extreme' answers (only 1's or only 5's as responses and a total time to respond of less than 2 minutes), which were disregarded.

The distribution of the responses over the disciplines of the architectural activity types, mapped to the roles known to the bank, is fairly evenly spread as shown in table 6 below

AAT	Role	Number	% share of the overall responses	% response rate
EA development	Enterprise architects	14	15,9%	29%
	Domain architects	11	12,5%	
	Platform architects	8	9,1%	
EA implementation	Feature engineers	17	19,3%	11%
	Lead DevOps engineers	9	10,2%	
	Solution architects	1	1,1%	
EA exploitation	Product owners	23	26,1%	8%
	IT management	5	5,7%	

Table 6 - distribution of responses

The third column holds the number of responses per role, the percentage of those responses related to the number of used responses (88) is added in the fourth column and the last column marks the response rate in that activity type received against the sent-out surveys (e.g. 29% of the targeted population of EA development returned a valid response)

#### 4.1.2. Differences between departments

We ran a Mann-Whitney U test to determine if there are statistically differences between the 2 main department. The U test is a non-parametric test and more appropriate than the parametric Student T-test for our case as we make use of ordinal data (MacFarland and Yates 2016).

	N		Mean rank		p-value	H0
H0 = No significant differences in the area of:	dept1	dept2	dept1	dept2		
Finance and accountability	57	41	46,80	53,26	0,267	Retained
Customer and relationships	54	41	47,17	49,20	0,735	Retained
Internal processes	55	41	47,07	50,41	0,561	Retained
Learning and growth	56	39	48,79	46,86	0,736	Retained
Overall	60	44	50,73	54,92	0,483	Retained

Table 7 - Results of Mann-Whitney U test

In above table 7 the first column indicates the null hypothesis (H0) that there are no significant differences between dept1 and dept2 for the respective perspectives of the balanced scorecard. As the significance of the test results are (a lot) larger than 0,05, the H0 can be retained for all the perspectives, hence our conclusion that there is no significant difference between the two departments. As a result of this observation, for the purpose of this thesis, we refrain from differentiating these departments and consider the organisation as one case.

#### 4.1.3.EAVF reliability test

Many of the aspects of the EAVF are filled by answers on more than 2 questions in the survey. As we are aggregating these answers to form an overall score, we need to ensure coherence in that overall score. We chose to perform a series of Cronbach's Alpha tests for those aggregated overall score items that have been composed of 3 items or more. Eisinga et al. (Eisinga, Grotenhuis, and Pelzer 2013) argue that a Spearman-Brown statistic is a more appropriate for two-item measures as Cronbach's alpha may result in an incorrect lower alpha than necessary. We applied both statistical tests

Item	Combined into	Cronbach's $\alpha$	Spearman-Brown coefficient
Revenuesandcost1	Revenues and costs		0,842
Revenuesandcost2			
Governance1	Governance		0,693
Governance2			
Socialresponsibility1	Social Responsibility	0,94	
Socialresponsibility2			
Socialresponsibility3			
Ecosystem1	Ecosystem	0,841	
Ecosystem2			
Ecosystem3			
Ecosystem4			
Businessprocess1	Business Process	0,84	
Businessprocess2			
Businessprocess3			
Datamanagement1	Data management	0,8	
Datamanagement2			
Datamanagement3			
Informationmanagement1	Information management	0,857	
Informationmanagement2			
Informationmanagement3			
Informationmanagement4			
Qualitymanagement1		0,912	



Qualitymanagement2	Quality management		
Qualitymanagement3			
Qualitymanagement4			
Compentences1	Competences	0,793	
Compentences2			
Compentences3			
Alignment1	Alignment	0,851	
Alignment2			
Alignment3			
Agility1	Agility	0,921	
Agility2			
Agility3			
Evaluationandreuse1	Evaluation and reuse	0,89	
Evaluationandreuse2			
Evaluationandreuse3			
Evaluationandreuse4			
Customerexperience1	Customer Experience		0,895
Customerexperience2			
Logistics1	Logistics		0,789
Logistics2			
Marketingandsales1	Marketing and sales		0,932
Marketingandsales2			
Innovation1	Innovation		0,941
Innovation2			
Generalmanagement1	General management		0,721
Generalmanagement2			
Culture1	Culture		0,845
Culture2			

Table 8 – Cronbach's alpha and Spearman-Brown internal reliability test results

We ran Cronbach (for aggregated constructs of 3 or more items) and Spearman-Brown (for aggregations of 2 items) respectively for all aggregated variables and found no indications of a reduced reliability of these variables, going by the rule of thumb as provided by Schutte et al. (Schutte et al. 2000), who consider an  $\alpha > 0.7$  as 'efficient'. There is one exception: the variable Governance has an  $\alpha$ -score of 0,693 which for aggregated variables of less than 5 items is still acceptable, according to Pallant (Pallant 2020). See above table 8 for details.

#### 4.1.4. Populated EAVF

The scores tallied up and averaged out, the EAVF can be populated (table 9). While doing so, we averaged the scores per aspect of the balance score card against the architectural activity type and

rounding the results to the nearest half or whole point. The 'Average' column represents the scores of all the questions after rounding to the nearest half or whole point for increased readability and interpretability.

AAT	BSC				Average
	Financial and accountability	Customer and relationships	Internal processes	Learning and growth	
EA development	4,5	4	4,5	4,5	4,5
EA implementation	3,5	3	3,5	3,5	3
EA exploitation	3	3,5	3,5	3,5	3,5

Table 9 - populated EAVF

Legend:

2	Slightly important
2,5	Less than average important
3	Average important
3,5	More than average important
4	Important
4,5	Very important
5	Extremely important

The overall score in resulting from the survey is 3,5 (more than average important), but the internal differences are remarkable. There are significant differences between the EA development type and the other 2 architectural activity types (i.e. EA implementation and EA exploitation), as demonstrated by the results of a Kruskal Wallis test that assesses the difference among the three architectural activity types. A Kruskal-Wallis test is a non-parametric test that is suitable for ordinal cases (McKight and Najab 2010)

	EA dev - EA impl	EA Dev - EA expl	EA impl - EA expl
Finance and accountability	<0,001*	<0,001*	0,761
Customer and relationships	<0,001*	<0,001*	0,412
Internal processes	<0,001*	<0,001*	0,668
Learning and growth	<0,001*	<0,001*	0,678
Overall	<0,001*	<0,001*	0,794

\* scores marked with an asterisk represent that there is a statistically significant difference

Table 10 – Significance levels for differences between the test results of the responses of the architectural activity types

Table 10 shows that the differences between the results of EA development and EA implementation and EA exploitation respectively are significant ( $p$  value  $< 0,05$ ). There are no significant differences between the scores of EA implementation and EA exploitation (as the  $p$ -values are all greater than 0,05). See appendix C for the larger table

We further see that participants in developing enterprise architecture, recognise the value that they bring and value that as minimally important ( $\geq 4$ ) across the board. There seems to be some doubt amongst participants from EA implementation and EA exploitation in their views to the importance of EA (scores never higher than 3,5). This may indicate that architects overestimate their contribution, but it can also mean that other groups have less visibility on the work of the architects. This observation underpins the problem statement (that the EA practice does not match the expectations of the organisation) and may indicate a lack of constructive communication between the activity types.

Appendix D contains the full scoring overview per aspect of the EAVF against the 3 architectural activity types. The variance of the individual aspects is noticeable. On 20 aspects, there is a difference of 1 or more points on the 5 points Likert scale between EA development and/or EA implementation/EA exploitation.

To provide confidence that the outcomes of the surveys were not a result of luck or coincidence, we ran a binomial test. The results of this test, which is elaborated in the appendix F, indicate that overall it is unlikely that this was the case.

#### 4.1.5. Goals of the organisation

Contributions of EA are relevant if they are in accordance with the goals of the organisation. We looked at the goals of the organisation of this case study, which are not publicly available and, with the aid of representatives of the organisation, mapped these against the aspects of the EAVF (see appendix E for the mapping). While it's not said that EA's work needs to be limited to these aspects (as highlighted by the senior management of the organisation), the EA practice may be expected to adopt at least its efforts to match the overall goals of the organisation. Three aspects score on average 'Important'; on one aspect the importance of EA is considered only 'Average important'. More interestingly, the differences between the activity type EA development and the other 2 activity types is at least 1 point on 12 aspects. We have selected the EAVF aspects that mapped to the organisation's spearheads in our Delphi study – see table 11.

BSC perspective	EAVF aspect mapped to one or more goals of the organisation	Average score EA dev	Average score EA impl	Average score EA impl	Average score of all respondents
<b>Financial and accountability</b>	Compliance	5,0	4,0	3,5	4,0
	Governance	4,5	3,0	3,0	3,5
	Revenues And Costs	4,5	3,5	3,0	3,5
	Investments	4,5	3,5	3,0	3,5

	Societal responsibility	3,5	3,0	2,5	3,0
<b>Customer &amp; relationships</b>	Customer relationships	4,5	3,0	3,5	3,5
	Market strategy	4,0	2,5	3,5	3,5
	Customer experience	4,5	3,0	3,5	3,5
<b>Internal processes</b>	Business processes	4,5	4,0	3,5	4,0
	General management	4,5	3,5	3,0	3,5
	Quality Management	4,5	3,5	3,5	3,5
	Logistics	4,0	3,0	3,5	3,5
	HRM	4,5	3,0	3,5	3,5
	Data management	4,5	4,0	4,0	4,0
<b>Learning &amp; growth</b>	Agility	4,5	3,0	3,5	3,5
	Technology research	4,0	2,5	3,5	3,5

Table 11 – Scores of EAVF aspects that were mapped to the goals of the organisation

#### 4.1.6. Comments from the EAVF survey

We provided the possibility for participants to submit free format comments in the survey. While the majority of the participants refrained from doing so, we collected 25 statements that give some further insight in the perceived value of EA at the organisation. A table containing the citations is available in appendix G of this document. In the submission we found that responders observe a lack of visibility of EA for the organisation (5 comments), that EA causes delay or shows a lack of contribution (6 comments), that the organisation is not dealing well with EA, for example due to time and budget constraints (6 comments) and that there seems to be a difference in the expected scope of EA (2 comments). We also found 2 comments that show the benefits the organisation enjoys from having this EA practice.

## 4.2. Agile traits and best practices

### 4.2.1. Analysis of publications

In the publications mentioned in the literature section, we found 87 agile traits and best practices. A complete overview of all traits found can be found in the appendix H. As we could not find a categorisation of best practices in literature, we created our own, based on the characteristics of the statements found. In a first round of analysis, the 87 were clustered in 6 categories:

- Governance of EA (the organisation of EA practice in an organisation that adopted an agile way of working)
- Individual role of EA (the behaviour and roles/responsibilities of individual EA practitioners)
- Skills of EA (competences of EA practitioners in an agile environment)
- Artifacts produced by EA (expected deliverables of the EA practice in an organisation that adopted an agile way of working)
- Principles of EA practice (architectural and design principles of an organisation that adopted an agile way of working)

- Other

Secondly, the statements were analysed for overlap whereby the best practices were combined if needed or marked as duplicates. As an example, a practice suggested by Hauder (Hauder et al. 2014), “Stakeholders provide fair feedback to EAM team” and another one by the Open Group (The Open Group n.d.), “Rapid Feedback Loops (Agile Architecture shall seek rapid feedback loops to verify customer and user assumptions)” were combined into “There is a constant and fair feedback loop from stakeholders to EA and back”. This exercise led to 37 unique agile traits and best practices for EA in organisations that adopted an agile way of working, see table 12.

Category	N after categorisation	N after deduplication and normalisation
Governance of EA	18	10
(individual) role of EA	12	4
Skills of EA	7	5
Artifacts produced by EA	22	7
Principles of EA practice	25	9
Other	3	2

Table 12- Clustering of agile traits

#### 4.2.2. List of best practices

As a result of the analysis of best practices, a list of 37 (table 13) was composed and has been presented to the participants of the Delphi study. While these statements are (still) rather generic, the request for the participants is to assess their relevance and provide practical handles where possible.

Nr	Statement	Source
1	There is a constant and fair feedback loop from stakeholders to EA and back	1, 2
2	EA organises itself in self organising cross-functional agile teams, with incorporation of retrospectives	1,2, 3
3	EA adopts Lean approach, including small units of work, one-piece work and iterations and processes must be reviewed constantly	1, 4
4	EA personnel should be co-located with agile teams but not be part of the agile dev team	5
5	The number of EA staff must match the number of agile teams	5
6	Avoid communication between EA and AT through a third person	5
7	Include AT in the architect production process to avoid BDUF fears	4, 5
8	EA must focus most on Business - IT alignment to improve organisational agility	4
9	The EA should have clearly defined authority, responsibility and accountability which is communicated widely	1, 2
10	EA must adopt the inverse Conway manoeuvre	2
11	EA should have an active participation in the development and design processes on a daily basis	6
12	EA practitioners should exchange a law enforcing attitude for a more collaborative one	6
13	EA must identify common step across several value streams	2, 7
14	EA must absorb the paradigm of "you build it, you run it"	2

Nr	Statement	Source
15	EA staff must possess management skills, such as diplomacy, negotiation and balancing skills.	1, 2
16	EA should foster a paradigm of learning by experiments	1
17	EA must possess specialised cross-functional skills	1
18	EA must possess and maintain technology skills as they serve the agile teams	5
19	EA produces a recognisable set of artifacts	7
20	EA produces a holistic vision based on a rationale	7
21	EA must produce its artifacts in a commonly understandable language (for example informal graphics) that is usable and findable for all stakeholders	1, 6, 8
22	EA must make use of patterns and standards, in combination with transparency and documentation of reasoning	6
23	EA must be able to produce fit for purpose architecture that can be adapted to the interest of stakeholders	6
24	Focus on technical debt and quality has a positive impact on acceptance of architecture	6
25	EA must be part of the team that performs code review	8
26	EA personnel must maintain high availability for the rest of the organisation	5
27	The PO's should have increased awareness of architecture	6
28	EA must enable a holistic orchestration of every single touchpoint of the bank and its ecosystem	2
29	Architects evangelise agile and Lean principles, also for their own work	7
30	Architects must prioritise time over quality and completeness	1
31	EA should focus on early delivery	1, 8
32	EA must adhere to flexibility when applying rules and principles	6
33	EA must focus on customer experience over everything else	2
34	EA must adhere to the paradigm of outside-in thinking/design thinking	2, 8
35	EA should focus on loosely coupled systems as it increases agility and simultaneous development	2
36	EA should create modular (data) platforms using domain decomposition logic	2
37	EA should create and maintain a simple list of architecture principles that are common over all elements	2

Legend:

ID	Reference
1	Hauder (Hauder et al. 2014)
2	O-AA(The Open Group n.d.)
3	Thummaddi et al. (Thummadi, Khapre, and Ocker n.d.)
4	Guo et al. (Guo et al. 2021)
5	Uludag et al. (Uludag et al. 2017, 2019; Uludag, Philipp, et al. 2021)
6	Duijs et al. (Duijs, Ravesteijn, and van Steenberghe 2018)
7	SAFe (Advanced Topic - Agile Architecture in SAFe n.d.; Elssamadisy 2013)
8	Cammin et al. (Cammin, Heilig, and Voß 2021)

Table 13 - Final set of best practices and their respective sources

### 4.3. Delphi study

We conducted a qualitative study in April-May 2022 using an e-Delphi technique as described in the section 3.2. The input for the study included:

- The final set of best practices and agile traits from section 4.2.2
- The results of the EAVF survey

We asked the panel members, in isolation from each other, to rate the best practices for their relevancy in the organisation of this case and provide comments and practical handles where they see them fit. Further, we asked them which of those relevant best practices would be beneficial in reducing the gaps in the mapped EAVF aspects (to the organisation's spearheads) where the perceived value was either low, or where the gap between the disciplines was high. See also appendix I

#### 4.3.1. Delphi first round

The response in the first round was 80% (12 out of 15), meaning 3 persons were unable to participate due to varying reasons. A commonly received piece of feedback on the design of the study was that the volume of requested work was too high. Participants gave as feedback that they spent more than 1,5 hours on the document, which was higher than we communicated.

The first round showed that we already reached positive consensus on 10 statements and negative consensus on 6 statements. From the remainder of the statements, 21 in total, 6 statements received a score of 3 or higher, but have not passed the mark of a median higher than 3,25.

Median score	# statements
>1 and <2	2
>2 and <3	10
>3 and <4	16
4	9

Table 14 - Delphi round 1: medians

Criteria	# statements	Result
3 or higher AND >70% 3 or above AND median >3,25	10	Accepted
2 or lower AND >70% 2 or below	6	Rejected
>70% 3 or above AND median <3,25	6	Undecided
Rest	15	Undecided

Table 15 – Delphi round 1: statistics

The following statements did receive scores of 2 or lower by >70% of the participants and with a median of 2 or less (table 16):

Statement	Comments include
The number of EA staff must match the number of agile teams	<p>"The number of EAs must be magnitudes smaller"</p> <p>"Domain architects could span more than one team, when working in the same domain"</p>
EA should have an active participation in the development and design process on a daily basis	<p>"This is equating EA with IT architecture, which is probably the very source of the perception mismatch this enquiry tries to tackle"</p> <p>"Daily is not necessary. Yet, there should be continuous communication with AT -- ideally in the form of mature AT members acting as trip wire for points of attention to EA"</p>
EA must be part of the team that performs code reviews	<p>"No really. This should be automated as much as possible and if it is done manually, then the reporting out of the code review needs to be trustable. The capacity needed to do this personally is not achievable on EA level. Besides not every EA is capable to engage on such a level of engineering detail."</p> <p>"Why?! How?"</p>
Architects must prioritise time over quality and completeness	<p>"That is a difficult question, I think the architects' focus must be on quality and completeness and only when senior management decides otherwise and is aware of the consequences and willing to take the extra money over time"</p> <p>"Understanding the trade-off is much more essential"</p> <p>"Absolutely not. Architects must balance between time and quality and completeness to achieve the needed quality levels and "just enough" completeness."</p>
EA must adhere to flexibility when applying rules and principles	<p>"Shu Ha Ri <sup>1</sup> springs to mind"</p> <p>"Principles are arguably the most essential EA deliverables and the closest artifact we have to facilitate discussions and make grounded decisions. Principles by nature are flexible and prone to change. This statement is not usable"</p>

---

<sup>1</sup> Shu Ha Ri, in the context of agile adoption, is a way of thinking about how one learns a technique. It describes 3 stages, from listening to mastery to learning from one's own technique progressively (Fowler n.d.)



Statement	Comments include
Architects evangelise agile and Lean principles, also for their own work	<p>“Evangelisation is not a tool that an architect should use. Lean is wholly inappropriate for EA”</p> <p>“This is a cultural aspect, not an EA principle”</p>

*Table 16 - Delphi round 1: Statements considered irrelevant.*

The respondents proposed 6 new statements that were largely variations on existing statements on early involvement of EA in programs/roadmaps or on architecture principles.

All participants also made their first pass at identifying best practices that could aid poor scoring aspects from the EAVF survey results.

#### 4.3.2. Delphi second round

In the second round of the Delphi setting, we confronted the participants with the list of statements that resulted in consensus in the first round, as well as the list of statements that did not lead to consensus (yet). In both cases, we provided the following data:

- The original statement
- The rating of the participant from the first round
- The submitted comment/argument/practical handle
- The average score of all participants from round 1
- The distribution of the scores of all participants from round 1
- The median score of the participants from round 1
- All comments/arguments/practical handles from participants scoring 1 or 2 and 3 and 4 respectively. It should be noted that some comments were redacted by us, removing irrelevant wording.

Six statements that received a score of 2 or lower by >70% of the participants in the first round were left out. Six new statements, added by the participants in the first round, were included in the list without consensus.

For those statements that led to consensus in the first round, we asked the participants to provide a practical handle for these statements that could be beneficial in addressing these.

For the statements that didn't lead to consensus and the new statements submitted in the first round, we asked participants to provide their scores after reviewing the ratings and comments from the other participants.

The response rate in the second round was 100% (meaning 12 from the remaining 12 respondents provided their responses in time).

Median score	# statements
1	1
2	7
3	15
4	4

Table 17 – Delphi round 2: Median scores

Criteria	# statements
3 or higher AND >70% 3 or above AND median > 3,25	6
2 or lower AND >70% 2 or below	2
>70% 3 or above	6
Rest	13

Table 18 - Delphi round 2: statistics

In the second-round responses, we observed that participants generally didn't change their opinions provided in the first round by much. Three of the panel-provided statements from the first round were marked for consensus as did 3 statements that did not receive consensus but were very close. Furthermore, 2 statements scored low enough to be marked as irrelevant. From the remaining 13 statements, no consensus has been reached, albeit that 6 statements scored a 3 or higher by 70% of the participants, yet the median score reached no further than 3, thus not meeting the criteria.

After round 2, we observed that:

- Consensus was reached positively on 14 statements, thus deemed relevant
- Consensus was reached negatively on 8 statements, thus deemed irrelevant
- No consensus was reached on 19 statements; some or all of these may be subject to future research

Considering the limited movements of scores by individuals, it was decided that, in the third round, the participants would not be requested to review and score the remaining statements.

The final list of best practices and a summary of key points from the practical handles, can be found in below table 19(full table in Appendix J).

Practice ID	Practice text	Practical handles
1	There is a constant and fair feedback loop from stakeholders to EA and back	Re-gain trust with all stakeholders, by delivering value that is recognisable. EA to learn the language of the business. Place formal checks in place.
8	EA must focus most on Business – IT alignment to improve organisational agility	While there is no formal divide between business and IT, the feedback loop could still help.

Practice ID	Practice text	Practical handles
9	The EA should have clearly defined authority, responsibility and accountability which is communicated widely	EA should prove its authority, not have it formalized. It helps in the trust. Communication loop is essential here too
10	EA must adopt the inverse Conway manoeuvre	While this may need a paradigm shift, it is the essence of EA at the financial institution of this research.
15	EA staff must possess management skills, such as diplomacy, negotiation and balancing skills.	Knowledge alone is no longer be a qualifying trait, soft skills (by training) is essential
17	EA must possess specialised cross-functional skills	A governance change that warrants different levels of functional skills
20	EA produces a holistic vision based on a rationale	Creation and maintenance of easily accessible and consistently referenced principles guidelines
21	EA must produce its artifacts in a commonly understandable language (for example informal graphics) that is usable and findable for all stakeholders	Soft skills
22	EA must make use of patterns and standards, in combination with transparency and documentation of reasoning	Usage of patterns (and anti-patterns)
37	EA should create and maintain a simple list of architecture principles that are common over all elements	Creation and maintenance of easily accessible and consistently referenced principles
38*	Architecture needs to be involved in bigger programs in on the business side. EA needs to earn the trust that business invites the architects in important initiatives.	Much earlier involvement of EA and by regaining trust by quality materials
39*	Target architecture needs to be based on clear framework with underlying principles which can explain decisions taken. Of course, intermediate state architecture is based on target and implementation possibilities.	Creation and maintenance of easily accessible and consistently referenced principles
40*	EA should be more involved with the business perspective/roadmaps.	Formal EA participation in this process and EA's input is taken seriously and acted upon.
43*	EA should have outstanding communication, presentation and storytelling skills including the ability to metaform concepts to support understanding by various stakeholders	No input

\* best practices marked with an asterisk were provided by the panel members

Table 19 - Best practices that received consensus and their practical handles

#### 4.3.3.Delphi third round

In the third round of the Delphi setting, we confronted the participants with the list of statements that resulted in consensus after the second round, as well as the list of statements that did not lead to consensus. We provided:

- The original statement
- The average score of all participants from round 2
- The distribution of the scores of all participants from round 2
- The median score of the participants from round 2
- All practical handles from participants where consensus was reached in round 1 or 2. Again, irrelevant wording has been redacted by us.
- An overview of the statements that received consensus linking them with the aspects of the poor scoring EAVF aspects from the first round

We asked the panel members to only indicate which of those relevant best practices would be beneficial in reducing the gaps in the EAVF aspects where the perceived value was either low, or where the gap between the disciplines was high.

The response rate in round 3 was 75%, meaning 9 out of 12 of the respondents provided their answers in time.

Table 20 below describes the list of the relevant statements where consensus was reached upon and the most named aspects per relevant statement. The EAVF aspects Governance, Agility and Quality management are mentioned most frequently as aspects that would benefit from the statements that are deemed relevant. Participants suggested, throughout the research, that the current governance structure of the EA practice does not fit its purpose at the organisation and its way of working. Participants identified several practices to help resolve that. Further, the panel recognised a few best practices that could help the organisation's agility; it is noticeable that this agility would seemingly benefit by agility of the EA practice itself. Finally, it was suggested that the quality of the EA service and produced artefacts would help the quality management of the complete organisation. Noticeably, the poorest scoring aspect from the EAVF survey, Societal responsibility, was named among the least as an aspect that could be helped by one of the relevant statements. This could indicate that EA may not have a role to play in the social responsibility of the organisation; another reason could be that the terminology is interpreted as a sociological aspect only. Agility (named 58 times for the relevant aspects), Governance (49 mentions) and Quality management (42 mentions) are the aspects in the EAVF that have most to gain, according to the panellists. Below figure depicts the overall scores. The highlighted numbers represent the top 2 most mentioned aspects per statement.

Practice id	Practice text	Governance	Costs and revenues	Investments	Customer relationship	Market strategy	Business processes	General management	Quality management	Agility	Customer experience	Logistics	HRM	Data management	Technology research	Societal responsibility
1	There is a constant and fair feedback loop from stakeholders to EA and back	6	2	2	1	1	0	1	2	5	1	0	0	0	0	0
8	EA must focus most on Business - IT alignment	1	3	1	0	1	2	1	0	3	3	0	0	0	0	1
9	The EA should have clearly defined authority, responsibility and accountability which is communicated widely	6	1	0	0	0	0	2	2	5	1	0	1	0	0	0
10	EA must adopt the inverse conway maneuver	7	1	1	0	1	1	0	0	7	1	0	0	0	0	0
15	EA staff must possess management skills, such as diplomacy, negotiation and balancing skills.	6	1	1	3	3	1	1	1	3	0	0	0	0	0	0
17	EA must possess specialised cross-functional skills	1	1	0	1	1	0	0	4	5	0	0	0	0	0	0
20	EA produces a holistic vision based on a rationale	1	5	5	1	1	0	0	5	1	1	0	0	0	0	0
21	EA must produce its artifacts in a commonly understandable language (for example informal graphics) that is usable and findable for all stakeholders	1	5	1	1	2	1	6	1	6	0	0	0	0	0	0
22	EA must make use of patterns and standards, in combination with transparency and documentation of reasoning	3	3	1	1	1	1	6	6	3	0	0	0	0	0	0
37	EA should create and maintain a simple list of architecture principles that are common over all elements	3	0	0	1	0	2	2	7	6	1	0	0	0	0	0
38	Architecture needs to be involved in bigger programs in on the business side. EA needs to earn the trust that business invites the architects in important initiatives.	4	2	1	4	1	2	2	2	4	1	0	0	0	0	0
39	Target architecture needs to be based on clear framework with underlying principles which can explain decisions taken. Offcourse intermediate state architecture is based on target and implementation possibilities.	3	0	0	0	1	1	1	8	2	1	0	0	0	0	0
40	EA should be more involved with the business perspective/roadmaps.	2	2	0	5	0	3	3	0	6	2	0	0	0	0	0
43	EA should have outstanding communication, presentation and story telling skills including the ability to metaform concepts to support understanding by various stakeholders	5	2	0	2	1	2	2	4	2	2	0	2	0	0	0

Table 20 - Relevant practices linked to EAVF aspects

#### 4.3.4. Observations and discussion

The results of the Delphi study show that the following best practices and suggestions should be taken in consideration:

##### 4.3.4.1. Recognisable collaboration

The lack of visibility of EA staff has been mentioned several times in the free format comments of the EAVF survey. Panel members of the Delphi study recognised this problem and considered that better communication about EA's authority, accountability and responsibility should be in place. Hauder (Hauder et al. 2014) presses on the common understanding of roles and responsibility within the organisation and The Open Group advise that accountability and responsibility improve predictability,

which in its turn helps meeting the customer promise and industrialising operations (The Open Group n.d.)

Further, consensus was reached on the statements on the production of artifacts in a commonly understandable language that is findable for all stakeholders as well as that EA should make use of patterns and standards that are recognised enterprise wide. These traits are backed by similar findings in literature (Cammin, Heilig, and Voß 2021; Duijs, Ravesteijn, and van Steenbergen 2018; Hauder et al. 2014)

#### *4.3.4.2. Feedback loop*

Participants in the Delphi study recognised that “a constant and fair feedback loop from stakeholders to EA and back” is an essential practice that the organisation should adhere to. Hauder (Hauder et al. 2014) found that a majority of the organisations researched by them incorporated this feedback loop and adds that this should be incorporated in the work of the teams. The Open Group states that “feedback is critical to managing expectations, and good design provides this. Feedback – knowledge of results – is how expectations are resolved and is critical to learning and the development of skilled behaviour”. This opinion seems to be shared by the Delphi panel, stating that a feedback loop should be (pro-)active, formalised in their work and using corporate collaboration tools.

#### *4.3.4.3. Architecture principles*

Architecture principles are ‘a coherent, consistent set of principles, broken down into starting points, rules, guidelines and standards that describe how an enterprise, the provision information, the applications and the (IT) infrastructure are designed and how they appear in their usage’ (Rijsenbrij, Schekkerman, and Hendrickx 2004)<sup>2</sup>.

The panel reached an early consensus on the creation, maintenance and usage of architectural principles, therefor supporting the statement of the O-AA that “EA should create and maintain a simple list of architecture principles that are common over all elements” (The Open Group n.d.). To make this practical, the panel advised that the principles should be a) easily accessible (in one place) and b) consistently referenced in designs and decisions in both use-modes: as supporting or (intentionally) conflicting principles; as such they provide transparency for the decision-making process.

---

<sup>2</sup> Translated from the original Dutch sentence “een coherente, consistente verzameling principes, verbijzonderd naar uitgangspunten, regels, richtlijnen en standaarden die beschrijft hoe een onderneming, de informatievoorziening, de applicaties en de infrastructuur zijn vormgegeven en zich voordoen in het gebruik”

Similarly, a panel-introduced statement, was deemed very relevant by the panel, describing that a “target architecture needs to be based on a clear framework with underlying principles which can explain decisions taken. Intermediate state architecture is based on target AND implementation constraints/possibilities”

Noticeably, the statement that “EA must adhere to flexibility when applying rules and principles” was regarded as irrelevant by most participants, which could indicate that architecture principles may be one of the most important artefacts of an EA practice in an agile way of working. Similar findings were done by Uludag et al. (Uludag, Nägele, et al. 2021) in a recent publication. They recognise the research gap on architectural principles in large scale agile development and introduce a tool to establish architectural principles.

#### *4.3.4.4. Skills of EA staff*

The need for acquisition and maintenance of skills for EA practitioners are highlighted by numerous publications (Hauder et al. 2014; The Open Group n.d.; Uludag et al. 2017, 2019). Hauder stated that high education permits the EA team to speak the same language as stakeholders and information providers. Uludag agreed but has a more refined argument stating that EA's role should be primarily technology focused and EA practitioners should keep their technical knowledge up-to-date (Uludag et al. 2019). While the latter statement did not resonate well with the panellists, the participants of the Delphi study did reach consensus on the statement that EA staff must possess management skills, such as diplomacy, negotiation and balancing skills. Especially balancing skills were mentioned in the practical handles: being able to balance between options (in statements such as “customer experience over everything else” or “prioritise time over quality and completeness”) has shown to be a key skill for an EA practitioner to have and use. Further, soft skill training for EA personnel, in order to be able to communicate EA's messages across the organisation, has been highlighted by several panel members.

A second round consensus was reached for the statement that EA personnel should possess cross-functional skills. A panellist argued that experience across functions underpins EA maturity, causing other participants to change their earlier opinion.

#### *4.3.4.5. Trust*

Members of the Delphi panel often referred to building or re-gaining trust as a practical handle for some of the best practices. The aforementioned feedback loop and recognisable collaboration as well as early involvement of EA in the organisation are seen as practices that may benefit EA's position, but in order to do so, the lack of trust between EA and its stakeholders must be resolved. Weiss et al. (Weiss, Aier, and Winter 2013) agree and state, that only if stakeholders trust the EA team, they will be willing to adopt certain architectural rules and collaborate towards goals of the organisation. The Delphi panel agreed that this is *Catch-22* dilemma. The communication between stakeholders and

architects is based on pre-existing trust (by the stakeholders) or at least in their willingness to create space for the trust to be built. Given its current absence, architecture should focus on regaining the trust by delivering value recognised by the business. This requires a few ingredients by the architects: not shying away from stakeholder discussions, trying to structure the communication stressing the actual business-understood benefits or quantified risks. EA needs to learn the language of the business while not losing sight of EA role, as the warden of sustainable growth of the enterprise.

## 5. Conclusions and recommendations

### 5.1. Revisiting the research questions

The rationale for this research is that there are indications that organisations in the Netherlands, which have adopted an agile way of working, struggle to see value from their EA practice. But other than anecdotal evidence and *gut feeling*, there has been no concrete evidence that the value that EA brings to the goals of the organisation is perceived to be low. It is in the interest of organisations to be able to quantify this value and take appropriate measures to address this. By not doing so, organisations may run the risk that the EA practice may not fulfil its potential value towards the goals of the organisations.

In this thesis, research was done on the above-mentioned topics, constructed in a research question and several sub-questions. The research consisted of literature review, a quantitative study and a Delphi study. With the results of the research, we can revisit the research questions.

#### SQ 1: Which models exist to describe value of EA?

In section 2.1, 2.2 and 2.3 of this document, we elaborated on the existing literature on value of EA. We found many publications that describe benefits or value of EA, though these publications largely lack a base of empirical evidence (E. Niemi and Pekkola 2020). Similarly, the mechanisms on how these benefits are reached are described by many authors, but a single comprehensive and largely accepted model does not seem to exist (E. I. Niemi and Pekkola 2016). To measure the value of an EA practice, irrespective on how this value is achieved, we considered the EAVF (Plessius and van Steenbergen 2019; Plessius, van Steenbergen, and Slot 2014) as the model of choice as, as far as we could find, it is the only model that allows for an unambiguous and complete mapping of the value of EA towards the goals of an organisation.

#### SQ 2: What are the best practices for EA practice in agile organisations?

In literature available to us, we found 11 recent publications that describe best practices and guidance for organisations that adopted an agile way of working in the context of enterprise architecture. There is a significant overlap in the conclusions of these publications. While for practical reasons for the purpose of the Delphi study we have normalised this list, the overview of the sources can be found in section 2.5 of this document (and the full list in appendix H).



SQ 3: What is the perceived value of EA in a large organisation that adopted agile way of working?

A survey was conducted in a large financial institution in the Netherlands measuring the value of EA in the aspects as defined by the EAVF. The results provide an indication that the value of EA is perceived generally as “more than averagely important”, albeit that the differences of perceived value, between EA development (the EA practitioners) and EA implementation (the solution architects and feature engineers) and EA exploitation (the product owners and (IT) managers) respectively, are significant. Having established this difference, which may indicate a suboptimal usage of the EA practice, we went ahead to seek measures to possibly reduce this gap.

SQ 4: What best practices extracted from literature can help address the low perceived value of EA

We found several publications in academic literature as answered in SQ2. In section 4.2, we described how we summarised these practices which have been then presented to a panel of experts from the organisation of this research. In a Delphi study setting, this expert group reached consensus on 14 of these statements addressing 16 EAVF aspects that were mapped to the goals of the organisation and that received a relatively low score from the survey. Section 4.3 goes deeper in the results of the Delphi study.

RQ: How can the Enterprise Architecture practice be adjusted to improve its value in organisations that adopted an agile way of working, using the EAVF?

The EAVF provides an unambiguous view on the perceived value of Enterprise Architecture towards the goals of an organisation. It highlights areas that may require further attention for improvement. We used best practices derived from literature to seek practical handles how these areas can be addressed. These practical handles focus mostly on addressing communication issues with stakeholders (including early involvement in programs and roadmaps), but to accomplish that, EA should (re-)gain the trust of those stakeholders by obtaining enhanced soft skills such as diplomacy and creating quality artefacts, most notably recognisable architectural principles (Duijs, Ravesteijn, and van Steenberghe 2018; Uludag, Nägele, et al. 2021). The EAVF provided the insight where these practical handles will benefit the organisation the most. Agility, governance and quality management were the most mentioned in that respect. The implementation of the best practices may lead to improvements in the value that EA can bring to the organisation.

## 5.2. Conclusions

Our research indicated that enterprise architecture may struggle to find a position in organisations in the Netherlands that adopted an agile way of working. In the case of the large financial institution in the Netherlands, regarding the perceived value that EA brings to the goals of the organisation, there are significant differences observable between the different architectural activity types as used by the EAVF. These differences may indicate a sub-optimal use of the enterprise architecture function in this

organisation. This may be an indication that architects overestimate their contribution, but it can also mean that other groups have less visibility on the work of the architects. The latter is underpinned by the comments provided by the participants in the survey results. The results indicate that EA development is significantly more positive than EA implementers and EA exploiters on near all aspects. Foorthuis et al. (Foorthuis et al. 2010) suggest that social psychology literature provides insights for explaining these differences. Due to their involvement and commitment, EA development should be regarded as a subjective source of information on EA. Studies discuss the binding effect of earlier commitments (i.e. becoming an (enterprise) architect) often results in them holding a relatively positive attitude towards EA and to “not being easily persuaded by critical signals on its effectiveness” (Foorthuis et al. 2010). Members of EA implementation and EA exploitation may be no less subjective as they sometimes cannot view the overall picture due to their local focus (Foorthuis et al. 2010). Therefore, in order to have a balanced view, it is of great importance to take all perspectives into account.

In our research we identified 14 best practices and other suggestions that could help improve the underlying reasons why the perceived value is that diverse. While 10 of these best practices were derived from existing literature, we have enriched these by adding practical handles for easier operationalisation of these practices. The process of acquiring these practical handles, through rounds of Delphi study and the belonging discussion, revealed possible root causes on those items that scored poorly in the EAVF survey, such as misalignment on the views of what EA's responsibility is and the need to re-gain stakeholders' trust. Four practices from the Delphi panel members were deemed relevant and focus largely on (early) interaction with stakeholders and EA's ability to speak their language. This seems to correspond with the findings of the EAVF survey whereby we observed large differences in value perception between the activity types. A lack of communication may have been the underlying reason of these differences, underpinning the problem statement of this research.

Generally, the practices that seemed most relevant were those that describe the dynamics with the stakeholders. EA must be visible to its stakeholders, must communicate with them in a recognisable way and should engage in feedback loops, provided that there is a mutual trust.

Finally, we found that these practices and their practical handles may target perceived low scores on EA's importance towards the agility of the organisation, its governance as well as the quality management, which were among the top mentioned EAVF aspects that may be positively influenced by the practices. On the other hand, we found no indication that these practices may be of benefit to other poor scoring EAVF aspects, such as social responsibility and technology research.

### 5.3. Constraints & limitations

A very important limitation is that the operationalisation of this research is limited to only one large financial institution in the Netherlands. While its population is diverse, Eisenhardt (Eisenhardt 1989) recommends 4 cases to generate complex theory, albeit that no ideal number of cases exist. The very

nature of the EAVF model of Plessius and van Steenberg (Plessius et al. 2018) is that it provides the perceived value of EA towards the goals of the organisation. Considering that many organisations will have many (different) goals, the outcomes of a broader study over more cases arguably could have become troubled by these differences.

The number of respondents during the EAVF survey has been disappointingly low. While we had access to the full population of the case's personnel, we only managed to get a 10% response rate. Within the received responses, we also saw an under coverage of the disciplines EA implementation and EA exploitation compared to the responses we received from EA development. While we didn't attach conclusions to this disbalance, it may, arguably, be an indication of how these groups view the role of EA within their organisation.

Further, while extra care has been applied in selecting the participants of the Delphi panel – a balanced group containing representation from all 3 disciplines of the architectural activity types -, not all participants have been able to complete all the rounds, which may have impacted the outcomes.

Finally, the literature review regarding the best practices on EA in organisations that adapted an agile way of working and agile traits has been limited to material that was accessible to us. We did find many publications that discuss the role of EA in agile management, but at the same time, many of these focus on the organisation of EA and refrain from advising value addition by EA.

## 5.4. Academic Contribution

There are four main contributions from this research. Firstly, it tests the theory of the existing EAVF of Plessius et al. (Plessius et al. 2018), which provides insight in the value of the EA function in the organisations and provides hardening of the EAVF framework, for future analysis and measurement; the comments received from the respondents, such as suggestions to include security and active alignment with regulators may be considered to be added to the framework for completeness.

Secondly, the research demonstrates the need for a concrete valuation framework allowing agile organisations to measure the value of the function of EA in the light of the goals of that organisation.

Thirdly, this research gives an overview from the literature on best practices used in agile organisations.

Finally, the outcomes of this study provide insights for organisations that adopted an agile way of working (or are in the process of doing so) on how EA may be positioned to improve the connection with its stakeholders.

## 5.5. Practical Contribution

Large organisations in the Netherlands, that adopted an agile way of working and experience a gap between EA and the stakeholders, may benefit from the outcome of the research. On one hand, it provides results from EAVF, concretely pointing out areas of attention for the positioning of enterprise architecture in departments of different focus. On the other hand, the outcome of the Delphi study may provide practical handles, a finite list of best practices, as how to connect the EA practice and the agile teams and arguably improve the perceived practical value of the EA practice. As a validation of the outcomes of the study, the results have been discussed with the financial institution's senior management to identify points of attention. As a result, the organisation has started the review of the expectations of the scope of EA across the organisation.

Finally, organisations may adopt the process of conducting the EAVF survey followed by a phase of analysis of what best practices could benefit the organisations' activities around enterprise architecture towards adding value to the goals of said organisations.

## 5.6. Recommendations and future research

### 5.6.1. General recommendations

We can distil the following recommendations to EA practices in organisations that adopted an agile way of working

Firstly, consider using the EAVF to provide insight into the perception that EA may bring to the organisation. The survey belonging to the EAVF is a tool that allows the organisation to unambiguously assess how EA practices are viewed. It has proven to be an instrument that organisations' (senior) management can use to be able to make corrective steering should it be necessary.

Secondly, review the expectations of the EA practice in the (changing) organisation. EA itself may not be a goal in itself, rather it should support the ambitions of the organisation and its teams. In our case study, we found, from the results of the EAVF survey as well as during our Delphi rounds, that EA development is taking up a larger scope of work than the EA implementation and EA exploitation representatives expect and, possibly consequently, value that work very differently.

### 5.6.2. Recommendations to the organisation of this case study

The research indicated that there may be a lack of communication between EA and its stakeholders; this is made visible in the results of the EAVF survey and was mentioned several times by the Delphi study participants. The organisation may consider to first address that issue by implementing and monitoring feedback loops between the disciplines. EAVF aspects 'general management' and 'quality management' as well as 'agility' may be helped by recognisable collaboration tools and agreed and clearly communicated principles. A sensible follow-up step could be to perform the same quantitative

analysis in the organisation in due time. Afterall, valuable practices have been identified that could improve the connection between the EA practice and an agile way of working. Conducting the survey after implementing these practices, may be additional validation of this exercise if the perceived value increases.

### 5.6.3. Future research

The research for this thesis has, similar to Foorthuis et al. (Foorthuis et al. 2010), confirmed that the value that EA brings to an organisation is perceived differently across the stakeholders of an organisation and it identified 14 relevant practices that were validated by a sample group within a specific context. Expanding the search for best practices to other domains and validating them by a sample group in different organisations might provide further insight or valuable additions.

Future research can also be done on the 19 statements that didn't reach a consensus among members of the Delphi panel. Special consideration may be applied to statements that received positive response by more than 70% of the respondents, but where the median didn't reach the 3,25 thresholds. These statements include the adherence of EA to the paradigm of outside-in thinking (The Open Group n.d.) and the suggestion of Duijs et al. that EA practitioners should exchange a law enforcing attitude for a more collaborative one (Duijs, Ravesteijn, and van Steenberghe 2018)

Finally, further studies may consider testing what impact variances of the organisation of EA practices has on the perceived value of EA towards the goal of an organisation. Feedback collected during this research indicated that the current organisation of the EA practice in the case of the financial institution may not be suitable for the current challenges at hand. Several participants indicated that structural changes to the way that EA interacts with the rest of the organisation should be considered in order to successfully reposition the EA practice in an agile way of working.

## 5.7. Lessons learnt

The making of this thesis has not always been a smooth ride as mistakes were made and many aspects could have been done differently. As these form a part of a learning process, it makes sense to highlight some of them for future work and information of the readers of this document.

First, we conducted the EAVF survey using a commercial survey tool, LimeSurvey.org. While the tool is very able, many organisations, including the organisation of this case study, have their own internal survey tools that may evoke a sense of trust with the population that supposed to fill it out. While we were able to send out the invitation for the survey from an internal organisation mail-account, we received negative feedback and even replies from concerned employees fearing the invite was a phishing scam.

Secondly, for the Delphi study, we carefully composed the panel of participants, introducing them on the matter and time expected. Some of the participants were unable to finish the full exercise for

various reasons. Participants advised in some cases that they found the effort needed to finish to be too large, which arguably caused the Delphi phase to take longer than planned. We probably should have made the exercise simpler to understand and fill out. The same can be said of our own time and effort needed to analyse rounds and prepare and build for the next rounds. While the tooling built for this is robust and well designed, we still spent too much focus on building a tool that helped in the statistical analysis and less in the fact that next rounds required a different experience.

Lastly, the research effected in a lot of traction at the organisation where we conducted this research: while it is generally good that the subject gained attention from many layers in the organisation, it remains a sensitive one. We could have predicted this and prepare the senior (EA) management of the expected discussion that could come out of this exercise.

## 6. References

We made use of the tool Zotero (Zotero.org) to keep track of references and citations for this document

Adler, Michael, and Erio Ziglio. 1996. *Gazing Into the Oracle: The Delphi Method and Its Application to Social Policy and Public Health*. Jessica Kingsley Publishers.

'Advanced Topic - Agile Architecture in SAFe'. *Scaled Agile Framework*.  
<https://www.scaledagileframework.com/agile-architecture/> (December 2, 2021).

Ahlemann, Frederik, Christine Legner, and Johannes Lux. 2021. 'A Resource-Based Perspective of Value Generation through Enterprise Architecture Management'. *Information & Management* 58(1): 103266.

Ali, Parveen Azam, and Roger Watson. 2016. 'Peer Review and the Publication Process'. *Nursing Open* 3(4): 193–202.

Alwadain, Ayed. 2020. 'Enterprise Architecture: A Business Value Realization Model'. *Sustainability* 12(20): 8485.

Barton, Dominic, Dennis Carey, and Ram Charan. 2018. 'One Bank's Agile Team Experiment'. *Harvard Business Review*. <https://hbr.org/2018/03/one-banks-agile-team-experiment> (December 10, 2021).

Beck, Kent et al. 'Manifesto for Agile Software Development'. <https://agilemanifesto.org/> (December 7, 2021).

Bloomberg, Jason. 2013. *The Agile Architecture Revolution: How Cloud Computing, REST-Based SOA, and Mobile Computing Are Changing Enterprise IT*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Boucharas, Vasilis, Marlies van Steenberghe, Slinger Jansen, and Sjaak Brinkkemper. 2010. 'The Contribution of Enterprise Architecture to the Achievement of Organizational Goals: A Review of the Evidence'. In *Trends in Enterprise Architecture Research*, Lecture Notes in Business Information Processing, eds. Erik Proper et al. Berlin, Heidelberg: Springer, 1–15.

Boucharas, Vasilis, Marlies Van, Slinger Jansen, and Sjaak Brinkkemper. 2010. 'The Contribution of Enterprise Architecture to the Achievement of Organizational Goals: Establishing the Enterprise Architecture Benefits Framework'.

- Bryman, Alan, and Emma Bell. 2015. *Business Research Methods*. Fourth edition. Cambridge, United Kingdom ; New York, NY, United States of America: Oxford University Press.
- Cammin, Philip, Leonard Heilig, and Stefan Voß. 2021. 'Assessing Requirements for Agile Enterprise Architecture Management: A Multiple-Case Study'. <http://hdl.handle.net/10125/71347> (March 15, 2022).
- Canat, Mert et al. 2018. 'Enterprise Architecture and Agile Development: Friends or Foes?' In *2018 IEEE 22nd International Enterprise Distributed Object Computing Workshop (EDOCW)*, Stockholm: IEEE, 176–83. <https://ieeexplore.ieee.org/document/8536119/> (September 28, 2021).
- Carugati, Andrea, Lapo Mola, Joao Cunha, and Walter Fernandez. 2020. 'The Changing Value of Enterprise Architecture Capability Maturity'. *Academy of Management Proceedings* 2020(1): 17752.
- Delone, William, and Ephraim McLean. 2003. 'The DeLone and McLean Model of Information Systems Success: A Ten-Year Update'. *J. of Management Information Systems* 19: 9–30.
- Diamond, Ivan R. et al. 2014. 'Defining Consensus: A Systematic Review Recommends Methodologic Criteria for Reporting of Delphi Studies'. *Journal of Clinical Epidemiology* 67(4): 401–9.
- Duijs, Robin, Pascal Ravesteijn, and Marlies van Steenberghe. 2018. 'Adaptation of Enterprise Architecture Efforts to an Agile Environment'. In *Digital Transformation – Meeting the Challenges*, Univerzitetna založba Univerze v Mariboru / University of Maribor Press, 389–400. <http://press.um.si/index.php/ump/catalog/book/343> (October 28, 2021).
- Eisenhardt, K. M. 1989. 'MAKING FAST STRATEGIC DECISIONS IN HIGH-VELOCITY ENVIRONMENTS.' *Academy of Management Journal* 32(3): 543–76.
- Eisinga, Rob, Manfred te Grotenhuis, and Ben Pelzer. 2013. 'The Reliability of a Two-Item Scale: Pearson, Cronbach, or Spearman-Brown?' *International Journal of Public Health* 58(4): 637–42.
- Ellis, Roger, and Elaine Hogard. 2020. *Professional Identity in the Caring Professions: Meaning, Measurement and Mastery*. Routledge.
- Elssamadisy, Amr. 2013. 'Has SAFe Cracked the Large Agile Adoption Nut?' *InfoQ*. <https://www.infoq.com/news/2013/08/safe/> (April 19, 2022).



- Foorthuis, Ralph et al. 2010. ICIS 2010 Proceedings - Thirty First International Conference on Information Systems *On Course, but Not There Yet: Enterprise Architecture Conformance and Benefits in Systems Development*.
- Fowler, Martin. 'ShuHaRi'. *martinfowler.com*. <https://martinfowler.com/bliki/ShuHaRi.html> (May 11, 2022).
- Giaglis, George M., Nikolaos A. Mylonopoulos, and Georgios I. Doukidis. 1999. 'The ISSUE Methodology for Quantifying Benefits from Information Systems'. In *Logistics Information Management*.
- Gong, Yiwei, and Marijn Janssen. 2019. 'The Value of and Myths about Enterprise Architecture'. *International Journal of Information Management* 46: 1–9.
- Guo, Hong, Darja Smite, Jingyue Li, and Shang Gao. 2021. 'Enterprise Architecture and Agility: A Systematic Mapping Study'. In , 296–305.
- Hasan, Rashedul, and Tai Chyi. 2017. 'PRACTICAL APPLICATION OF BALANCED SCORECARD-A LITERATURE REVIEW'. *Journal of Strategy and Performance Management* 5: 87–103.
- Hasson, Felicity, Sinead Keeney, and Hugh McKenna. 2000. 'Research Guidelines for the Delphi Survey Technique'. *Journal of Advanced Nursing* 32(4): 1008–15.
- Hauder, Matheus, Sascha Roth, Christopher Schulz, and Florian Matthes. 2014. 'Agile Enterprise Architecture ManagementAn Analysis on the Application of Agile Principles'. : 38–46.
- Hazen, Benjamin T. et al. 2017. 'Enterprise Architecture: A Competence-Based Approach to Achieving Agility and Firm Performance'. *International Journal of Production Economics* 193: 566–77.
- Hendriks, Peter. 2018. 'The Tension between Agile and Architecture'. : 15.
- Hosiaislouma, Eero, Katja Penttinen, Juha Mustonen, and Jukka Heikkilä. 2018. *Lean Enterprise Architecture Method for Value Chain Based Development in Public Sector*.
- Hsu, Chia-Chien, and Brian Sandford. 2007. 'The Delphi Technique: Making Sense Of Consensus'. *Practical Assessment, Research and Evaluation* 12.
- IBM. 2021. *IBM SPSS Statistics for Macintosh*. Armonk, NY: IBM Corp.
- Israel, Glenn D. 1992. 'Determining Sample Size'. (Fact Sheet PEOD-6).
- Jr, H.N., and D.A. Boone. 2012. 'Analyzing Likert Data'. *Journal of Extension* 50.

- Jusuf, Muhammad Baharudin, and Sherah Kurnia. 2017. 'Understanding the Benefits and Success Factors of Enterprise Architecture'. <http://scholarspace.manoa.hawaii.edu/handle/10125/41755> (October 15, 2021).
- Kaisler, S.H., F. Armour, and M. Valivullah. 2005. 'Enterprise Architecting: Critical Problems'. In *Proceedings of the 38th Annual Hawaii International Conference on System Sciences*, Big Island, HI, USA: IEEE, 224b–224b. <http://ieeexplore.ieee.org/document/1385698/> (September 30, 2021).
- Kaisler, Stephen, and Frank Armour. 2017. '15 Years of Enterprise Architecting at HICSS: Revisiting the Critical Problems'. <http://hdl.handle.net/10125/41747> (September 28, 2021).
- Kaplan, Robert S. et al. 2004. *Strategy Maps: Converting Intangible Assets Into Tangible Outcomes*. Harvard Business Press.
- Kaplan, Robert S, and David P Norton. 1992. 'The Balanced Scorecard - Measures That Drive Performance'. *BALANCED SCORECARD*: 11.
- Kaplan, Robert S., and David P. Norton. 2001. 'Transforming the Balanced Scorecard from Performance Measurement to Strategic Management: Part I'. *Accounting Horizons* 15(1): 87–104.
- Kluge, C, A Dietzsch, and M Rosemann. 2006. 'How to Realise Corporate Value from Enterprise Architecture'. : 11.
- Kniberg, Henrik, and Anders Ivarsson. 2012. 'Scaling Agile @ Spotify with Tribes, Squads, Chapters & Guilds'. : 14.
- Lange, M., Jan Mendling, and Jan Recker. 2012. 'Realizing Benefits from Enterprise Architecture: A Measurement Model'.
- Lange, Matthias, Jan Mendling, and Jan Recker. 2015. 'An Empirical Analysis of the Factors and Measures of Enterprise Architecture Management Success'. *European Journal of Information Systems* 6.
- Lankhorst, Marc et al. 2005. *Enterprise Architecture at Work: Modelling, Communication, and Analysis* *Enterprise Architecture at Work: Modelling, Communication, and Analysis*.
- . 2016. 'Enterprise Architecture and Agile Development: Opposites Attract?' *BiZZdesign*. <https://bizzdesign.com/blog/enterprise-architecture-and-agile-development-opposites-attract/> (December 10, 2021).

- Lehong, S. M., E. Dube, and G. Angelopoulos. 2013. 'An Investigation into the Perceptions of Business Stakeholders on the Benefits of Enterprise Architecture: The Case of Telkom SA'. *South African Journal of Business Management* 44(2): 45–56.
- MacEachren, Alan M. et al. 2006. 'Building a Geocollaboratory: Supporting Human–Environment Regional Observatory (HERO) Collaborative Science Activities'. *Computers, Environment and Urban Systems* 30(2): 201–25.
- MacFarland, Thomas W., and Jan M. Yates. 2016. 'Mann–Whitney U Test'. In *Introduction to Nonparametric Statistics for the Biological Sciences Using R*, eds. Thomas W. MacFarland and Jan M. Yates. Cham: Springer International Publishing, 103–32.  
[https://doi.org/10.1007/978-3-319-30634-6\\_4](https://doi.org/10.1007/978-3-319-30634-6_4) (June 7, 2022).
- McKight, Patrick E., and Julius Najab. 2010. 'Kruskal-Wallis Test'. In *The Corsini Encyclopedia of Psychology*, John Wiley & Sons, Ltd, 1–1.  
<https://onlinelibrary.wiley.com/doi/abs/10.1002/9780470479216.corpsy0491> (June 7, 2022).
- Meade, Adam W., and S. Bartholomew Craig. 2012. 'Identifying Careless Responses in Survey Data'. *Psychological Methods* 17(3): 437–55.
- Niemi, Eetu. 2006. 'Enterprise Architecture Benefits: Perceptions from Literature and Practice'. 2006.
- Niemi, Eetu I., and Samuli Pekkola. 2016. 'Enterprise Architecture Benefit Realization: Review of the Models and a Case Study of a Public Organization'. *ACM SIGMIS Database: the DATABASE for Advances in Information Systems* 47(3): 55–80.
- Niemi, Eetu, and Samuli Pekkola. 2020. 'The Benefits of Enterprise Architecture in Organizational Transformation'. *Business & Information Systems Engineering* 62(6): 585–97.
- Pallant, Julie. 2020. *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using IBM SPSS*. 7th ed. London: Routledge.
- Peter Jacobs and Bart Schlatmann. 2016. 'ING's Agile Transformation'.  
<https://www.mckinsey.com/~media/mckinsey/industries/financial%20services/our%20insights/ings%20agile%20transformation/ings-agile-transformation.pdf?shouldIndex=false>  
(September 30, 2021).
- Plessius, Henk, Raymond Slot, and Leo Pruijt. 2012. 'On the Categorization and Measurability of Enterprise Architecture Benefits with the Enterprise Architecture Value Framework'. In *Trends in Enterprise Architecture Research and Practice-Driven Research on Enterprise Transformation*, Lecture Notes in Business Information Processing, eds. Stephan Aier et al.

- Berlin, Heidelberg: Springer Berlin Heidelberg, 79–92. [http://link.springer.com/10.1007/978-3-642-34163-2\\_5](http://link.springer.com/10.1007/978-3-642-34163-2_5) (October 28, 2021).
- Plessius, Henk, and Marlies van Steenberg. 2019. 'A STUDY INTO THE CLASSIFICATION OF ENTERPRISE ARCHITECTURE BENEFITS'. In Naples. <https://aisel.aisnet.org/mcis2019/33> (October 28, 2021).
- Plessius, Henk, Marlies van Steenberg, and Raymond Slot. 2014. 'Perceived Benefits from Enterprise Architecture'. : 15.
- Plessius, Henk, Marlies van Steenberg, Raymond Slot, and Johan Versendaal. 2018. 'The Enterprise Architecture Value Framework'. In Portsmouth UK.
- Rijssenbrij, D.B.B, Jaap Schekkerman, and Harry Hendrickx. 2004. *Architectuur, besturingsinstrument voor adaptieve organisaties: de rol van architectuur in het besluitvormingsproces en de vormgeving van de informatievoorziening*. Utrecht: LEMMA.
- Rodrigues, Luis, and Luis Amaral. 2010. 'Issues in Enterprise Architecture Value'. *Journal of Enterprise Architecture* 6: 27–32.
- Ross, Jeanne W., Peter Weill, and David Robertson. 2006. *Enterprise Architecture as Strategy: Creating a Foundation for Business Execution*. Boston, Mass: Harvard Business School Press.
- Rouhani, Babak Darvish, Rodina Binti Ahmad, Fatemeh Nikpay, and Reza Mohamaddoust. 2019. 'CRITICAL SUCCESS FACTOR MODEL FOR ENTERPRISE ARCHITECTURE IMPLEMENTATION'. *Malaysian Journal of Computer Science* 32(2): 133–48.
- Salameh, Abdallah, and Julian M. Bass. 2021. 'An Architecture Governance Approach for Agile Development by Tailoring the Spotify Model'. *AI & SOCIETY*. <https://doi.org/10.1007/s00146-021-01240-x> (December 2, 2021).
- Schmidt, Christian, and Peter Buxmann. 2011. 'Outcomes and Success Factors of Enterprise IT Architecture Management: Empirical Insight from the International Financial Services Industry'. *European Journal of Information Systems* 20(2): 168–85.
- Schmidt, Rainer et al. 2015. 'Benefits of Enterprise Architecture Management – Insights from European Experts'. In *The Practice of Enterprise Modeling*, Lecture Notes in Business Information Processing, eds. Jolita Ralyté, Sergio España, and Óscar Pastor. Cham: Springer International Publishing, 223–36.

- Schmitz, Carsten. 2021. *LimeSurvey: An Open Source Survey Tool*. Hamburg, Germany: LimeSurvey Project. <https://www.limesurvey.org>.
- Schotkamp, Tom, and Martin Danoesastro. 2018. 'HR's Pioneering Role in Agile at ING'. : 7.
- Schutte, Nico, Salla Toppinen, Raija Kalimo, and Wilmar Schaufeli. 2000. 'The Factorial Validity of the Maslach Burnout Inventory-General Survey (MBI-GS) across Occupational Groups and Nations'. *Journal of Occupational and Organizational Psychology* 73(1): 53–66.
- Shanks, Graeme et al. 2018. 'Achieving Benefits with Enterprise Architecture'. *The Journal of Strategic Information Systems* 27(2): 139–56.
- Shirazi, Hossein, Babak Darvish Rouhani, and Mohammad Shirazi. 2009. 'A Framework for Agile Enterprise Architecture'. *International Journal of Intelligent Information Technology Application* 2: 82.
- Skulmoski, Gregory J., Francis T. Hartman, and Jennifer Krahn. 2007. 'The Delphi Method for Graduate Research'. *Journal of Information Technology Education: Research* 6(1): 1–21.
- S&P Global. 2020. 'The World's 100 Largest Banks, 2020'.  
<https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/the-world-s-100-largest-banks-2020-57854079> (December 10, 2021).
- van Steenberghe, Marlies, and Sjaak Brinkkemper. 2010. 'Modeling the Contribution of Enterprise Architecture Practice to the Achievement of Business Goals'. In *Information Systems Development: Towards a Service Provision Society*, eds. George Angelos Papadopoulos et al. Boston, MA: Springer US, 609–18. [https://doi.org/10.1007/b137171\\_63](https://doi.org/10.1007/b137171_63) (May 30, 2022).
- Sullivan, Gail M., and Anthony R. Artino. 2013. 'Analyzing and Interpreting Data From Likert-Type Scales'. *Journal of Graduate Medical Education* 5(4): 541–42.
- Tamm, Toomas, Peter Seddon, Graeme Shanks, and Peter Reynolds. 2011. 'How Does Enterprise Architecture Add Value to Organisations?' *Communications of the Association for Information Systems* 28(1). <https://aisel.aisnet.org/cais/vol28/iss1/10>.
- Tashakkori, Abbas, Charles Teddlie, and Charles B. Teddlie. 2003. *Handbook of Mixed Methods in Social & Behavioral Research*. SAGE.
- The Open Group. : 'Open Agile Architecture™'. *Open Agile Architecture*.  
<https://pubs.opengroup.org/architecture/o-aa-standard/> (March 14, 2022).
- Thummadi, B Veeresh, Vishal D Khapre, and Rosalie Ocker. 'Unpacking Agile Enterprise Architecture Innovation Work Practices: A Qualitative Case Study of a Railroad Company'. : 10.

'TOGAF'. 2018. *The Open Group Website*. <https://www.opengroup.org/togaf> (November 5, 2021).

Uludag, Ömer, Pascal Philipp, et al. 2021. *Revealing the State-of-the-Art in Large-Scale Agile Development: A Systematic Mapping Study*.

Uludag, Ömer, Martin Kleeaus, Niklas Reiter, and Florian Matthes. 2019. 'What to Expect from Enterprise Architects in Large-Scale Agile Development? A Multiple-Case Study'. *AMCIS 2019 Proceedings*.  
[https://aisel.aisnet.org/amcis2019/org\\_transformation\\_is/org\\_transformation\\_is/23](https://aisel.aisnet.org/amcis2019/org_transformation_is/org_transformation_is/23).

Uludag, Ömer, Martin Kleeaus, Xian Xu, and Florian Matthes. 2017. *Investigating the Role of Architects in Scaling Agile Frameworks*.

Uludag, Ömer, Sascha Nägele, Matheus Hauder, and Florian Matthes. 2021. 'A Tool Supporting Architecture Principles and Guidelines in Large-Scale Agile Development'. In , 327–44.

Urdan, Timothy C. 2016. *Statistics in Plain English*. 4th ed. Routledge.  
<https://www.routledge.com/Statistics-in-Plain-English/Urdan/p/book/9781138838345> (March 15, 2022).

Weiss, Simon, Stephan Aier, and Robert Winter. 2013. 'Institutionalization and the Effectiveness of Enterprise Architecture Management'. : 19.

Yang, Chen, Peng Liang, and Paris Avgeriou. 2016. 'A Systematic Mapping Study on the Combination of Software Architecture and Agile Development'. *Journal of Systems and Software* 111: 157–84.

Zachman, J. A. 1987. 'A Framework for Information Systems Architecture'. *IBM Systems Journal* 26(3): 276–92.

## Appendix A. EAVF topics and subcategories

EAVF topics and subcategories as per Plessius' research (Plessius and van Steenberghe 2019) in table

21

Subcategory	Topic
<b>Financial and Accountability</b>	
<i>Costs and revenues</i>	Lower operational costs c.q. higher revenues
	The costs that must be made to implement the desired changes
<i>Investments</i>	The investments that must be made to implement the desired changes
<i>Compliance</i>	Compliance with laws and regulations as well as internal standards
<i>Governance</i>	Directions from the architecture supervising board (governance)
	Alignment of the enterprise architecture with the general strategy of the organization
	Prevention of undocumented deviations from the architecture
	Coordination with other projects
<i>Risk management</i>	Prevention of risks in business processes and information processing
<i>Societal responsibility</i>	Sustainability
	Decent working conditions (both internally and with partners, suppliers and customers)
	Alignment with the Corporate Social Responsibility (CSR) strategy of the organization
<b>Customer and Partnerships</b>	
<i>Customer experience</i>	The (expected) effects on customer experience and customer satisfaction
	The results of usability testing
<i>Customer relationships</i>	Improvement of the interaction with customers
<i>Product position</i>	The expected effects on markets and market shares
<i>Market strategy</i>	Alignment with the chosen market strategy of the organization
<i>Ecosystem</i>	The cooperation with partners in partner networks
	The exchangeability of data with partners
	Supply chain integration
	The alignment of architecture, solutions and systems with the architecture, solutions and systems of partners
<b>Internal processes</b>	
<i>Logistics</i>	The coherence of business processes
	The support of business processes with logistics software
<i>Procurement</i>	-
<i>Business processes</i>	The interoperability, standardization and integration of business processes
	Business process performance
	Digitization of business processes
<i>Marketing and sales</i>	The "time-to-market" of new products and services
	The use of customer journeys to model how customers make contact with the organization
<i>Service delivery</i>	Support for (external) customers with the products and services of the organization (for example with a helpdesk)
	Support for colleagues (internal customers) with the procedures and systems of the organization
<i>Data management</i>	The quality of stored data (for example completeness, availability, timeliness, redundancy, ...)
	The interoperability of data between information systems
	The ability to make connections between all kinds of – often very extensive – data files ("big data")
	Coordination of IT processes

Subcategory	Topic
<i>Information management</i>	The quality of information systems and IT infrastructure (for example availability, accessibility, adaptability, reusability, ...)
	The security of information, information systems and infrastructure
	'Outsourcing' and 'cloud'
<i>General management</i>	Support for decision-making
	The requirements from portfolio management
<i>Quality management</i>	The involvement of stakeholders
	The quality of the design, the implementation and the (intended) results of projects
	The manageability of projects (in time, money, scope, risks, ...)
	Support with 'agile' project implementation
<i>Technology (non-IT)</i>	-
<i>HRM</i>	The satisfaction (of users and management) with information systems and infrastructure
<i>Innovation</i>	The innovation of products and services
	The innovation of business processes, information systems and infrastructure
<b>Learning and Growth</b>	
<i>Competences</i>	The professionalization of the organization
	The professionalization of the architectural function
	The professionalization of project management
<i>Culture</i>	The willingness and ability to cooperate in the organization
	The culture in the organization
<i>Alignment</i>	Mutual alignment of business processes (business / business alignment)
	Alignment of business processes and IT (business / IT alignment)
	Providing insight into the current and the desired situation as well as into the road map
<i>Agility</i>	The ability to respond to changes (agility) in the environment of the organization
	The resilience to changes in the environment of the organization
	The ability to respond to changes in business processes and IT (within the organization)
<i>Technology research</i>	Research of and gaining experience with new technology
<i>Communication and knowledge mgt</i>	Improvement of communication and knowledge sharing
<i>Evaluation and re-use</i>	Experiences with previous results of architecture
	Evaluations of project results
	Solving technical debt
	The creation of artifacts for reuse

Table 21 – EAVF topics and sub-categories



## Appendix B. Overview of the EAVF questions in the survey

The following table (table 22) has been retrieved from Henk Plessius and consists of the questions from the EAVF survey. Participants in the survey were asked to state the importance of the topics in developing/implementing/contribution of enterprise architecture.

- D: EA development
- I: EA implementation
- E: EA exploitation

<i>Financial and Accountability</i>				
<i>Subcategory</i>	<i>Topic</i>	<i>D</i>	<i>I</i>	<i>E</i>
Costs and benefits	Lower operational costs c.q. higher revenues	x	x	x
	The costs (one-off expenses) that must be made to implement the desired changes	x	x	x
Investments	The investments (expenses that are amortized over a longer period, such as computer equipment) that must be made to implement the desired changes	x	x	x
Compliance	Compliance with laws and regulations as well as internal standards	x	x	x
Governance	Directions from the architecture supervising board (governance) <sup>3</sup>	x	x	
	Alignment of the enterprise architecture with the strategy of the organization <sup>2</sup>	x		x
	Prevention of undocumented deviations from the architecture <sup>4</sup>		x	
	Coordination with other projects <sup>1</sup>		x	x
Risk management	Prevention of risks in business processes and information processing	x	x	x
Societal responsibility	Sustainability (lower use of energy and raw materials)	x	x	x
	Decent working conditions (both internally and with partners, suppliers and customers)	x	x	x
	Alignment with the CSR strategy (Corporate Social Responsibility) of the organization <sup>2</sup>	x		x

<i>Customer and Partnerships</i>				
<i>Subcategory</i>	<i>Topic</i>	<i>D</i>	<i>I</i>	<i>U</i>
(Customer) experience	The (expected) effects on customer experience and customer satisfaction	x	x	x
	The results of 'usability testing' <sup>4</sup>		x	

(Customer) relationships	Improvement of the interaction with customers	x	x	x
Product position	The expected effects on markets and market shares	x	x	x
Market strategy	Alignment with the chosen market strategy of the organization (e.g. focus on price or service)	x	x	x
Ecosystem	The cooperation with partners in partner networks	x	x	x
	The exchangeability of data with partners	x	x	x
	Supply chain integration (alignment of business processes with partners)	x	x	x
	The alignment of architecture, solutions and systems with the architecture, solutions and systems of partners	x	x	x

<i>Internal processes</i>				
<i>Subcategory</i>	<i>Topic</i>	<i>D</i>	<i>I</i>	<i>U</i>
Logistics	The connection of business processes	x	x	x
	The support of business processes with logistics software such as ERP or workflow software	x	x	x
Procurement	-			
Business processes	The interoperability, standardization and integration of business processes	x	x	x
	Business process performance	x	x	x
	Digitization of business processes	x	x	x
Marketing and sales	The “time-to-market” of new products and services	x	x	x
	The use of customer journeys to model how customers make contact with the organization <sup>4</sup>		x	
Service delivery	Support for (external) customers with the products and services of the organization (for example with a helpdesk)	x	x	x
	Support for colleagues (internal customers) with the procedures and systems of the organization	x	x	x
Data management	The quality of stored data (for example completeness, availability, timeliness, redundancy, ...)	x	x	x
	The interoperability of data between information systems	x	x	x
	The ability to make connections between all kinds of – often very extensive – data files (“big data”)	x	x	x
Information management	Coordination of IT processes	x	x	x
	The quality of information systems and IT infrastructure (for example availability, accessibility, adaptability, reusability, ...)	x	x	x
	The security of information, information systems and infrastructure	x	x	x

	'Outsourcing' and 'cloud'	x	x	x
Technology (non-IT)	-			
General management	Support for decision-making	x	x	x
	The requirements from portfolio management <sup>3</sup>	x	x	
Quality management	The involvement of stakeholders	x	x	x
	The quality of the design, the implementation and the (intended) results of projects	x	x	x
	The manageability of projects (in time, money, scope, risks, ...) <sup>1</sup>		x	x
	Support with 'agile' project implementation	x	x	x
HRM	The satisfaction (of users and management) with information systems and infrastructure	x	x	x
Innovation	The innovation of products and services	x	x	x
	The innovation of business processes, information systems and infrastructure	x	x	x

<i>Learning and Growth</i>				
<i>Subcategory</i>	<i>Topic</i>	<i>D</i>	<i>I</i>	<i>U</i>
Competences	The contribution to the professionalization of the organization	x	x	x
	The contribution to the professionalization of the architectural function <sup>3</sup>	x	x	
	The contribution to the professionalization of project management <sup>1</sup>		x	x
Culture	The willingness and ability to cooperate in the organization	x	x	x
	The culture (the way of dealing with one another) in the organization <sup>1,2</sup>			x
Alignment	Alignment business processes (business / business alignment)	x	x	x
	Alignment business processes and IT (business / IT alignment)	x	x	x
	Providing insight into the current and the desired situation as well as into the road map	x	x	x
Agility	The ability to respond to changes (agility) in the environment of the organization in a controlled way (resilience)	x	x	x
	The ability to respond to changes in business processes and IT (within the organization)	x	x	x

Technology research	Research of and gaining experience with new technology	x	x	x
Communication and KM	Improvement of communication and knowledge sharing	x	x	x
Evaluation and re-use	Experiences with previous results of architecture <sup>3</sup>	x	x	
	Evaluation of project results <sup>1</sup>		x	x
	Solving 'technical debt' <sup>4</sup>		x	
	Creation of artifacts for reuse <sup>3</sup>	x	x	

*Table 22 - EAVF survey questions and topic description*

<sup>1</sup>) – Topic not in scope of EA development

<sup>2</sup>) – Topic not in scope of EA implementation

<sup>3</sup>) – Topic not in scope EA exploitation

<sup>4</sup>) – Topic only makes sense to EA implementation

## Appendix C. Quantitative analysis

Below SPSS screenshot (table 23) depicts the Kruskal-Wallis test results to compare the results of the EAVF survey between architectural activity types (AAT)

Pairwise Comparisons of AAT						
	Sample 1- Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig. <sup>a</sup>
Finance and accountability	EA expl- EA impl	2.191	7.195	.305	.761	1.000
	EA expl- EA dev	30.496	7.328	4.162	<.001	.000
	EA impl- EA dev	28.304	6.754	4.191	<.001	.000
Customer and relationships	EA impl- EA expl	-5.846	7.131	-.820	.412	1.000
	EA impl- EA dev	31.500	6.740	4.674	<.001	.000
	EA expl- EA dev	25.654	6.987	3.672	<.001	.001
Internal processes	EA expl- EA impl	3.048	7.109	.429	.668	1.000
	EA expl- EA dev	25.489	7.109	3.586	<.001	.001
	EA impl- EA dev	22.441	6.756	3.322	<.001	.003
Learning and growth	EA expl- EA impl	2.939	7.082	.415	.678	1.000
	EA expl- EA dev	29.279	7.034	4.162	<.001	.000
	EA impl- EA dev	26.340	6.736	3.910	<.001	.000
Overall	EA expl- EA impl	.792	7.396	.107	.915	1.000
	EA expl- EA dev	33.350	7.649	4.360	<.001	.000
	EA impl- EA dev	32.558	6.942	4.690	<.001	.000

Table 23 - results of Kruskal-Wallis test to compare the results per architectural activity types

## Appendix D. Scores per aspect of the EAVF and AAT

BSC perspective	Aspect	EA dev		EA impl		EA expl	
		Mean	Median	Mean	Median	Mean	Median
Finance and accountability	Revenues And Costs	4,6	4,5	3,3	3,5	3,0	3
	Investments	4,3	4	3,3	4	3,2	4
	Compliance	4,8	5	3,9	4	3,6	4
	Governance	4,7	4,5	3,2	3,5	3,1	4
	riskManagement	4,5	5	3,2	4	3,2	3
	SocietalResponsibility	3,7	4	3,0	3	2,5	2,3
Customer and relationship	CustomerExperience	4,4	5	3,1	3,5	3,4	3
	CustomerRelationships	4,4	5	2,9	3,5	3,4	3
	ProductPosition	3,8	4	2,4	3	2,8	3
	MarketStrategy	4,2	4	2,7	3	3,4	3
	Ecosystem	4,2	4,3	3,1	3,8	3,4	3,5
Internal processes	Logistics	3,8	3,5	3,0	3	3,6	3,5
	BusinessProcesses	4,3	4,33	3,8	4	3,6	3,8
	MarketingAndSales	4,3	4	3,5	4	3,5	4
	ServiceDelivery	4,1	4	3,5	2,5	3,1	3
	DataManagement	4,5	4,7	3,9	4	3,9	4
	InformationManagement	4,6	4,5	3,7	3,8	3,4	3,4
	GeneralManagement	4,4	4,5	3,4	3	3,2	3
	QualityManagement	4,4	4,3	3,3	3	3,4	3,3
	HRM	4,3	4	3,0	4	3,3	3
	Innovation	4,4	4,5	3,0	3,3	3,3	3
Learning and growth	Competences	4,5	4,5	3,2	3,7	3,1	2,5
	Culture	4,5	5	3,4	4	3,2	3
	Alignment	4,6	4,7	3,9	4	3,9	4,3
	Agility	4,5	4,7	3,2	3,7	3,4	3,3
	TechnologyResearch	4,1	4	2,8	3	3,6	4
	CommunicationAndKnowledgeManagement	4,2	4	3,3	3	3,2	3,5
	EvaluationAndRe-use	3,9	4	3,1	3,5	3,0	3

Table 24 - Average and median scores per perspective/aspect EAVF

## Appendix E. Organisation's spearheads mapped to EAVF aspects

The financial institution published an internal document on their spearheads, which we mapped to the EAVF aspects in table 25.

Organisation's spearheads	BSC perspective	EAVF aspect
Safe, Secure & Compliant	Financial and accountability	Compliance
		Governance
	Internal processes	Data management
Hold the line on RoE	Financial and accountability	Costs and revenues
		Investments
	Customer & relationships	Customer relationship
		Market strategy
	Internal processes	Business processes
		General management
		Quality management
	Learning & growth	Agility
Become a data driven digital leader	Financial and accountability	Costs and revenues
	Customer & relationships	Customer experience
	Internal processes	Logistics
		HRM
	Learning & growth	Data management
		Technology research
Sustainability	Financial and accountability	Societal responsibility
		Compliance

Table 25 - Organisation's spearheads mapped against EAVF aspects

## Appendix F. EAVF survey results binomial test

As there was no theoretical or empirical information available about the distribution of the scores, we used a non-parametrical test. Each EAVF aspect was subjected to a one-sided binomial test. The null hypothesis, assuming the distribution  $B(n, 0.4)$ , states that EA's importance is low at the respective aspect and is thus supported by the 'Not important at all' and 'Slightly important' response categories; as a result, it may be expected that 40% (or more) of the respondents falls in either of these two categories. The alternative hypothesis, which consequently states that less than 40% falls within these two categories, is supported by the 'Average important', 'Important' and 'Very important' categories (i.e. assuming that EA has some level of importance for these aspects, one may expect significantly more than 60% of the answers to fall in these 3 response categories). Regardless of the type, respondents in the 'Unknown' category were considered as missing values and thus excluded in the test. See below table 26 for the results.

The first column states the aspect tested and the row tells us more on the distribution over the 5 scores. The underlined value represents the median score and the grey-coloured cells represent the hypothesis that the scores of considerable or very important value. Other than 2 aspects, the test results indicate that it is unlikely that the distribution was done by luck or coincidence.



High importance of....:	Not important at all	Slightly important	Average important	Important	Very important	N	Median	P-value	H1
<b>H1=</b>									
Investments	7%	10%	9%	<u>47%</u>	27%	86	4	<.001	TRUE
Compliance	5%	6%	7%	23%	<u>60%</u>	87	5	<.001	TRUE
Risk Management	10%	7%	11%	<u>30%</u>	43%	84	4	<.001	TRUE
Customer relationships	13%	9%	12%	<u>34%</u>	33%	86	4	<.001	TRUE
Product position	12%	17%	<u>25%</u>	25%	20%	83	3	.168	FALSE
Market strategy	6%	13%	19%	<u>35%</u>	27%	84	4	<.001	TRUE
HRM	7%	9%	18%	<u>35%</u>	31%	85	4	<.001	TRUE
Technology research	7%	9%	18%	<u>46%</u>	20%	87	4	<.001	TRUE
Communication and knowledgemanagement	9%	8%	16%	<u>42%</u>	25%	88	4	<.001	TRUE
Revenues And Costs	8%	7%	14%	<u>26%</u>	44%	84	4	<.001	TRUE
Governance	3%	5%	11%	<u>33%</u>	47%	87	4	<.001	TRUE
Societal Responsibility	14%	14%	<u>23%</u>	29%	20%	84	3	.208	FALSE
Customer Experience	9%	8%	16%	<u>28%</u>	38%	86	4	<.001	TRUE
Ecosystem	4%	7%	15%	<u>54%</u>	20%	84	4	<.001	TRUE
Logistics	6%	8%	26%	<u>34%</u>	26%	85	4	.022	TRUE
Business Processes	1%	9%	15%	<u>41%</u>	33%	87	4	<.001	TRUE
Marketing and sales	8%	8%	8%	<u>37%</u>	38%	86	4	<.001	TRUE
Service delivery	10%	7%	19%	<u>36%</u>	27%	88	4	<.001	TRUE
Data management	1%	7%	14%	<u>35%</u>	43%	88	4	<.001	TRUE
Information management	2%	11%	14%	<u>32%</u>	41%	88	4	<.001	TRUE
General management	7%	7%	20%	<u>33%</u>	33%	87	4	<.001	TRUE
Quality management	3%	11%	19%	<u>38%</u>	28%	88	4	<.001	TRUE
Innovation	8%	10%	16%	<u>30%</u>	35%	86	4	<.001	TRUE
Competences	6%	15%	14%	<u>32%</u>	33%	87	4	<.001	TRUE
Culture	9%	3%	16%	<u>31%</u>	40%	86	4	<.001	TRUE
Alignment	3%	5%	9%	<u>35%</u>	48%	88	4	.000	TRUE
Agility	6%	7%	23%	<u>35%</u>	30%	88	4	<.001	TRUE
Evaluation and reuse	10%	13%	19%	<u>34%</u>	24%	88	4	.001	TRUE

Table 26 - Binomial test results

## Appendix G. Comments received from EAVF survey

The survey response included a limited number of free-format comments, to support the provided scores. Below table (table 27) includes these statements. The responses have been redacted (in some cases) to remove typo's and remove references to the organisation.

ID	Provided by participant from AAT	Comment
1	EA dev	The level of governance is a function of the organisation's maturity. As the organisation matures the governance may transform into self governance. it is to be noted that very few organisations (within finance industry) have achieved adequate levels in this area.
2		In various business units I miss proper business & IT alignment (incl. EA). Within <our organisation> most decision making seems to be made by the business, driven by time-to-market, KPI's etc. EA is not always considered an enabler to deliver features fast.
3		I answered (very) important most of the time, however in the reality of scarceness the net result is often lower <than> the intention... Although architecture can be a mirror it still is the organizations line management who should do better alignment/prioritization (but I do not envy their job with the limits and (external) pressures on them either...)
4		The model lacks alignment with regulators: "Alignment with regulators (like PSD2...)"
5		The EA practice must be agile enough to support any development process that the business wants to use, which today is Agile-Scrum-DevOps. EA must support these processes on the key moments of these processes
6		Architects have... "No direct dealings with customers"
7	EA impl	A lot is budget-driven, even if it will save money on the long term. Technical superior solution, which have proven to provide better resilience and scalability and lower TCO, and not preferred over solutions that are already in place, for a number of reasons.
8		Enterprise architecture is, how I see it, poorly communicated and poorly visible. The impact on anything is not clear to me
9		Some topics like Time to market (solution delivery time), Security are not asked. Enterprise Architecture increases business value.
10		Constant changes are time consuming and costly. Aligning those better would benefit <our organisation> greatly. <Our organisation> lacks a technical governing body, which looks at the technical side. That is now handled by the teams, who don't do well in that area.
11		I find Enterprise architecture very important. We would not be as successful as we are now without EA
12		In my experience in day-to-day change delivery architects are almost never playing a visible role. They are inquired if required for decision making. Mostly due to the lack of usable roadmap horizons (e.g. a phased approach towards a long term target). Having a clear target is good but often due to regulatory or time-restrictions alternative (tactical) solutions are required in changes, only in limited cases architects play a key role.
13		The questionnaire asks to reflect on the current situation/experience which I think results in a more negative view based on experiences. While another aspect would be to look at if & how (E)A can add benefit to the aspects mentioned in these groups and what would be necessary to achieve this. Because the fact that an item is rated low may not be interpreted that this is an area where more (E)A involvement is needed, it may work fine already.
14		EA are expected to deliver a pre-agreed solution for <feature engineers> to implement as a design. Currently there is too much overlap between design and architectural direction. Organization needs to find a way to reduce this overlap (in terms of time spent) between architectural solution and design implementation.
15		Unfortunately, I do not see Architects in my organization do the contribution expected from them.

ID	Provided by participant from AAT	Comment
16		Architecture is invisible in my domain
17		I have also worked a couple of years as domain architect but as this role does nearly add no value for the organisation I switched back to FE.
18	EA impl	my answers are focussed on the effect I see; to clarify I think customer experience and satisfaction are very important but I do not really see architecture focusing on these areas. On the contrary, sometimes I feel architecture decisions are blocking improved customer satisfaction.
19		Architecture is in quite some cases way ahead of what is available as IT component which in some cases delays time to market of products and services
20		It is important that the architecture is according to target. But it is important that it is feasible and not depending on target elements that are not in place. In that case the architect is expected to think along how we can realize new products without without being fully dependent on the target architecture.
21		<Our organisation> has decided on implementing a separate system and infrastructure for many parts of the end to end processes. A lot of that is done historically, but also with advice from architects. The overall result of this approach is a cumbersome change process which leads to delays, many exceptions and increased risk in security, speed and lack of end to end sustainable process. Furthermore, the lack of detailed knowledge on banking, products and systems makes the involvement of the architects slow and ineffective and inefficient. Finally, very often the advice from architects is very high level/generic, too complex or too difficult to implement within the <our organisation> day to day business and comes too late. Very often a framework from the architects leads to the need to filing and decide on many deviations. My personal experience is that architects make my work much more difficult and slow. I am talking not only from point of view of my current, but also my past experience in this respect.
22		EA should share the principles they follow when making their decisions.
23		EA brings in my opinion quite often the global bank perspective or perspectives from other countries to a country or tribe.
24		Unfortunately, I don't think that architects should have a prominent role anymore
25		Architecture is completely invisible, which is a good thing because timelines are stretched as it is

Table 27 - free format comments from EAVF survey

## Appendix H. Literature analysis EA agile best practices

The following list (table 28) has been considered as input for the agile best practices and agile traits.

Sources include: SAFe(Advanced Topic - Agile Architecture in SAFe n.d.), Hauder (Hauder et al. 2014), Uludag (Uludag et al. 2017, 2019; Uludag, Philipp, et al. 2021), Guo (Guo et al. 2021), Duijs (Duijs, Ravesteijn, and van Steenberghe 2018), Thummaddi (Thummadi, Khapre, and Ocker n.d.), the O-AA (The Open Group n.d.) and Cammin (Cammin, Heilig, and Voß 2021).

After normalisation, the table is as follows, effectively leaving 37 best practices:

Original text	Author	Rewrite
Stakeholders provide feedback to EAM team	Hauder	There is a constant and fair feedback loop from stakeholders to EA and back
Leader fosters team's self-organization	Hauder	EA organises itself in self organising cross-functional agile teams, with incorporation of retrospectives
EAM team incorporates feedback	Hauder	There is a constant and fair feedback loop from stakeholders to EA and back
Incorporation of reflections & retrospectives	Hauder	EA organises itself in self organising agile teams, with incorporation of retrospectives
Iterative	Hauder	EA adopts Lean approach, including small units of work, one-piece work and iterations and processes must be reviewed constantly
EA personnel should be co-located with agile teams	Uludag	EA personnel should be co-located with agile teams but not be part of the agile dev team
The number of EA staff must match the number of agile teams	Uludag	The number of EA staff must match the number of agile teams
Avoid communication between EA and AT through a third person	Uludag	Avoid communication between EA and AT through a third person
Include AT in the architect production process to avoid BDUF fears	Uludag	Include AT in the architect production process to avoid BDUF fears
Business - IT alignment is the most important use of EA for improving organisational agility	Guo	EA must focus most on Business - IT alignment to improve organisational agility
EA processes must be reviewed constantly for staying Lean	Guo	EA adopts Lean approach, including small units of work, one-piece work and iterations and processes must be reviewed constantly
EA must be organised in small agile teams themselves	Thummaddi	EA organises itself in self organising agile teams, with incorporation of retrospectives
ING must be pushed to the edges in order to define the best agile EA structure	Thummaddi	ING must be pushed to the edges in order to define the best agile EA structure
Rapid Feedback Loops (Agile Architecture shall seek rapid feedback loops to verify customer and user assumptions)	O-AA	There is a constant and fair feedback loop from stakeholders to EA and back
Autonomous Cross-Functional Teams (If teams spend too much time coordinating with other teams, it increases lead time)	O-AA	EA organises itself in self organising agile teams, with incorporation of retrospectives
Authority, Responsibility, and Accountability Distribution (Accountability and responsibility improve predictability, which is a prerequisite to meeting the customer promise and industrializing operations)	O-AA	The EA should have clearly defined authority, responsibility and accountability,
Organization Mirroring Architecture (The Inverse Conway Maneuver is about shaping the enterprise's organization in a way that mirrors its intentional product and software architectures)	O-AA	EA must adopt the inverse Conway manoeuvre
Organizational Leveling (business architecture: Organizations shall be described at different granularity levels)	O-AA	drop
Three roles of IT architecture: EA, Solution architect and System architect	SAFe	drop
Architect are Lean-Agile leaders and are mentors to teams	SAFe	drop
Clear definition of roles & responsibilities	Hauder	The EA should have clearly defined authority, responsibility and accountability which is communicated widely
Characterized by defined roles & responsibilities	Hauder	The EA should have clearly defined authority, responsibility and accountability which is communicated widely
Members know their colleagues' duties	Hauder	The EA should have clearly defined authority, responsibility and accountability which is communicated widely
Leader acts as servant for the team	Hauder	drop

Original text	Author	Rewrite
EA should not be part of agile teams	Uludag	EA personnel should be co-located with agile teams but not be part of the agile dev team
Direct and active involvement of architects has a positive impact on acceptance of architecture	Duijs	EA should have an active participation in the development and design processes on a daily basis
Architects can start attending agile team meetings and working with them on a daily basis	Duijs	EA should have an active participation in the development and design processes on a daily basis
The law enforcing attitude can be exchanged for a more collaborative one, discussing the needs for deviation instead of enforcing principles	Duijs	EA practitioners should exchange a law enforcing attitude for a more collaborative one
Value Stream Alignment (Identifying common steps across several value streams is a key input to operating model design)	O-AA	EA must identify common step across several value streams
Project to Product Shift ("you build it, you run it" or "eat your own dogfood" )	O-AA	EA must absorb the paradigm of "you build it, you run it"
Diplomacy and negotiation skills	Hauder	EA staff must possess management skills, such as diplomacy, negotiation and balancing skills.
Foster learning by experiments	Hauder	EA should foster a paradigm of learning by experiments
Specialized to perform various tasks	Hauder	EA must possess specialised cross-functional skills
Performs tasks in self-organized manner	Hauder	EA organises itself in self organising cross-functional agile teams, wiith incorporation of retrospectives
Operates cross-functional	Hauder	EA must possess specialised cross-functional skills
EA should be technology focused and knowledge needs to be kept up to date	Uludag	EA must possess and maintain technology skills as they serve the agile teams
Bias for Change (Agile Architecture shall seek a balance between intentional and emerging architecture)	O-AA	EA staff must possess management skills, such as diplomacy, negotiation and balancing skills.
System architect to produce Architectural Runway, NFR's and design/support of the CI/CD pipeline	SAFe	EA produces a recognisable set of artifacts
IT architects produce a vision	SAFe	EA produces a holistic vision based on a rationale
IT architects produce a solution intent and solution context	SAFe	EA produces a recognisable set of artifacts
IT architects produce a architecture roadmap that drives the backlog for a release train	SAFe	EA produces a recognisable set of artifacts
IT architect support the PI planning	SAFe	EA produces a recognisable set of artifacts
Enterprise Architects support and influence this process by providing input, attending Value Stream Mapping workshops, and setting expectations on technical feasibility.	SAFe	EA produces a recognisable set of artifacts
Common language	Hauder	EA must produce its artifacts in a commonly understandable language that is usable and findable for all stakeholders
Usable for stakeholders	Hauder	EA must produce its artifacts in a commonly understandable language that is usable and findable for all stakeholders
As simple and accessible as possible	Hauder	EA must produce its artifacts in a commonly understandable language (for example informal graphics) that is usable and findable for all stakeholders
Provision and maintenance of architectural models	Uludag	Architectural models are as simple as possible and maintained forever
Transparency and documentation of reasoning has a positive impact on acceptance of architecture	Duijs	EA must make use of patterns and standards, in combination with transparency and documentation of reasoning
Fit for purpose architecture has a positive impact on acceptance of architecture	Duijs	EA must be able to produce fit for purpose architecture that can be adapted to the interest of stakeholders
Focus on technical debt and quality has a positive impact on acceptance of architecture	Duijs	Focus on technical debt and quality has a positive impact on acceptance of architecture
Using patterns and standards has a positive impact on acceptance of architecture	Duijs	EA must make use of patterns and standards, in combination with transparency and documentation of reasoning
Architecture functions can start documenting all decisions for everyone to see	Duijs	EA must produce its artifacts in a commonly understandable language (for example informal graphics) that is usable and findable for all stakeholders
Architecture deliverables can be adapted to the interests of stakeholders	Duijs	EA must be able to produce fit for purpose architecture that can be adapted to the interest of stakeholders
Secure by Design (The Agile enterprise will shift from DevOps to DevSecOps)	O-AA	drop
Valuable architectural work is realized early and periodically to improve the EA quickly	Cammin	drop
Use meta-modelling	Cammin	drop
Conduct code-reviews by EA	Cammin	EA must be part of the team that performs code review

Original text	Author	Rewrite
To facilitate discussions and increase common understanding: use informal and user-oriented models or graphics.	Cammin	EA must produce its artifacts in a commonly understandable language (for example informal graphics) that is usable and findable for all stakeholders
To increase usability of models on a daily basis and acceptance of EAM: create a uniform terminology	Cammin	EA must produce its artifacts in a commonly understandable language (for example informal graphics) that is usable and findable for all stakeholders
Availability of EA personnel should be high	Uludag	EA personnel must maintain high availability for the rest of the organisation
Architecture awareness of the PO has a positive impact on acceptance of architecture	Duijs	The PO's should have increased awareness of architecture
Touchpoint Orchestration (Agile Architecture shall enable a holistic orchestration of every single touchpoint of an enterprise and its ecosystem)	O-AA	EA must enable a holistic orchestration of every single touchpoint of the bank and its ecosystem
Architects evangelise CALMR principles: Culture of sharing responsibility; Automation of continuous delivery pipeline; Lean flow accelerates delivery; Measurement of everything; Recovery enables low-risk releases.	SAFe	Architects evangelise agile and Lean principles, also for their own work
Valuation of time over quality	Hauder	Architects must prioritise time over quality and completeness
EA must exactly respond to the stakeholders' demands	Hauder	Stakeholders of the organisation must be clear and EA must exactly respond to those stakeholders, who should actually use the artifacts
Adherence to the Lean one-piece flow	Hauder	Architects evangelise agile and Lean principles, also for their own work
Application of the Lean pull-principle, in essence limiting the WIP to 1	Hauder	EA practitioners must limit their WIP to 1
Advancement with a indefinite & constant pace	Hauder	Architects evangelise agile and Lean principles, also for their own work
Agreed level of done	Hauder	Architects evangelise agile and Lean principles, also for their own work
EA artifacts are actually used by stakeholders	Hauder	Stakeholders of the organisation must be clear and EA must exactly respond to those stakeholders, who should actually use the artifacts
Embracement of changes, be that IT, business or governance changes	Hauder	Architects evangelise agile and Lean principles, also for their own work
Valuation of time over completeness	Hauder	Architects must prioritise time over quality and completeness
Satisfied with its work	Hauder	drop
Focus on requirements	Hauder	Stakeholders of the organisation must be clear and EA must exactly respond to those stakeholders, who should actually use the artifacts
Satisfy stakeholders	Hauder	Stakeholders of the organisation must be clear and EA must exactly respond to those stakeholders, who should actually use the artifacts
Focus on high-quality	Hauder	EA should focus on high-quality
Accomplishes EAM tasks in small subteams	Hauder	Architects evangelise agile and Lean principles, also for their own work
Early delivery	Hauder	EA should focus on early delivery
Incremental	Hauder	Architects evangelise agile and Lean principles, also for their own work
Being flexible when applying rules and principles has a positive impact on acceptance of architecture	Duijs	EA must adhere to flexibility when applying rules and principles
Customer Experience Focus	O-AA	EA must focus on customer experience over everything else
Outside-In Thinking (Design thinking, which is a human-centered approach, incorporates human cognition and emotion as key aspects of the value definition)	O-AA	EA must adhere to the paradigm of outside-in thinking/design thinking
Loosely-Coupled Systems (as it shortens development time as separate teams can work on each module with little need for communication and it increases product flexibility as changes to one module have little impact on other modules)	O-AA	EA should focus on loosely coupled systems as it increases agility and simultaneous development
Modular Data Platform (Agile Architecture shall create modular data platforms using domain decomposition logic)	O-AA	EA should create modular (data) platforms using domain decomposition logic
Simple Common Operating Principles (Agile Architecture shall use a set of simple mechanisms that all elements and connections will use)	O-AA	EA should create and maintain a simple list of architecture principles that are common over all elements
Use the principle "Target models are less detailed"	Cammin	EA should embrace the fact that target models should be less detailed

Table 28 - Normalisation efforts best practices

## Appendix I. Delphi round 1 questionnaire

In the first round of the Delphi study, we asked the participants how they would score the relevancy of each best practice/agile trait from the final list. We added the following instructions (figure 6):

This excel workbook is structured as follows:  
This is the **Instructions tab**: just read it and apply the instructions on the following tabs  
The **Tab 1 . Best practices** lists the best practices found in literature on the subject of agile architecture. They are often vague or just too general, but they have been proven true. We're after the practicalities of them  
The **Tab 2. EAVF aspects**, will ask you to link those best practices to the EAVF aspects that in an earlier survey scored low or where the difference between the disciplines is high

**The EAVF survey exposed that the value of EA is perceived differently between EA itself, the implementers of EA and the users of EA. The underlying reason could be quite diverse.  
In your expert view, what could be done to reduce this gap? What are best practices that we could apply or what 'best practices' do you have to do this?**

Instructions:

Start with tab 1. Best practices. In column B, you'll find 37 best practices derived from academic literature, that have been in their respective studies found to be valuable.  
Assess the best practice and **please rate every line** with a score of 1-4, whereby  
1 = Irrelevant  
2 = Not relevant enough  
3 = Somewhat relevant  
4 = Very relevant

It could very well be that the best practice itself is not practical enough or needs a lot more details to be useful - that's the part where it becomes interesting.  
**In column D, I'm asking you, if you think it's necessary, to add the how we can use this, for example:**  
*Best Practice: "Architectural models are as simple as possible and maintained forever", and column D: "by adopting an acceptance protocol and a structured repository"*

You can also add your own "best practices" in column D. Note that some "best practices" may, in your eyes, not be useful even with a practical handle. Just score them low without something in D  
Please be VERY critical and provide as many practical handles as possible if needed.

Those practices that are scored with a 3 or higher, will appear on the tab 2. EAVF aspects  
There you can find the lowest scores of the EAVF survey held earlier at ING - you would have participated in that. In the hover-text, you can find what the question was on the subject of the aspect  
What I'm asking you to do here is to assess your own high rated best practices and tell what aspects it could help 'solving'. If the best practice would solve more than one aspect, you can select up to 3, or simply use ALL

Once all best practices on your list have been assessed against EAVF best practices, you're done for this round. Please save your work and share it with me (only). I will analyse all results and see where consensus is reached and where not for round 2!  
All participants will remain anonymous - only I will know your submitted suggestions and ratings. And I promise not to share!

Figure 6 - screenshot of the Delphi study instructions for the participants



## Appendix J. Practical handles of best practices

The below table (table 29) holds the final overview of the practical handles as provided by the Delphi panel members.

Practice ID	Practice text	Practical handles
1	There is a constant and fair feedback loop from stakeholders to EA and back	<ul style="list-style-type: none"> <li>- By finding a balance in steps to target architecture and side steps to make next steps on business side</li> <li>- Ask for feedback on Architecture Decisions and other deliverables and take the comments serious and change the deliverable based on the comments. Make it very concrete by making "getting feedback" as part of Architecture work, just ask for it and take it serious</li> <li>- "This is something the EA does, and actively so (beyond publishing on some Intranet page). To that end, make it an explicit part of the (yearly) review: show me how you build and maintained that feedback loop. "</li> <li>- by implementing a strict protocol that includes this feedback on our collaboration tool</li> <li>- This is a bit of a catch 22 dilemma. The communication between stakeholders and architects is based on pre-existing trust (by the stakeholders) or at least in their willingness to create space for the trust to be built. Given its current absence, architecture should focus on regaining the trust by delivering value recognised by the business. This requires a few ingredients by the architects: not shying away from stakeholder discussions, trying to structure the communication stressing the actual business-understood benefits or quantified risks. In other words, EA needs to learn the language of the business while not losing sight of EA role, as the warden of sustainable growth of the enterprise.</li> </ul>
8	EA must focus most on Business – IT alignment to improve organisational agility	<ul style="list-style-type: none"> <li>- Ok if we limit the IT exposure of EA (move to include business too)</li> <li>- IT and business divide is an old concept so not relevant anymore which only causes problems. There are only customers (internal and external) who need something.</li> <li>- Let EA be involved as from the start (in the business roadmaps ) ==&gt; alignment will be there</li> </ul>
9	The EA should have clearly defined authority, responsibility and accountability which is communicated widely	<ul style="list-style-type: none"> <li>- clear and practical material on what to expect from EA/DAs show examples, explain this to stakeholders, explain the why etc</li> <li>- Prove me your authority, gain my trust</li> <li>- I still believe that on the expected seniority level of an EA one cannot rely on formal authority. Yet to make this practical, the role can be formalised thorough mandatory and consistent participation of EA role in key decisions, i.e. being a gate at some of the processes. Where architects could help is with quality documentation of the decision rationale and by retrospective assessment of the impact of the decisions taken - all: those where EA supported the decision, where it was against and also where it modified the decision. Especially for the last two, the feedback loop on impact is critical for building the trust by retrospective substantiation.</li> <li>- By constant and fair review of the job description globally</li> </ul>
10	EA must adopt the inverse Conway maneuver	<ul style="list-style-type: none"> <li>- very major shift since we need to let go of the link to software assets and look at actual flows instead.</li> <li>- This is a significant paradigm shift and may require a governance change.</li> </ul>
15	EA staff must possess management skills, such as diplomacy, negotiation and balancing skills.	<ul style="list-style-type: none"> <li>- Matching also hierarchy to the different parties. For example, domain architects to align with ITAL's and PAL's and responsible EA to align with Tribe lead and IT lead.</li> <li>- focus the development budget on these topics. Technology skills and be easily found on internet and via books but these skills can only be learned via hand on courses</li> <li>- While sounding very obvious, this is still much lacking. We may need to spend some time in identifying the why for this deficit in skill. In</li> </ul>



Practice ID	Practice text	Practical handles
		<p>long-run the reason need to be translating into better profiling of EA candidates (that should focus on these skills in particular) for both internal promotions as well as external hiring. Knowledge alone should no longer be the only qualifying trait. In shorter run, we need to really sift through EA potential and select out people with true enterprise level thinking and remove them from domain topics to create space for them to a) focus on the real enterprise aspects and b) investment in the skills needed. Both components are complementary as lifting the discussion to enterprise level should get them closer to the senior stakeholders that in turn is the practice field for the needed soft-skills.</p> <ul style="list-style-type: none"> <li>- by training. This is an underlit aspect of the development of EA folks.</li> </ul>
17	EA must possess specialised cross-functional skills	<ul style="list-style-type: none"> <li>- Architect must have an overview of the company (may be very high level ), the domain architect should be one for the specialists of his domain</li> <li>- I couldn't care less how they organize, as long the out I need is delivered.</li> </ul>
20	EA produces a holistic vision based on a rationale	<ul style="list-style-type: none"> <li>- Create principles for the different layers in the LAA</li> <li>- include and review the why of architecture proposals but the bigger the scope (more holistic) the less level of detail</li> <li>- Principles and standards should be made useful artefacts and adhered to (be used). A practice for principle formalisation (and structuring) should be established and evolved</li> </ul>
21	EA must produce its artifacts in a commonly understandable language (for example informal graphics) that is usable and findable for all stakeholders	<ul style="list-style-type: none"> <li>- we make architecture artifacts for non architects so send everybody on communication courses, use other ways of communication that forces everybody to make simple understandable materials. Most people understand boxes and lines, stick to that and explain the level of abstraction and detail</li> <li>- Per type of stakeholder, EA must produce "other" artifacts: from a high-level view ( management ) to a low-level ( per piece ) for the developers</li> <li>- This goes closely with the soft skill of an architect. The first practical step is to realise and widely communicate the need of architect to tailor messaging to its target audiences. The mere fact that architects can (and should) speak more languages than their stakeholders should be considered a responsibility of the architect to be understood rather than the one of the stakeholder to understand.</li> </ul>
22	EA must make use of patterns and standards, in combination with transparency and documentation of reasoning	<ul style="list-style-type: none"> <li>- Here another documented artefact to rescue: Patterns. We should have a pattern and antipattern repository (potentially linked with the principles) to serve as the library and guidance for the architects.</li> <li>- By enforcing and testing this rationale.</li> </ul>
37	EA should create and maintain a simple list of architecture principles that are common over all elements	<ul style="list-style-type: none"> <li>- Start creating them anywhere and most important start discussing and agreeing on global EA level.</li> <li>- This is what guides the company's setup, so off course!</li> <li>- limited since not everybody sees the value of principles, but we should publish on confluence and refer to them but keep them generic and review now and then since the world is always changing</li> <li>- Principles must be there, but more important is that they are accepted by the full organisation (not only architecture )</li> <li>- Prove your authority, gain my trust</li> <li>- ABSOLUTELY! Also to make this practical, the principles should be a) easily accessible (in one place) and b) consistently referenced in designs and decisions in both use-modes: as supporting or (intentionally) conflicting principles -- as such they provide transparency for the decision making process.</li> </ul>

Practice ID	Practice text	Practical handles
38	Architecture needs to be involved in bigger programs in on the business side. EA needs to earn the trust that business invites the architects in important initiatives.	<ul style="list-style-type: none"> <li>- we need to be relevant and be involved in key discussions and early on. We should have the behaviour and attitude to do so</li> <li>- EA must as fast as possible in the chain be involved, so the company vision is followed (solution must be as much as possible in line with the target )</li> <li>- I tend to see Architecture has IT architecture and often fail to see that EA also incorporates Business architecture. So in that sense if the Business architecture is not present in big programs well.. No under that we had, key projects..... down the drain..</li> <li>- This links to the trust. The seat at the stakeholder's table cannot be really demanded but rather gain. A bit of Catch 22 but bit by bit through recognised involvement in the programmes and documented value to the organisation (such as cost avoidance, increase of time to market) that are clearly linked to the architecture guidance we give should help</li> <li>- Architecture should be closer to the business regardless. But architecture should deserve to be in this position. That may mean that EA should become the trusted advisor again.</li> </ul>
39	Target architecture needs to be based on clear framework with underlying principles which can explain decisions taken. Ofcourse intermediate state architecture is based on target and implementation possibilities.	<ul style="list-style-type: none"> <li>- This is a variation on the principles theme</li> <li>- yes but don't go overboard with complex references and frameworks</li> <li>- Important is to have a target architecture, but more important is to have a roadmap to get to the target (intermediary steps ); if this is not there, the architecture will NOT be a success.</li> </ul>
40	EA should be more involved with the business perspective/roadmaps.	<ul style="list-style-type: none"> <li>- They should have clear architecture that enables rapid implementation of changes</li> <li>- understand the business and challenge priorities is crucial</li> <li>- EA must as fast as possible in the chain be involved, so the company vision is followed (solution must be as much as possible in line with the target )</li> <li>- EA should be a participant in the roadmap preparation and execution at tribe level and cross tribes. Next to the service/product-offering by business there should be a "business architecture" which enables the service offering. This will not only help to have less discussions on lower-level on which technology/Solution architecture to use, but also lead to a better and earlier alignment between the business and the IT roadmap.</li> <li>- The level of involvement is to a degree a function of value. Yet we may need some formal trigger coming from a process (such as PARP) to actually get involved not only when an Architecture chapter is needed. But at the inception point to be able to influence the idea (this is also branching to the Business architecture function of EA). If EA is present at this stage it is also imperative that our input is taken seriously and acted upon.</li> </ul>
43	EA should have outstanding communication, presentation and storytelling skills including the ability to metaform concepts to support understanding by various stakeholders	<ul style="list-style-type: none"> <li>- EA are story tellers explaining the why and include some EA deliverables in that story</li> </ul>

Table 29 - Practical handles on best practices

