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Generic Enterprise Architecture Framework Adoption Practices in Higher Education Institutions

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Abstract

Recent studies have provided much information about enterprise architecture (EA) and reference architectural models in general but less concerning the adoption of enterprise architecture frameworks (EAFs) suitable to higher educational institutions (HEIs).

The purpose of this study is to explore EAF adoption in HEIs and identify the key requirements and empirical evidence for the successful adoption of EAFs. To answer the research questions, an exploratory holistic single-case study research approach is adopted. Data is collected by conducting semi-structured interviews with the key stakeholders and by performing document and archival research put at our disposal by one specific HEI.

Findings based on the researcher's own research conducted at their own case organization show that EAFs can be adopted to be suitable for successful usage in HEIs. Key requirements of a successful adoption are a centralized EA vision and decision authority, sufficient EA resources (mandate included), tailoring existing EA frameworks, avoiding over-standardization, an agile and lean implementation approach, management buy-in, unambiguous key performance indicators and tangible deliverables, stakeholder participation (business-driven), leveraging via outsourcing, and open organizational culture.

Identifying tangible quick wins by promoting participatory development at the board level and adopting an agile phased approach based on the cyclical TOGAF architecture development method practice are highlighted as practical implications.

Key terms

Enterprise Architecture, Enterprise Architecture Management, EA Adoption, EA Application, EA Frameworks, Generic EA Frameworks, EA Challenges, Higher Education, HEI

Summary

Given the challenges, HEIs are currently confronted with (alignment tensions between business and IT), and the solution (improvement of learning processes, business agility, and so on) EAFs provide in overcoming those challenges, the objective was to investigate successful EAF adoption practices within HEIs, focusing on key requirements for successful adoption.

The research regarding EAF adoption in HEIs is still in an embryonic stage, but there is a clear need for EAF practices in HEI contexts and a strong demand for more research to be conducted to guide the process of HEIs using EAF and add to the body of knowledge. There is considerable interest from HEIs because EAFs could facilitate instruments for improving the performance of educational services.

Enterprise architecture framework adoption has historically been considered a complex and cumbersome issue. Few reference architectures specific for HEIs can be found, and the available ones are usually highly context-dependent and thus not suited to be applied in different institutions in general. Often, such studies were fostered by lightweight or hybrid EA development methods for HEI.

The main practical contribution of this research is the identification of key requirements of successful adoption of generic EAF in HEIs. Applying these requirements may increase the likelihood of successful adoption. The study aims not only to help academics but also practitioners (business organizations) by using the requirements as a guideline to successfully adopt a generic EAF in HEI.

The main research question of this research is the following:

"How can generic enterprise architecture frameworks be adopted for successful usage in HEIs?"

The following research sub-questions are used for answering the main research question:

1. How are HEIs different from other organizations (concerning EA)?
2. How are EAFs being used in HEIs?
3. What are the key requirements for the successful adoption of EAFs in HEIs?

The first two questions are dealt with in the literature study, and the third sub-research question was dealt with in the empirical part of this research.

Regarding the first question, the literature study shows that HEIs need to fulfill their mission of improving educational services in complex and fast-changing environments. The education system has changed, there is a shift from mass teaching systems to flexible learning paths and student-centric learning approaches, creating complex core processes, which often are not interconnected. Disparate investments in technology supporting the teaching-learning process, disparate demands from different stakeholders, creating large heterogeneous application landscapes and different systems, posing several problems (inconsistency of data, lack of interoperability), implying overlapping and redundant systems. The thrive on diversity in HEI's decision making and the HEI's need for continuous innovation makes strategic alignment more complex and difficult. The challenges and opportunities these learning demands and technologies bring are overwhelming for HEI, often resulting in some level of misalignment with original business goals and strategies. However, while its target audience of digital natives effortlessly switches between new systems, this is less obvious for a large organization such as an HEI creates tension between the school and its students and explains its uniqueness and complexity.

Regarding the second question, the literature study shows that due to the undeniable benefits of EA, being business agility, better decision-making, improvement of processes, and quality of services, several EAFs have been developed; some are specific for HEIs, developed a lightweight EA method, whereas others proposed a method based on TOGAF ADM, suggesting a hybrid (blended) specialized framework for HEI. Often, such studies were fostered by lightweight or hybrid EA development

methods for HEI. Such a hybrid (blended) approach states that when selecting the most desirable EAF for HEI, it is convenient to attempt to join the most interesting elements of each approach in a hybrid specialized framework for HEI.

Several challenges can significantly impede the process toward successful EA(F) adoption in HEIs, including the lack of an **overarching governing body** (no entity with formal **mandate**) and the **lack** of an agreement on the **vision** and the extent of the EA (multiple separate initiatives without a holistic EA perspective). Enterprise architecture initiatives are often triggered from an IT viewpoint (instead of business; specifically, **a lack of real and relevant business requirements).**

The research method used to investigate the problem statement is a single-case study approach that is explorative, inductive, and uses a holistic approach. Due to stringent timing and the coronavirus outbreak, this was the preferred method from a practical point of view. Data was collected using semi-structured interviews, documents, and archival research. The data produced was analyzed by thematic analysis, was data-driven, and serves to provide additional empirical evidence on the stated main research question and the third sub-question, *"What are key requirements of successful generic EAF adoption in HEI?"*

While conducting the interviews, the interview questions were grouped, the first part(s) of the interview focalize on the maturity of the current EA at the UAS, to elicit (possible) issues, what is going well, what is going not so well, what can be better, what is missing. Finally, we can distill key elements, key requirements that are minimum and necessary for successful adoption of generic EAFs in HEI.

The maturity assessment conducted at first by the researcher was not the goal of this research but a means to distill key requirements, aiming to provide a description and provide additional empirical evidence on the practical EAF adoption in a real HEI context.

These key requirements are a centralized (unified) EA vision, central decision authority, and sufficient EA resources (mandate included); tailoring (blending) existing EAFs (cherry-picking the most suitable components); avoiding over-standardization; foreseeing an agile, phased, and lean implementation approach, with short lead time; triggering management buy-in; defining unambiguous key performance indicators (KPIs) and tangible deliverables; promoting stakeholder participation (business-driven); and collaborating through a bottom-up perspective with the business in control and with information technology (IT) in a supporting role. Such an arrangement enables leveraging via outsourcing the EAF setup but keeping enterprise architecture management (EAM) internal and creating an open organizational culture.

Enterprise architecture frameworks are adoptable for successful usage for the UAS, but a "blended" and "lightweight" approach might provide the most viable solution. HEIs will never employ full-blown formal repositories, as these are too time- and budget-consuming. A less formal approach to repositories is advised, cherry-picking (tailoring) the most suitable artifacts. The selection of deliverables could ideally be made by assessing the current maturity model with EAF (as-is vs to-be, identifying the gaps) and prioritizing and creating a realistic and visible roadmap, which must be approved by the board of directors.

The research setup of this thesis concerns a single-case study. Arguably the most prominent critique of single-case study analysis is the issue of external validity or generalizability. Findings cannot be widely accepted but are based on the experience and input by contacts of the researcher (anecdotal references) backed up by literature research conducted by similar non-profit organizations. Tentative (conservative) assumptions and certain findings can be made plausible by saying that the present finding resulted from the empirical research also applies to other similar Universities or Universities of Applied Sciences.

Due to restrictions in timing and limited availability of resources, literature study is not exhaustive. This may lead to an incomplete portrayal of the investigation of the research topic.

The resulting requirement set can be of practical utility for HEI practitioners in terms of providing high-level support and guidance for several EAF and business-related (practical) activities. The present study contains valuable info for project managers who are responsible for the implementation of EAFs in HEIs. It can act as a valuable tool for guiding HE stakeholders into making better-informed decisions regarding EAF being conveniently adapted or applied in different EA practices conducted at their respective HEIs.

Therefore, we believe that this research at hand could be of interest to HEI business and IT managers as well as for IT service consultancy firms or IT vendor providers.

Our research was exploratory and performed in one specific university within the educational sector. It has therefore limited generalizability, providing opportunities for subsequent research of EAF implementation in other educational enterprises (extrapolation to multiple case studies). Additional empirical studies in the form of use cases providing evidence on how the proposed key requirements are effectively used and operationalized in practice could be interesting future contributions.

Contents

1. Introduction

1.1. Background

Education has been called a pillar of any society (Alamri, Abdullah, & Albar, 2018), and it is one of the main engines of progress around the world (Sanchez-Puchol, Pastor-Collado, & Borrell, 2017). Education is currently called upon to improve the quality of educational services in complex and fast-changing environments (Bourmpoulias & Tarabanis, n.d.).

External conditions—such as modern highly competitive environments, the need to respond to fast changes and new requirements, digitalization, pressure for efficient information technology (IT) systems, and imposed governmental regulations—force educational organizations to be more flexible and optimize their IT performance (Bourmpoulias & Tarabanis, n.d.).

Enterprise architecture is considered as one of the major instruments for enabling companies to cope with such alignment tensions (Sanchez-Puchol et al., 2017). Enterprise architecture frameworks (EAFs) have emerged over recent years as instruments to increase the quality of EA practice and development (Sanchez-Puchol, Pastor-Collado, & Borrell, 2018a). When developing an EA, it is necessary to adopt an EAF that is suitable for higher education (HE; Komariah Hildayanti et al., 2018).

It is a considerable challenge for higher education institutions (HEIs) to implement EA in an educational environment, and limited research exists on EAF adoption in HEIs (Olsen & Trelsgård, 2016a).

Few articles have focused on EA implementation in the educational field (Bourmpoulias & Tarabanis, n.d.), and there is also a clear need for more research on EA practices in HE contexts (Sanchez-Puchol et al., 2017).

The objective of this research is to investigate successful EAF adoption in HEIs, determining how a generic EAF can be successfully used in HEIs, with a focus on providing empirical evidence regarding possible key requirements for successful adoption in real HEI contexts. Due to limited time and resources, we have chosen to delimit the scope to universities of applied sciences located in Flanders.

1.2. Exploration of the topic

Enterprise architecture is the definition and representation of a high-level view of an enterprise's business processes and IT systems, their interrelationships, and the extent to which these processes and systems are shared by different parts of the enterprise. Enterprise architecture aims to define a suitable operating platform to support an organization's future goals and the roadmap for moving toward this vision (Tamm, Seddon, Shanks, & Reynolds, 2011).

The genesis of EA as an organizational management discipline can be traced to the mid-1980s. At that time, John Zachman, widely recognized as a leader in the EA field, identified the need to use a logical construction blueprint (i.e., an architecture) for defining and controlling the integration of systems and their components (Hite, Randolph, 2010).

Enterprise architecture promises to help HEIs identify the need to standardize or integrate key processes, efficiently manage large infrastructure investments, provide a consistent view for all stakeholders, and establish a more agile enterprise (Oderinde, 2010). It helps HEIs to better leverage their current resources, capabilities, and competencies to meet institutional needs and manage change effectively (Alamri et al., 2018). Enterprise architecture has been viewed by educational stakeholders as a promising method for more effective change management, more sustainability, and better return on investment (Bourmpoulias & Tarabanis, n.d.). It also has important strategic outcomes, such as better operational excellence and strategic agility (Ross et al., 2006).

Enterprise architecture frameworks have been defined as generic EAs—including common architecture principles and standards—that consist of three coherent partial architectures: the business architecture, application architecture, and the technology architecture (Sanchez-Puchol et al., 2017). Enterprise architectures typically embrace the following components: a reference architecture, a standard vocabulary, and a methodology for planning and implementation, instruments and guidance for conceptualizing and documenting EA (Ahlemann, Stettiner, Messerschmid, & Legner, 2012).

For this matter, an EAF can provide help and support by providing organizations the ability to comprehend and analyze weaknesses or inconsistencies that need to be identified and addressed (Urbaczewski & Mrdalj, 2006). An EAF can describe the underlying infrastructure, therefore providing the groundwork for the hardware, software, and networks to work together (Komariahhildayanti, Putra, & Sanmorino, 2018).

1.3. Problem statement

Higher education institutions face many challenges: the emergence of new educational (learning) technology and new quality assurance requirements derived from educational reforms boosted by the Bologna process. This makes them compete strategically, but due to the heterogeneous IT landscape, there is a continuous and growing tension between the business (requirements) of HEI and their available technological capabilities, leading to a mismatch in alignment between business and IT (Sanchez-Puchol et al., 2017). An HEI is a public service organization but also a business ecosystem that needs to understand its strategic position and service portfolio (Tjong et al., 2018).

It is imperative for HEIs to meet changing and increasing learning demands effectively (Oderinde, 2010).Enterprise architecture, as a key enabler of strategy formulation and business-IT alignment, could play a central role in helping HEIs develop their full IT strategy and gain a competitive advantage (Bourmpoulias & Tarabanis, n.d.). Despite beforementioned and other benefits to be gained, EA is not widely adopted in HEIs (Schekkerman, 2003).

Enterprise architecture framework adoption has historically been considered a complex and cumbersome issue (Luftman & Kempaiah, 2007), and EA management practices have not been pervasively used in HEIs. Many EA management endeavours end up creating an “ivory tower” model, not matching stakeholder analysis, leading to a non-flexible and unrealistic model to apply (Buckl, Matthes, Neubert, & Schweda, 2011).

While a wide variety of different EAFs have been proposed for different industries and types of business, only a few have been devoted to the HE sector (Sanchez-Puchol, Pastor-Collado, & Borrell, 2018b). Even the EAFs specifically deployed in concrete HEIs are usually highly context-dependent and not well suited to being applied in other situations (Sanchez-Puchol et al., 2017).

This research aims to investigate successful adoption of generic EAFs within HEIs.

1.4. Research objective and questions

Given the research problem and context, the objective of this research is to investigate generic EAF adoption practices within HEIs, exploring how a generic EAF can be adopted for successful usage in HEIs with a focus on providing empirical evidence regarding possible key requirements for successful adoption in real HEI contexts.

This research attempts to find an answer to the following main research question: “**How can generic enterprise architecture frameworks be adopted for successful usage in HEIs?”**

The following research sub-questions can be used as a basis for answering the main research question:

1. How are HEIs different from other organizations?
2. How is the usage of EAFs in HEIs?
3. What are the key requirements of successful EAF adoption in HEI?

1.5. Motivation and relevance

The research is scientifically relevant as it will contribute to the existing literature on generic EAFs and adoption within HEIs. The research regarding frameworks is still in an embryonic stage, and there is a strong demand for more research on EA practices (Sanchez-Puchol et al., 2017).

Enterprise architecture frameworks have been developed for several specific industries; in contrast, little has been done so far in the HE industry (Sanchez-Puchol et al., 2017). Only a small number of articles focus on EAF adoption and assessment in HEIs (Bourmpoulias & Tarabanis, n.d.). It is a challenge for HEIs to implement EA in an educational environment and limited research has been conducted on EAF adoption and application in HEIs (Olsen & Trelsgård, 2016a). Nevertheless, there is considerable interest from HEIs because EAFs could facilitate instruments for improving the performance of educational services.

In summary, all previous research seems to confirm the need for conducting further research on EAFs for HEIs. The main practical contributions of the thesis are key requirements of successful EAF adoption in HEIs. By applying these requirements, one may increase the likelihood of successful EA adoption in HEI. The study aims not only to help academics but also practitioners (business organizations) by using the requirements as a guide to the successful adoption of an EAF in HE. This guideline can act as a valuable tool for guiding HE stakeholders in making better-informed decisions regarding EAF being conveniently adopted or applied in different EA practices conducted at their respective HEIs. Therefore, we believe that this research could be of interest to HEI business and IT managers as well as IT service consultancy firms or IT vendor providers.

1.6. Main lines of approach

The remainder of this current study is structured as follows. This research begins with an extensive literature review on EA, its common frameworks, interoperability with HEIs, and adoption challenges in Chapter 2. This chapter provides the theoretical framework according to which the research was executed. The chapter is followed by a description of the methodology used for this research in Chapter 3.

Chapter 4 provides an overview of the data produced by the empirical research, and in Chapter 5, the main research conclusions, discussion points, limitations (reflection), and recommendations from practice and for further research are outlined.

2. Theoretical framework

2.1. Research approach

The direction of this research was defined in the previous chapter. The goal of Chapter 2 is to situate this research in the current theoretical state of knowledge regarding EAF adoption practices in HEIs. This will be done by exploring what has already been investigated by scientists regarding the research topic, main question, and sub-question(s).

This literature study should respond to the first two sub-research questions as stated in Section 1.4, and the last (3rd) sub-research question is dealt with in the empirical part of this research. The used queries and correlated databases can be found in Appendix 8.1. In the next chapter, more details

regarding this process and the implementation and execution of the literature research approach will be dealt with.

2.2. Implementation

Searches were initially executed with Google Scholar, as this is an easy and accessible way to find articles in a wide range of journals. Furthermore, the digital library environment of the Open University was used. Primary and secondary sources were consulted from the following information databases at the Open University: "EBSCO HOST," "GOOGLE SCHOLAR," and the "IEEE Digital Library".

The total time available for the literature study of this study was about 50 hours. The literature study is not exhaustive because of the restricted time available, and this limitation may have led to an incomplete picture of the research topic. Management of all literature was conducted using Mendeley.

Individual search terms were used for Section 1.2 (exploration of the topic). This did not look at mutual coherence between the individual research topics. A combination of search terms was used to answer sub-research questions. Some search terms yielded many results. Articles were initially assessed on the title and the extent to which keywords matched the focus area of this research. Depending on the number of useful articles, a second selection was made after reading the abstracts, followed by skimming the article, reading the conclusion, and if deemed relevant, reading the complete article and, if relevant, using it for this research.

An article was deemed relevant when there is a connection with the main topic and (sub-) research question(s), especially EA and EAF usage in HEI, adoption practices of EAFs in HEIs, and depiction of the complexity and unique position of HEIs.

In the literature study, forward and backward searching (Levy & Ellis, 2006) were methods frequently used (reference searching, chain searching, citation mining). In Appendix 8.1, an overview of the queries, keywords, and databases that were used and how many relevant articles were selected is presented.

The results of this literature search can be found in the following subchapter.

2.3. Results and conclusions

2.3.1. Higher education institution differentiation and complexity

Higher education institutions worldwide are under an increased "complexity pressure" due to growing international competition and budget cuts but also the IT revolution that is re-shaping teaching, learning and all other aspects of HEI life, exploring new ways of working, changing HEI core activity, and student and staff mobility (Fabio Nascimbeni, 2014).

Higher education institutions have been called upon to fulfill their mission of improving educational services in complex and fast-changing environments. Components affecting the way education deploys its functions are democracy issues, security risks, aging societies, and modern cultures (Bourmpoulias & Tarabanis, n.d.).

The education system has changed. Previously, such systems attempted to focus on process-driven and mass teaching systems, but there is currently a focus on flexible learning paths, imparting life skills, and student-centric learning approaches; for example, education 4.0. Furthermore, HEIs have highly complex core processes. These processes show a large variety of definitions that are not connected to one another (Tjong et al., 2018).

An HEI is a know²ledge producer and is confronted by disparate investments in technology supporting the teaching-learning process, which leads to different systems and inconsistencies within the same

HEI. The environment for HEIs is characterized by disparate demands from regulatory bodies, industry partners, students, and staff development in the face of constrained resources (Op 't Land, Proper, Waage, Cloo, & Steghuis, 2009). This creates large heterogeneous application landscapes and different systems, posing a number of problems (inconsistency of data, lack of interoperability), implying overlapping and redundant systems which become a threat to the organization (Tjong, R., Adi, & Prabowo, 2018). Higher education institutions also thrives on diversity in decision-making due to the involvement of stakeholders, external business clients, disparate business units, and the need for continuous innovation (Oderinde, 2010), which makes strategic alignment (business, IT) more complex and difficult. Universities must meet this changing and increasing learning demands effectively. The change needed at the institutional and individual levels to take full advantage of the possibilities is related to issues such as leadership, vision, new sets of skills and processes (Fabio Nascimbeni, 2014).

These institutions find the challenges (IT-business complexity) and opportunities these learning technologies bring overwhelming, which results in some level of misalignment with original business goals and strategies (Oderinde, 2010). Universities and colleges have often chosen very different solutions to their IT needs, leading to rigid and different IT systems, which imposes many EA and IT issues and challenges (Olsen & Trelsgård, 2016b).

2.3.2. Higher education institutions and enterprise architecture

Enterprise architecture is a description of an organization from an integrated business and IT perspective (Olsen & Trelsgård, 2016b). What EA also can deliver (Covington and Jahangir, 2009) within HEIs includes the following: The current model of key infrastructure, system, or processes; the future reference model based on proposed business strategy, gap analysis within the system that identifies shortfalls of the current model in terms of its ability to support future objectives, and an architectural roadmap that defines the steps required to migrate to another level of enterprise maturity. The most important benefits yielded are business agility, better decision-making (Olsen & Trelsgård, 2016a) and improvement of processes, and quality of educational services (Bourmpoulias & Tarabanis, n.d.).

Improving teaching-learning processes, lack of interoperability between systems, data inconsistencies, management of IT assets and resources, improvement of quality of services, and planning of information technology infrastructure are important drivers of (or reasons to use) EAFs in an educational environment (Tjong et al., 2018).

By adopting and applying EAFs, organizations may gain several benefits such as better decision-making, increased revenues and cost reductions, and alignment of business and IT (Syynimaa, 2015). However, data inconsistency and redundancy, lack of interoperability, IT-business complexity, and non-integrated information systems (IS) seem to be major challenges to developing EA in educational organizations (Bourmpoulias & Tarabanis, n.d.).

2.3.3. Enterprise architecture framework usage in higher education institutions

An EAF can help to measure the effectiveness of an EA in the education domain but selecting the right EAF to suit the needs and wishes of HEI and its structure is a difficult and complex task. An organization needs to involve relevant stakeholders to select the proper EAF (Tjong et al., 2018).

One of the pioneering EAFs is the Zachman framework (Alamri et al., 2018). Zachman describes his framework using a dimensional approach. The six dimensions are data (what?), function (how?), network (where?), people (who?), time (when?), and motivation (why?; Tjong et al., 2018). The open group architecture framework (TOGAF) is an open framework and is process-oriented, has complete guidance, and is easy to follow. The open group architecture framework consists of four domains to support designing EA: business architecture, data architecture, application architecture, and technology architecture (Tjong et al., 2018).

Many methodologies and standards reflect the traditional perspective of EA as a collection of artifacts, such as TOGAF, the Zachman framework (Zachman, 1987), and the federal architecture (FEA) (Ahlemann, Stettiner, Messerschmidt, et al., 2012).

Due to the undeniable benefits of the EA, several authors and government agencies have developed EAFs such as TAFIM[1], FEAF[2], TOGAF, DoDAF [3]3, MODAF4[4], and PEAF5[5] (Carrillo, Cabrera, Román, Abad, & Jaramillo, 2010). Therefore, there are a significant number of published papers regarding EAF but few of these have focused on the educational sector (Tjong et al., 2018). Often, such studies were fostered by lightweight or hybrid EA development methods for HEI (Bourmpoulias & Tarabanis, n.d.). Such a hybrid (blended) approach states that when selecting the most desirable EAF for HEI, it is convenient to attempt to join the most interesting elements of each approach in a hybrid specialized framework for HEI (Carrillo et al., 2010).

Several challenges can significantly impede the process toward successful EA(F) adoption in HEIs, including the lack of an overarching governing body (no entity with formal mandate) and the lack of an agreement on the vision and the extent of the EA (multiple separate initiatives without a holistic EA perspective). Enterprise architecture initiatives are often triggered from an IT viewpoint (instead of business; specifically, a lack of real and relevant business requirements). Often, initiatives from top management are completely absent (Olsen & Trelsgård, 2016a).

It is a considerable challenge to implement EAF in an educational environment, and there is limited research on successful EAF adoption (Olsen & Trelsgård, 2016a). There is a clear need for more research on EA practices in HE contexts as specific benefits (improving teaching processes) can be gained. Reference architecture specifically made for HEIs exists, but it is usually highly context-dependent and thus is not well suited to being applied in different institutions in general (Sanchez-Puchol et al., 2018b). There is a need for more research to be conducted to guide the process of HEIs using EA and add to the body of knowledge (Olsen & Trelsgård, 2016b).

2.4. Objective of the follow-up research

In summary, as there are no specific EAFs being used to partially fill the gap described in the theoretical framework, we focus on providing empirical evidence regarding possible key requirements for successful adoption of generic EAFs in real HEI contexts. The guideline can act as a valuable tool, useful for several practical purposes; for instance, providing guidance to HEI stakeholders on making better-informed decisions regarding a generic EAF being conveniently adopted or applied in different EA practices conducted at their respective HEIs.

3. Methodology

In this section, the rationale of the research approach of this study is given. The type of research approach and different data collection methods employed for the different data sources are described, followed by an outline of the data analysis process. Finally, concerns regarding validity, reliability, and ethics are covered.

[1] Technical Architecture Framework for Information Management
[2] Federal Enterprise Architecture Framework
[3] Department of Defense Architecture Framework
[4] Ministry of Defense Architecture Framework
[5] Pragmatic EA Framework

3.1. Conceptual design: research method selection

To be able to answer the research question placed in this research, a comparative analysis was performed by reviewing the available research methods, each with their advantages, disadvantages, and compatibility with this type of research. The most used research approaches are experiments, surveys, archival and document research, case study, ethnography, action research, grounded theory, and narrative theory (Saunders, Lewis, & Thornhill, 2015). As this present research does not involve testing a defined hypothesis, the experimental approach is ruled out. The same is true for surveys; specifically, quantitative research was impossible due to the time-limit, the possible non-response, and the invasive nature of the research. This limited the research to qualitative approaches, of which a few were viable.

The objective of this research is to investigate a contemporary phenomenon within its real-life context (with the aim of providing additional empirical evidence on the adoptability of generic EAFs in HEIs). The focus is on depth instead of breadth. This is achieved through a detailed case observation and by conducting interviews in combination with studying relevant (contribute direct or indirectly to research questions) documents. Thereby, the researcher gains profound insight into the research topic, objective, and problems. Such a research project is called a case study (Verschuren & Doorewaard, 2010, p. 158).

Of the other qualitative research approaches, *ethnographic* research was ruled out due to time constraints. The *narrative* approach was not a good fit because of the mismatch between the focus of narrative research and the subject of this research question. Given the limited time frame, the outburst of the coronavirus pandemic, and the complex and multifaced nature of HEIs, a single holistic case study research approach was adopted. Such an approach is holistic because it covers the university or organization as a single entity; hence, the unit of analysis will be a university of applied sciences (UAS). More details regarding the case organization can be found in the Appendix and Chapter 4.1.

3.2. Technical design: elaboration of the method

The goal of a case study is to give an in-depth description of a phenomenon, preferably based on multiple data sources. When compiling the building blocks for the narrative of the case study, the inclusion of information is based on the notion of triangulation. This entails that only when information is convergent in multiple sources is it considered valid information that adds to the case description (Creswell, 2007; Yin, 2012). Although the information is regarded as more trustworthy when it is supported by more than one type of data, it is also deemed triangulated when multiple sources of one data type (e.g., two or three interviews) constitute sufficient similarity (Creswell, 2007).

The research was executed at a UAS located in Belgium, Ghent. More details can be found in the appendix and Chapter 4.1. This research was performed using different methods of data collection. Related documents and archival records were collected, and semi-structured interviews with employees of the UAS were conducted.

The motivation of selecting semi-structured interviews as a preferred type of data collection method is further elaborated upon in this section. Data was collected using semi-structured interviews. As it is difficult to predict the outcome of those interviews, the usage of semi-structured is preferred as the themes can already be set up and selected beforehand, still providing sufficient flexibility and diversity if necessary. Group sessions and workshops were omitted from data collection procedures, both being difficult to manage and highly time-consuming (Saunders et al., 2015, p. 419).

A general set of open-ended questions was developed. These interviews were recorded, transcribed non-verbatim, and presented back to the case organization for approval. The interviews were time-boxed over approximately 1–2 hours and divided into two parts, each with a 5-minute break. Every interview was introduced by the researcher, who explained the general topics of EA, EAF, and adoption and the

theme and topic of this research. Each interview was transcribed non-verbatim and presented back to and approved by the respondent(s).

All relevant documents were extracted from the data management system from the UAS. They can be divided into analysis files, project files, and assessment reports. All were assembled by the UAS and or supplier(s) working for the UAS. A detailed list of used documents—including coding—can be found in the appendix.

3.3. Data analysis

The analysis of relevant data (interviews and documents) was conducted by using thematic analysis. Thematic analysis is a technique used to analyze qualitative data that involves the search for themes, or patterns, occurring across a data set (Saunders et al., 2015). This approach is mostly used in qualitative analysis because it is a simple, data-driven, accessible, less time-consuming (than other coding approaches), and flexible approach. As this approach can be used with many kinds of qualitative data and with many goals in mind, it offers an accessible and data-flexible approach to analyzing qualitative data (Braun & Clarke, 2006).

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3.4. Reflection with regards to validity, reliability, and ethical aspects

3.4.1. Internal validity

Interval validity applies to the correctness of conclusions drawn in scientific research: it reflects the quality of the research design (Saunders et al., 2015). This investigation attempted to ensure internal validity by limiting different types of possible bias:

- Before startup, a test interview was held to check if the setup of the semi-structured interview was comprehensible and the right questions were being asked (i.e., changing accordingly what was less comprehensible).
- Interviews were recorded, transcribed, and subsequently validated by the respondent (feedback, participant validation).
- All respondents had relevant experience in information systems.
- All interviews were held privately (reducing participant bias); never after lunch or in the evening (avoiding participant and research error).

After conducting interviews, documents were analyzed, which means triangulation was possible. Triangulation means that multiple independent data sources are used, which has a positive impact on the substantiation of internal validity.

3.4.2. External validity

External validity checks if the research can be applied generally; that is, outside the specific case. However, as we are going to conduct empirical research at only one UAS, there can be an issue of external validity or analytic generalization of empirical observation; specifically, findings will not be widely accepted.

The outcome of this research will add to the current st ate of knowledge, but caution is required due to the limited number of cases (only one). Careful reasoning will have to be undertaken regarding the similarities and differences at distinct universities of applied sciences and what this means when concluding.

3.4.3. Reliability

The reliability of research is determined by the degree of reproducibility and consistency, where the re-conduct of the same research should lead to the same results (Saunders et al., 2016, p. 202). To make this research as reliable as possible, many measures were taken: the construction of the theoretical framework (sources and queries) and the research method (data collection and analysis) were well documented and a case study database was used for organizing and warehousing case study data and analysis including notes, documents, and so on in a single location.

One of the main data-collection artifacts was interviews. Subjectivity cannot be excluded, and this will have a negative impact on reliability. To improve reliability, the following measures were taken:

- Usage of semi-structured interviews, as the predefined structure will cause fewer errors to occur during the interview itself.
- Interviews were recorded, transcribed (non-verbatim), and subsequently validated by the participants.
- All participants received the same questions and the same explanation about the general idea of the research and project regarding the most important terms and definitions.
- Interviews occurred separately in a safe environment (avoiding peer pressure from colleagues and management and preventing socially desirable answers).
- Data collected was processed respecting privacy.

3.4.4. Ethical aspects

All scientific research was conducted objectively and independently (the researcher has no conflict of interest regarding a certain outcome), legally, with integrity, and with respect for the privacy of all interviewees and intellectual property.

All data was kept confidential and any harm to participants was avoided. A safe environment will be created so the participant can speak freely, all participants need to be fully informed beforehand regarding the goal of the research, to have written permission, debriefing (after an interview), and confidentiality (Saunders et al., 2015, p. 243).

4. Results

This section briefly describes the implementation of the research and discusses the outcomes obtained through the research.

4.1. Description of case organization

The information of the case organization is derived from the corporate documents provided by the case organization and stated in the appendix.

4.2. Implementation of the research

4.2.1. Documents

The research of archives and documents for document analysis and desk research, available at the UAS, comprise the following categories: organizational and government sources (reports, and strategy documents, all EA-related).

In this research, a total of 35 documents were collected, which could be narrowed down to a total of 25 relevant documents (specifically concerning EA, technical architecture, strategy, and vision, and so on), and were used for this research as empirical evidence for the 3rd sub research question.

We started by analyzing this documentation provided by the UAS to identify and assess the EA maturity of the organization, current issues, wishes and needs and obtain key requirements regarding successful EAF adoption in an educational environment.

A table with name, date, and a short description of these documents can be found in appendix 8.4. Data relevant to this research subject was coded. The documents that have been provided are coded like the semi-structured interviews and are integrated into the same coding table, also to be found in the appendix.

4.2.2. Semi-structured interviews

Due to the coronavirus outbreak, all semi-structured interviews were held separately and online. Microsoft Teams was used for communicating and recording. Each session lasted between 1 and 2 hours.

Given the difficulties linked with the coronavirus outbreak regarding availability, a limited number of relevant interviewees (five) were identified. A list of interviewees accompanied by their role, can be found in appendix 8.2. They were selected based on objective criteria, for example, knowledge of EA and relevant knowledge of information systems and business processes in the case organization. To substantiate this further, the list of interviewees is provisioned with an extra column stating the link with EA for each person.

Each respondent was presented the same list of interview questions, which were introduced and depicted by the researcher. Each interview was transcribed non-verbatim and presented back to and approved by the interviewees. The analysis was performed according to the thematic analysis methodology, using an inductive approach (Saunders et al., 2015). The text transcripts were reduced (only data relevant for this research was retained: focusing on providing empirical evidence to 3rd sub research question); data familiarized with (to obtain an overall impression); initial codes generated (of relevant text blocks); and theme generated, reviewed, and finalized.

4.3. Results

This section represents the results of the researched semi-structured interviews and documents and will provide additional empirical evidence on the stated main research question and the sub-question “What are key requirements for a successful EAF adoption in HEI?”

While conducting the interviews, the interview questions were grouped, the first part(s) of the interview focalize on the maturity of the current EA at the UAS, to elicit (possible) issues, what is going well, what is going not so well, what can be better, what is missing. Finally, we can distillate key elements, key requirements that are minimum and necessary for successful adoption of a generic EAF in HEI.

The maturity assessment conducted at first by the researcher was not the goal of this research but a means to distill key requirements, aiming to provide a description and provide additional empirical evidence on the practical adoption of a generic EAF in a real HEI context.

This section is structured according to the categories deducted from the thematic data analysis (see appendix 8.5): all relevant and main outcomes regarding the most prominent success requirements were grouped into these categories.

The key categories are:

1. Centralized EA vision.
2. Decision authority and sufficient EA resources (mandate included).
3. Tailor (blending) existing generic EAFs (cherry-picking the most suitable components).
4. Avoid over-standardization.
5. Agile implementation approach.

6. Management buy-in.
7. Unambiguous KPIs and tangible deliverables.
8. Stakeholder participation (business-driven).
9. Leveraging via outsourcing.
10. Open organizational culture.

Each category represents a possible key requirement for successful generic EAF adoption. In below subsections, each requirement is further elaborated upon, making general observations based on the data produced by semi-structured interviews and document research. Mentioning points of agreement, patterns, and trends, and individual responses that were particularly significant to the research question, clarifying and supporting with direct quotations.

4.3.1. Centralized (unified) enterprise architecture vision.

Many respondents can confirm that there is a strong need for investment in a long-term EA vision. The UAS currently works in an excessively project-based manner without a central vision, and once the project is finished, there is no subsequent domain management. Often, these projects are executed using a bottom-up approach, with the associated risk that the initiatives depend on the continued presence of their advocates.

This brings us to the first key requirement for the successful adoption of a generic EAF: the construction of a centralized EA vision. As stated by the head of the IT department and enterprise resource planning (ERP) program manager, there is not a clear view of the decision-making criteria of management regarding IT and business strategy. Enterprise architecture initiatives are not coordinated, no general picture is present, and a holistic view is missing.

In the existing project documentation, relevant data exists regarding the startup of an EA program called "INDIGO," which states that one of the issues the UAS is confronted with is many different and disparate IT architecture projects and a lack of central coordination. One document regarding the strategic goals also stated the clear need for alignment between business goals and IT goals, and this was to occur through a centralized and unified vision.

4.3.2. Central decision authority and sufficient enterprise architecture resources (mandate included).

Another key requirement that can be distilled from the data produced by interviews and document research is the availability of decision authority and relevant, sufficient EA resources and appropriate roles, as these are essential for the successful adoption of a selected EAF in the UAS.

The INDIGO project document states that the UAS is confronted with a lack of resources, a formal mandate is missing and the need for a formal decision structure. All respondents also claim that there is a strong need for a comprehensive list of IT governance rules and data governance rules.

As stated by the ERP manager, and team leader of application management and service manager, EAF and EA can only work if there are fixed resources permanently assigned with a specific role and sufficient mandate. This implies an overarching artifact that is monitoring current architecture, identifying gaps, alignment checks, and coordination of project initiatives (high-level). As remarked by the head of IT, the lack of available resources compared with the private industry is a reason for the current low EA maturity level and the feasibility of working with formal frameworks.

The allocation of an enterprise architect who monitors centrally all high-level projects and who can assess the impact on the different EA layers would be a critical driver for EA adoption and EAF introduction within the UAS, according to the team leader of application management. An architect appointed as a separate full time equivalent (FTE) on our scale is potentially unrealistic but if

provisioned as a shared role (program management), is likely to be more feasible. In contrast, if seen as a distinct role with sufficient mandate (granted by management), this could provide benefits by identifying gaps and issues in our current processes and be an instigator of process optimization, according to the head of IT department. An enterprise architect should not be a goal but a means to an end (improving efficiency, agility, etc.).

4.3.3. Tailoring (blending) existing generic enterprise architecture frameworks (cherry-picking).

Another key element of successful EAF adoption in HEI that can be produced from documents, archival research, and semi-structured interviews is blending EAFs to suit HEI needs (cherry-picking). The strict following or blindly adopting an existing HEI standard model will not necessarily support the organization's business, people, culture, processes, and technology needs.

All respondents agree that complicated EAFs (including expensive tooling and extensive terminology) negatively impact successful EAF adoption. In the past, the UAS worked with the Gartner framework (as a knowledge repository) but was unsuccessful for being overly abstract and conceptual (no clear return on investment or tangible deliverables) and there was an excessive focus on terminology.

All respondents confirmed that EAFs are not a goal but are merely a means of achieving the above strategical goals. An EAF can be interesting as a monitoring tool for guarding the IT strategy and business vision. The best approach in the UAS, according to the head of the IT department, would be to comprise the combination of a hybrid and lightweight framework, instead of a formal framework:

"The UAS will never walk the extremities of a formal EAF, as to impactful on available resources and too complex to maintain, it is interesting to look to different frameworks and get the best out of it (cherry-picking)."

As stated by the team lead application management and ERP program manager, EAF adoption should be approached pragmatically (reduced effort, reduced maintenance) using a short lead time; cherry-picking the best practices, models, methods, and guidelines from various available frameworks; and tailoring elements of selected EAFs to suit the needs of the UAS.

To summarize the general adoptability and blending elements suitable for HEI, the head of IT department states that an adoptable EAF in HEI should at least contain guidance, rules, and best practices regarding organizational, process, data, and technical topics. A less formal approach to repositories is advised, cherry-picking the most suitable artifacts.

4.3.4. Avoid over-standardization.

The team lead service management and application management declare that the UAS wants to shift to more software as a service (SAAS)-framework-based, off-the-shelf available appliance based on industry best practices. This could imply appliances less tailored to all the specific needs of the organization but economically more affordable and efficient software frameworks. Industry-based standard tools, products, and methods are more easily introduced in the general organization and framework-based applications, OOTB[6]; receive a quicker user acceptance; and have higher sustainability in this organization as declares the service manager and the IT business analyst.

This leads us to another key requirement in successful EAF adoption; specifically, the avoidance of over-standardization. As revealed in documents researched at the case organization and data from several respondents in the interviews, careful attention needs to be paid when using standard (industry-

[6] Out of the Box

based) tools, frameworks, and policies. Overfocussing and overwhelming users with too many standards could potentiate risks.

4.3.5. Agile implementation approach

One requirement that is crucial for successful EAF adoption is the project management approach; that is, how the EAF development can be facilitated and fostered in an HEI.

As mentioned in different documents in the case organization, an agile method is advised when operationalizing architecture. Working cyclically, in an iterative manner, prioritizing steps methodically should result in optimal efficiency.

The team lead application management and lead service management declared that strong stakeholder involvement is imperative: an agile, lean, and iterative (cyclical) approach (lean and with iterations), while linking the EA(F) to the current maturity model of the UAS prioritizing key elements of improvement could be valued as an efficient and applicable bottom-up approach. This agile approach has also been substantiated by various project and process documents.

The current project lifecycle in the UAS follows a light version of the TOGAF ADM cycle, declared the team leader of application management and according to the head of IT, this development method looks very promising. Both the service manager and team leader of application management confirmed that an agile (phased) approach via program management where best practices, methods, and guidelines regarding security, project lifecycle, performance, testing, coding, and so on are being centrally managed but provisioned via separate initiatives or projects could be an effective way of successfully adopting EAF.

4.3.6. Trigger management buy-in.

It is essential to have management buy-in (executive sponsorship) to successfully adopt an EAF in an education environment instead of isolating artifacts with disparate requirements and needs. In the existing documentation, relevant data exists regarding the challenges that the UAS is confronted with; for example, management buy-in is not present, and no formal decision structure (corporate sponsorship) regarding the EA program "INDIGO" is present. Regarding management buy-in, the head of IT department declares the following:

"The buy-in of central management is missing for the moment in the UAS regarding EA(F) usage, as there is no formal believe in the introduction of a full-blown enterprise architecture with formal frameworks."

The following quote can be found in IT strategical documentation:

"Use executive sponsors to blast political roadblocks that undermine EA projects. "

As stated by the team lead application management and service management, our current director of digital transformation (IT manager) acts as an instigator of the mapping of current processes and applications and as a catalyst regarding application automation and improvement; that is, gently facilitating EA(F).

According to the head of the IT department and team lead application management, separate initiatives such as the introduction of a modern ERP system, a new ITSM [7]system, or for example an event-driven application framework can be triggers for further process optimization and increase of maturity;

[7] IT Service Management

specifically, this could trigger management buy-in and eventually enable the installment of further parts of EAF.

As stated by most of the respondents, the reason for missing management buy-in in the EA field often relates to non-tangible deliverables and unclear return on investment (short-term benefits are missing, lack of resources). Therefore, to trigger a management buy-in, tangible deliverables (long and especially short-term) and measurable benefits need to be constructed.

4.3.7. Unambiguous key performance indicators and tangible deliverables.

As discussed in a previous chapter, another key requirement of successful EAF adoption in HEI is obtaining management buy-in, which can be fostered by defining unambiguous KPIs, tangible deliverables, and measurable benefits regarding EAF usage. This can be traced back in a document titled "KPI's voor dienst ICT." The head of the IT department also declares that the setup of a selected EAF needs to be a time-restricted trajectory with clear and tangible deliverables.

Also noted by the ERP program manager and the IT-business analyst is that deliverables must be clearly defined, have a clear **outcome** and **output**, and be both practical and applicable. The KPIs must be attractive for management, clear, and easily measurable. Enterprise architecture framework quick wins (tangible benefits with limited efforts (Ahlemann, Stettiner, Messerschmid, et al., 2012)) should be identified by participatory development and stakeholder analysis, as stated and confirmed by all respondents and current case documentation.

When assessing the current maturity of the UAS in cooperation with the different respondents during the interviews, it also became clear that the product and service portfolio, customer, and market segments, and related KPIs are not centrally published or available.

An important side note remarked by the IT service manager was that, for example, the KPIs "improvement of agility" and "improvement student quality" would be difficult to substantiate with the introduction and usage of EAF in UAS.

As found in archival records, the UAS worked with the Gartner framework (as a knowledge repository) but was unsuccessful for being overly abstract lacking clear performance measures of tangible deliverables.

4.3.8. Stakeholder participation (business-driven).

Another key requirement of successful EAF introduction is the participation of primary stakeholders, focalizing on a business-driven, (bottom-up) approach. The documents provided various and relevant information regarding the maturity of the current EA at the UAS. Mainly because of IT as an enabler, different initiatives were begun regarding process documentation, documentation of current application, and integration architecture, but all were in a premature state, were not interconnected with the strategical business goals, and lacked formal cooperate sponsorship.

However, the head of the IT department also declared the following:

"The collateral advantage of IT automation projects could act as a catalyst for EA(F) development."

According to the ERP program manager, the challenge of missing stakeholder participation was critically visible a few years ago, at the introduction of a new ERP [8]system (which is also a framework of various processes). The benefits of this project were that it acted as an instigator for process development, optimization, and documentation. However, this caused a considerable burden in terms

[8] Enterprise Resource Planning

of time and materials. Therefore, after completion, the continuity of process development and optimization soon started to decrease, mainly due to the lack of stakeholder buy-in and cooperation, not being business-driven, and a missing monitoring and change management framework. This project was an "IT project," hence domain responsibility of IT and not of the relevant business owner (missing role).

Also stated by the team leader of application management and the service manager was that the current "EA" initiatives should be triggered from a business viewpoint; project initiatives are now being sparked by early technology adopters in the IT department and tend to lose focus within a certain amount of time or remain isolated. The business should be the driver for process transparency, optimization, gap detection, and so on.

Some of the relevant critical success factors (CSFs) of the UAS regarding creating a future-proof organization are "investment in IT and infrastructure," and "change management (bottom-up)". In the new strategical documents (e.g., "strategisch_instellingsplan.docx") we can deduce that bottom-up approaches and business-driven change management are being focused on. As noted down in "business_analytics_roadmap.pptx," strategical EA goals must be operationalized in a bottom-up manner (bottom-up promotion). According to the ERP program manager, an efficient approach would indeed be a phased approach, with stakeholder involvement (business-driven), process owner in control, and with IT in a supporting role.

To summarize, all respondents declared that stakeholder buy-in is essential, and a collaborative approach with a bottom-up perspective of EAF adoption is advised.

4.3.9. Leveraging via outsourcing.

As already explained and noted by various documents and respondents, sufficient resources are crucial, but this is often a problem in an HEI environment. Leveraging via outsourcing could be beneficial for successful EAF adoption in education. According to different respondents, leveraging via outsourcing represents a valid and sustainable approach as company budgeting is more flexible toward this approach. For example, the vision and strategy of EA should be created in-house, and the installment or setup of EA(F) can be facilitated by external providers. The internal resources should be used for EAM [9] and provide EA(F) data input.

Also remarked by the team lead application management and software development was that the IT vision should be promoted by internal resources (EAF repositories could be interesting as a source of[10] inspiration), but the implementation of this vision can be executed by external partners who also use existing EAFs, as the organization does not have the time or materials to execute this alone.

4.3.10. Open organizational culture (flexible mindset).

Finally, the mindset and company (organizational) culture are also a vital component in successful EAF adoption in HEI. As stated in strategical case documentation, "Culture eats strategy for breakfast." Installment of an innovative culture is a requirement for success in digital transformation planning for the UAS. The UAS is therefore striving to become an open and flexible culture that is less rigid.

All respondents also confirmed that company culture is an essential criterion in successful EAF adoption. The head of the department and the ERP program manager also stated that the introduction of an EAF is only possible in an open and appreciative culture.

[9] Enterprise Architecture Management
[10]

Regarding the possible cultural challenges in an educational environment, the ERP program manager remarked:

"Educational people are very open-minded and flexible but difficult to assign to one specific 'way of working', i.e., a gentle bottom-up approach is advised, diplomatic, reaching for consensus."

Furthermore, the "quick-return mindset" must be omitted from company culture, and for this, a formal EA mindset is needed at the C level.

5. Discussion, reflection, conclusions, and recommendations

5.1. Discussion: reflection and limitations

5.1.1. Discussion – reflection

The data suggest that there are possible key requirements which can aid in successful adoption of generic EAFs in HEIs. The key is to start defining a minimum viable product, handling an agile and lean approach from a business viewpoint and foresee management buy-in (tangible deliverables). Try to curb the lead time, cherry-picking the most suitable components, and focus on lightweight (hybrid/blended) generic frameworks. The provisioning of EA should be outsourced, keeping EAM internally, assigned to specific roles with a proper mandate in the HEI.

As stated by all respondents, generic enterprise architecture frameworks are adoptable for successful usage for the UAS, but a "blended" and "lightweight" approach might provide the most viable solution. HEIs will never employ full-blown formal repositories, as these are too time- and budget-consuming. This is also confirmed by the literature research conducted, for example stated by (Carrillo et al., 2010): the hybrid (blended) approach means joining the most interesting elements of each approach in a hybrid or specialized framework for HEI.

In the present climate, the UAS does not use a formal framework, but all the newly purchased software solutions are provided by external suppliers who work with industry standards (non-formal repositories). This will not be the real challenge of using frameworks in the UAS. The daunting challenge is realizing such changes in HEIs such that they are adopted by all personnel within the HEI. The constructed requirements in this research could be of great aid in realizing such changes.

Regarding the usage of existing frameworks based on industry standards to be applied for various causes, the researcher recommends focusing on defining sufficient standards to help guide the organization toward a business-driven future-state vision rather than putting efforts and business at risk by overfocusing and overwhelming their users with too many standards. Organizations are advised to be certain that a specific set of standards is needed to support the business (key requirement "avoid over-standardization") before proceeding.

The perceived benefits stated in the theoretical framework regarding EA(F)—specifically, an increase in business agility, business performance, and economic scalability—will not be easily quantified by the proper metrics (and justified by management). Effectively triggering management will be a daunting challenge (as these types of EA projects are remarkably resource-consuming and have no clear view on short-term tangible benefits).

As HEI maturity rises due to different EA initiatives, and these various detached initiatives are favored by management, the credibility and evangelization of EA and generic frameworks could develop within management. The quick return – an attitude that aims for too much change in too little time - must be

omitted from management culture, as a formal EA mindset and long-term vision are imperative to achieving an increase in business agility.

The respondents have each also a different idea regarding the value of EAFs and their relative implementation in HEI. Depending on their function and role in the company's hierarchy, an alternative vision and viewpoint are handled; that is, a possible conflict of interest. The technical persons will genuinely appreciate all aspects of EA and their corresponding frameworks. As for the head of the department, the financial outlook and the pressure on the current resources make way for a more critical view of the matter. An enterprise architect appointed as a separate FTE will not be feasible (but requested by other respondents); instead, a shared role or provisioning via program management could be a viable solution.

As educational people are very versatile, creative, and flexible people but also difficult to assign to one specific "way of working," a slow bottom-up approach is advised; that is, a diplomatic viewpoint with a focus on consensus. However, a risk with a bottom-up approach without management buy-in is that the initiatives rely on the continued presence of the advocates.

As deduced from the different documents and interviews, the IT department has a conflicting but also supporting role regarding EAF provisioning in HEI. On the one hand, the collateral advantage of IT automation projects could act as a catalyst for EA(F) development; on the other hand, if not supported by the business, these IT projects will soon diminish in their momentum. The challenges that can significantly impede the process toward successful EAF adoption in HEIs, as stated in the literature research, are also identified in the empirical part of this research executed at the UAS.

Similar technological developments (introducing SAAS applications, ITIL/safe-based applications, off-the-shelf appliances) and EAF initiatives can equally be found at other universities or universities of applied sciences. These similar EA(F) initiatives and developments have been confirmed as being initiated, developed, or present. The sole difference at the other public organizations could be the speed or level of maturity regarding the implementation phase, scope, and quality. The different IT and EA initiatives are also discussed monthly on the Vhlora [11]council, and based on the monthly minutes of meetings, we can also conclude that similar EA initiatives are being undertaken at the other universities of applied sciences, but each with their accent, focus, speed, timing, and scope.

Hence, anecdotal references from the researcher also attest to the fact that the key requirements constructed in this research could also be abstracted to apply to other universities of applied sciences. This involves a tentative and conservative assumption based on the researcher's position as team leader of application management and software development, which provides him with a large amount of input through various bilateral contacts across the different universities.

The perceived benefits stated in the theoretical framework—specifically, an increase in business agility, business performance, and economic scalability—are not easily quantified by the proper metrics. The importance of EA is certainly established, but it is not a goal, but merely a means of achieving the strategic goals.

5.1.2. Limitations

Because of the coronavirus outbreak, a smaller number of respondents were interviewed than originally anticipated, which could lead to less substantiated data. All measures taken to improve reliability do not offer any guarantee, as data was collected in conjunction with the participant, and some degree of subjectivity always exists. For example, people behave differently when they know they are being tested: this is called the Hawthorne effect (McCambridge, Witton, & Elbourne, 2014). A moderating

[11] Vlaamse Hogescholen Raad

third factor can never be completely excluded, which is a further disadvantage of using a case study research approach. By using various citations of the respondents, the researcher has attempted to decrease the subjectivity level of the data collected by semi-structured interviews.

The research setup of this thesis concerns a single-case study: arguably the most prominent critique of single-case study analysis is the issue of external validity or generalizability. Specifically, findings cannot be widely accepted. While thematic analysis is flexible, this flexibility can lead to inconsistency and a lack of coherence when developing themes derived from the research data (Holloway & Todres, 2003). Reliability is the main concern due to the vast variety of potential interpretations by different researchers.

Another issue, again incorporating issues of construct validity, is that of the reliability and replicability of various forms of single case study analysis. This is usually tied to a broader critique of qualitative research methods (Berg & Lune, 2004). The question of researcher subjectivity (researcher bias) is a valid one, and it may be intended only as a methodological critique. In our research, the researcher was also involved in the "INDIGO" (EA) program as a project coordinator, which could lead to a subjective view or disposition regarding EAFs, as the respondents were aware of the benefits that EA and generic frameworks could deliver to the UAS, but there was no familiar knowledge of generic EAFs.

Research errors could also have occurred since some interviews occurred during the coronavirus period in challenging and tense times. Participant bias could also occur, as people behave differently when they know they are being interviewed (McCambridge et al., 2014). As some respondents had to care for their children, they already were showing signs of fatigue, which could cause misunderstanding of the interview questions. Most of the meetings were also held online, and it is impossible to exclude the possibility that participant bias was induced by this fact.

Due to restrictions in timing and limited availability of resources, the literature study is not exhaustive. This may lead to an incomplete portrayal of the investigation of the research topic.

5.2. Conclusions

Given the challenges HEIs are currently confronted with (alignment tensions) and the solution generic EAFs provide in overcoming those challenges, the objective was to investigate adoption of generic EAFs within HEIs, focusing on key requirements for successful adoption. Given the limited research on successful adoption, there is a clear need for EAF practices in HE contexts and strong demand for more research to be conducted to guide the process of HEIs using generic EAFs and add to the body of knowledge.

The main practical contribution of this research is the identification of key requirements of successful generic EAF adoption in HEIs. Applying these requirements may increase the likelihood of this successful adoption and providing an answer on the main research question. The study aims not only to help academics but also practitioners (business organizations) by using the requirements as a guideline to successfully adopt a generic EAF in HEIs.

These key requirements are defining a centralized (unified) EA vision; installing a central decision authority and provisioning sufficient EA resources (mandate included); tailoring (blending) existing generic EAFs (cherry-picking the most suitable components); avoiding over-standardization; foreseeing an agile, phased, and lean implementation approach with short lead time; triggering management buy-in, defining unambiguous KPIs and tangible deliverables; promoting stakeholder participation (business-driven); and collaborating from a bottom-up perspective with the business in control and with IT in a supporting role, leveraging via outsourcing the EAF setup (but keeping EAM internal) and creating an open organizational culture.

The daunting challenge is realizing such changes in HEIs such that they are adopted by all personnel within the HEI. The constructed key requirements in this research could be of great aid in realizing such changes. Generic enterprise architecture frameworks are adoptable for successful usage for the UAS, but a "blended" and "lightweight" approach might provide the most viable solution. HEIs will never employ full-blown formal repositories, as these are too time- and budget-consuming. A less formal approach to repositories is advised, cherry-picking (tailoring) the most suitable artifacts.

Based on the experience, anecdotal references, and contacts of the researcher, confirmed by literature research conducted for similar non-profit organizations, tentative (conservative) assumptions are that the present finding resulted from the empirical research could also be abstracted to similar universities or universities of applied sciences.

Given the objectives of this present research, we believe that the findings presented can be perceived as interesting and valuable by both IS HEI professionals and researchers. The next two chapters elaborate on this conviction in detail.

5.3. Recommendations for practice

The resulting requirement set can be of practical utility for HEI practitioners in terms of providing high-level support and guidance for several generic EAF and business-related (practical) activities, as a communication and decision-making support-tool for several HEIs practitioners, stakeholders, or management.

The present study contains valuable info for project managers who are responsible for the implementation of generic EAFs in HEI. An agile phased approach of an EAF implementation like the cyclical TOGAF ADM approach and integrating this into the existing project management structure can be a realistic and practical appliance.

The selection of the tangible EAF deliverables can be made by assessing the current EAF maturity model (as-is vs to-be, identifying the gaps) and prioritizing and creating a realistic and visible roadmap, which must be approved by the board of directors (management buy-in).

In general, it is vital to foresee stakeholder buy-in and management approval in all the stages of EAF implementation. It is also crucial that the necessary monitoring artifacts are installed so that the EA continues to be updated and improved.

The study could act as a guideline for proper and efficient EAF resource management. The installment and provisioning of EAF should be leveraged by external suppliers, and subsequent monitoring and change management should be fostered internally. In this way, the lack of resources can be managed. The installment of a RASCI[12] model could aid in promoting EA roles and resources.

Appointing an enterprise architect who has a sufficient and visible mandate is crucial. If the assignment of a separate EA team, architect(s) is not viable due to resource issues, a program manager (which is common in HEI) could facilitate the role of EA, each project manager (PM) guarding a specific artifact/layer of the EA and their frameworks and reporting to a change advisory board. This change advisory board [13]could consist of IT, business, and board stakeholders so the proper projects are conducted (alignment). Tangible quick wins can be identified by promoting participatory development at the board level.

[12] Responsible, accountable, supported, consulted, and informed.
[13] Change Advisory Board.

The guideline can act as a valuable tool for guiding HE stakeholders on making better-informed decisions regarding EAF being conveniently adapted or applied in different EA practices conducted at their respective HEIs.

Therefore, we believe that this research at hand could be of interest for HEI business and IT managers as well as for IT service consultancy firms or IT vendor providers.

5.4. Recommendations for further research

Non-limitative recommendations include the extrapolation to a multiple case study. Our research was exploratory and performed in one specific university within the educational sector. It has therefore limited generalizability, providing opportunities for subsequent research.

This research can serve as an input to subsequent studies of generic EAF implementation in other educational enterprises (to extrapolate to multiple case studies). Other educational enterprises could also comprise primary and/or secondary education. It would be fascinating to see if our findings are generalizable to such settings. Even if we cannot generalize the findings, the study and the findings should serve to enlighten educational enterprises about requirements related to successful generic EAF adoption.

In addition, we hope this research will stimulate new research in the field of EAFs, decision-making models, or toolkit development for ease of use, EAF best practices, implementation, and selection of generic EAFs suitable for HEI. Additional empirical studies in the form of use cases providing evidence on how the proposed key requirements are effectively used and operationalized in practice could be interesting future contributions.

Finally, in the absence of a time constraint, an inductive, quantitative approach would provide more statistical information. The introduction of a survey method could help to further quantify the business HEI needs and KPIs (or business performance measures) regarding successful EAF adoption.

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7. References

Ahlemann, F., Stettiner, E., Messerschmid, M., & Legner, C. (2012). Strategic Enterprise Architecture Management Challenges, Best Practices, and Future Developments. In *Springer*. https://doi.org/10.1007/978-3-642-31371-4

Ahlemann, F., Stettiner, E., Messerschmidt, M., Legner, C., Basten, D., & Brons, D. (2012). EA frameworks, modelling and tools. In *Strategic Enterprise Architecture Management* (pp. 201–227). https://doi.org/10.1007/978-3-642-24223-6_8

Alamri, S., Abdullah, M., & Albar, A. (2018). Enterprise architecture adoption for higher education institutions. *International Journal of Simulation: Systems, Science and Technology*, *19*(5), 16.1-16.8. https://doi.org/10.5013/IJSSST.a.19.05.16

Bourmpoulias, S., & Tarabanis, K. (n.d.). *A systematic mapping study on Enterprise Architecture for the Education domain: Approaches and Challenges*. https://doi.org/10.1109/CBI49978.2020.10055

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Buckl, S., Matthes, F., Neubert, C., & Schweda, C. M. (2011). A lightweight approach to enterprise architecture modeling and documentation. *Lecture Notes in Business Information Processing*, *72 LNBIP*, 136–149. https://doi.org/10.1007/978-3-642-17722-4_10

Carrillo, J., Cabrera, A., Román, C., Abad, M., & Jaramillo, D. (2010). Roadmap for the implementation of an enterprise architecture framework oriented to institutions of higher education in Ecuador. *ICSTE 2010 - 2010 2nd International Conference on Software Technology and Engineering, Proceedings*, *2*. https://doi.org/10.1109/ICSTE.2010.5608752

Creswell, J. W. (2007). *Qualitative inquiry and research design: choosing among five approaches.* (2nd ed.). Sage.

Fabio Nascimbeni. (2014). (PDF) The increased complexity of Higher Education collaboration in times of Open Education. Retrieved October 25, 2020, from 2014 website: https://www.researchgate.net/publication/273380522_The_increased_complexity_of_Higher_Education_collaboration_in_times_of_Open_Education

Hite, Randolph, C. (2010). *United States Government Accountability Office Executive Guide ORGANIZATIONAL TRANSFORMATION A Framework for Assessing and Improving Enterprise Architecture Management (Version 2.0)*.

Holloway, I., & Todres, L. (2003). The Status of Method: Flexibility, Consistency and Coherence. *Qualitative Research*, *3*(3), 345–357. https://doi.org/10.1177/1468794103033004

Komariah Hildayanti, S., Putra, R. R., Suhandi, N., Sanmorino, A., Antony, F., Heryati, A., … Gustriansyah, R. (2018). Enterprise architecture framework selection for higher education using TOPSIS method. *International Journal of Engineering & Technology*, *7*(4), 5327–5330. https://doi.org/10.14419/ijet.v7i4.16140

Komariahhildayanti, S., Putra, R. R., & Sanmorino, A. (2018). *Enterprise architecture framework selection for higher education using Enterprise architecture framework selection for higher education using TOPSIS method*. (March 2019). https://doi.org/10.14419/ijet.v7i4.16140

Levy, Y., & Ellis, T. J. (2006). A systems approach to conduct an effective literature review in support of information systems research. *Informing Science*, *9*, 181–211. https://doi.org/10.28945/479

Luftman, J., & Kempaiah, R. (2007). An update on business-IT alignment: "A line" has been drawn. *MIS Quarterly Executive*, *6*(3), 165–177. Retrieved from https://www.researchgate.net/publication/220500512_An_Update_on_Business-IT_Alignment_A_Line_Has_Been_Drawn

McCambridge, J., Witton, J., & Elbourne, D. R. (2014). Systematic review of the Hawthorne effect: New concepts are needed to study research participation effects. *Journal of Clinical Epidemiology*, Vol. 67, pp. 267–277. https://doi.org/10.1016/j.jclinepi.2013.08.015

Niemi, E., & Pekkola, S. (2017). Using enterprise architecture artefacts in an organisation. *Enterprise Information Systems*, *11*(3), 313–338. https://doi.org/10.1080/17517575.2015.1048831

Oderinde, D. (2010). Using Enterprise Architecture (EA) as a Business- IT Strategy Alignment for Higher Educational Institutions (HEIs). In *UK academy for Information Systems Conference*. Retrieved from http://aisel.aisnet.org/ukais2010/41

Olsen, D. H., & Trelsgård, K. (2016a). Enterprise Architecture Adoption Challenges: An exploratory Case Study of the Norwegian Higher Education Sector. *Procedia Computer Science*. https://doi.org/10.1016/j.procs.2016.09.228

Olsen, D. H., & Trelsgård, K. (2016b). Enterprise Architecture Adoption Challenges: An exploratory Case Study of the Norwegian Higher Education Sector. *Procedia Computer Science*, *100*, 804–811. https://doi.org/10.1016/j.procs.2016.09.228

Op 't Land, M. M., Proper, E., Waage, M., Cloo, J., & Steghuis, C. (2009). Enterprise Architecture: Creating Value by Informed Governance (The Enterprise Engineering Series). In *ACM Computing Classification*. https://doi.org/10.1007/978-3-540-85232-2

Sanchez-Puchol, F., Pastor-Collado, J. A., & Borrell, B. (n.d.). FIRST IN-DEPTH ANALYSIS OF ENTERPRISE ARCHITECTURES AND MODELS FOR HIGHER EDUCATION INSTITUTIONS. *IADIS International Journal on Computer Science and Information Systems*, *13*(2), 30–46.

Sanchez-Puchol, F., Pastor-Collado, J. A., & Borrell, B. (2017). Towards an Unified Information Systems Reference Model for Higher Education Institutions. *Procedia Computer Science*, *121*, 542–553. https://doi.org/10.1016/j.procs.2017.11.072

Sanchez-Puchol, F., Pastor-Collado, J. A., & Borrell, B. (2018a). A critical review on reference architectures and models for higher education institutions. *MCCSIS 2018 - Multi Conference on Computer Science and Information Systems; Proceedings of the International Conferences on Big Data Analytics, Data Mining and Computational Intelligence 2018, Theory and Practice in Modern Computing 2018 and Connected Sma*, 113–120.

Sanchez-Puchol, F., Pastor-Collado, J. A., & Borrell, B. (2018b). First in-depth analysis of enterprise architectures and models for higher education institutions. *IADIS INTERNATIONAL JOURNAL ON COMPUTER SCIENCE AND INFORMATION SYSTEMS*, *13*(2), 30–46. https://doi.org/10.33965/ijcsis_2018130203

Saunders, M., Lewis, P., & Thornhill, A. (2015). Research Methods for Business Students 7th Edition 2015 (Mark N. K. Saunders , Philip Lewis , Adrian Thornhill). In *עלון הנוטע* (Vol. 66). Retrieved from

https://www.academia.edu/40208148/Research_Methods_for_Business_Students_7th_Edition_2015_Mark_N._K._Saunders_Philip_Lewis_Adrian_Thornhill_

Schekkerman, J. (2003). How to Survive in the Jungle of Enterprise Architecture Framework | Guide books. Retrieved October 23, 2020, from https://dl.acm.org/doi/book/10.5555/995660

Syynimaa, N. (2015). Modelling the resistance of Enterprise Architecture adoption: Linking strategic level of enterprise architecture to organisational changes and change resistance. *ICEIS 2015 - 17th International Conference on Enterprise Information Systems, Proceedings*, *3*, 143–153. https://doi.org/10.5220/0005349901430153

Tamm, T., Seddon, P. B., Shanks, G., & Reynolds, P. (2011). How does enterprise architecture add value to organisations? *Communications of the Association for Information Systems*, *28*(1), 141–168. https://doi.org/10.17705/1cais.02810

Tjong, Y., R., K., Adi, S., & Prabowo, H. (2018). (PDF) A systematic mapping study on enterprise architecture framework for HEI. Retrieved June 12, 2020, from https://www.researchgate.net/publication/330352996_A_systematic_mapping_study_on_enterprise_architecture_framework_for_HEI

Urbaczewski, L., & Mrdalj, S. (2006). *A COMPARISON OF ENTERPRISE ARCHITECTURE FRAMEWORKS*.

Verschuren, P., & Doorewaard, H. (2010). *Designing a research project, second edition* (second, Vol. 3).

Yin, R. K. (2012). A (VERY) BRIEF REFRESHER ON THE CASE STUDY METHOD The. *Applications of Case Study Research*, 3–20.

8. Appendices

8.1. Search query results

Search queries were executed using the following keywords: “ENTERPRISE ARCHITECTURE “, “FRAMEWORKS”, “EA APPLICATION”, “EA ADOPTION”, “KEY REQUIREMENTS”, “EA”, “SUCCESS CRITERIA”, “CHALLENGES”, “PROBLEM”,” HIGHER EDUCATION”, “HEI”, “BLENDED FRAMEWORK”, “EA REFERENCE MODEL” and a combination of these words.

In the below table you can find an overview of the used search queries. The number of results has been reduced as much as possible by placing quotation marks and by searching the most recent literature (2015), i.e., to increase the chance of relevant data.

All the articles had a publication date limiting no further than 5 years ago, all of them were peer-reviewed, there was not a limitation set on content type and the basic language was English.

Table 1- search query results

Query	Source	Result	Relevant	Used
“Enterprise Architecture”	Open University (peer-reviewed)	2647	20	2
“Enterprise Architecture” “frameworks”	Open University	409	10	3
“Enterprise Architecture benefits”	Google Scholar	119	15	2
“Enterprise Architecture” “Higher Education Institutions”	Google Scholar	476	7	2
“Enterprise Architecture” “frameworks” “higher education institution” “adoption”	Google Scholar	55	8	2
"Enterprise Architecture” "Frameworks" “Higher Education Institutions” "challenges"	Google Scholar	191	15	4
“hybrid frameworks” “Enterprise Architecture”	Google Scholar	75	3	1
“Enterprise Architecture frameworks” “comparison” "higher education institution"	Google Scholar	9	4	1

8.2. Interview questions

Interview questions are in Dutch as the interviews were conducted in Dutch. An English version can be submitted on request.

The first parts of the interview focus on the maturity of the current EA at the UAS, as to elicit possible issues, what is going well, what is going not so well, what can be better, what is missing. Hence, we can distillate key elements, key requirements that are minimum and necessary for successful EAF adoption in HEI.

8.2.1. Inleiding

Vraag: Kan je even kort jouw rol toelichten?

Vraag: kan je even een kort overzicht bezorgen van de structuur van de UAS?

8.2.2. Aligneering

Vraag: Hoe helpt jouw team (IT) voor het bereiken van de doelstellingen gesteld door de business (UAS)?

Vraag: Zijn deze doelstellingen gekend en in kaart gebracht?

8.2.3. Definities

Vraag: Wat is volgens jou EA?

Vraag: Wat is volgens jou een EA-raamwerk?

Vraag: wat is volgens jou een hybride raamwerk?

Vraag: Wat is volgens jou een lichtgewicht raamwerk?

8.2.4. Ervaring EAF

Vraag: Met welke raamwerken heb je al gewerkt?

Vraag: Welke raamwerken ben je gekend mee?

Vraag: Is er een voorkeur voor een raamwerk?

Vraag: Welke EAF hanteert de UAS?

Vraag: Wat is het niveau van gebruik van EA/EAF?

Vraag: Ben je al betrokken geweest bij EA-integratie projecten?

Vraag: Als er geen frameworks gebruikt worden, wat dan wel?

Vraag: Hoe zou het ideale raamwerk eruitzien?

8.2.5. Complexiteit in het onderwijs

Vraag: Is een specifieke complexiteit inherent verbonden aan het Hoger onderwijs? (Vlaamse Hoger Onderwijs?

Vraag: Is er een verschil in complexiteit/architectuur tussen Vlaamse Universiteiten en Vlaamse hogescholen?

8.2.6. Maturiteit van huidige EA binnen HEI

Vraag: Wat is de maturiteit van de huidige proces laag?

Vraag: Wat is de maturiteit van de huidige business laag?

Vraag: Wat is de maturiteit van de huidige organisatie laag?

Vraag: Wat is e maturiteit van de huidige IS laag? (applicaties, data, integratie?)

Vraag: Wat zou de introductie van een EAF op de huidige lagen zijn?

Vraag: Is er een (nood aan) uniforme tools en applicaties, best practices?

Vraag: Is er (nood aan) centrale coördinatie, flexibiliteit (kostenbesparend)?

Vraag: Is er een duidelijke samenhang tussen producten, processen, organisatie, informatievoorziening en de technische infrastructuur van de organisatie?

Vraag: Is er een gedocumenteerde architecturale visie?

Vraag: Is er een verzameling van architecturale richtlijnen en principes?

Vraag: Zijn de belangrijkste processen gedocumenteerd (modellen + tekstuele verduidelijking, om zo ook de kwaliteit te borgen)?

Vraag: Beschikt de organisatie en dienst over kaders en richtlijnen voor het ontwerpen en realiseren van producten, processen, organisatie, informatievoorziening en infrastructuur?

Vraag: Beschikt de UAS over een service portfolio?

8.3.7 Sleutel componenten in EA-raamwerken en adoptie

Vraag: Welke elementen zijn er belangrijk voor een raamwerk?

Vraag: Wat zijn succesfactoren (of voorwaarden tot succes) voor de introductie van een EAF?

Vraag: Hoe wordt de performantie bepaald binnen de UAS?

Vraag: wat zijn belangrijke beslissingen die genomen zijn die een impact kunnen hebben op de EA-structuur?

Vraag: Hoe worden changes ingevoerd? (gebeurt dit iteratief, agile, eerder top-down?)

Vraag: Is er een vraag naar ontsluiten van corporate data?

Vraag: Hoe flexibel zijn de huidige systemen en hun interacties?

Vraag: Kan een gefaseerde aanpak (ADM TOGAF) bijdragen tot een succesvolle adoptie van EAF binnen de UAS?

8.3. Document and archival research

Below table contains a detailed list of documents used and discussed in this research. These were harvested by document and archival research and examined in detail. Coding of data relevant for this research of specific documents can be found in the coding table (thematical analysis).

Table 2 - overview of document and archival research

Name document	Date	Description
Kwaliteitsplan.docx	08/2019	Documentation of quality management approach.
Biztalktalk-architectuur.pdf	05/2015	High-level description of the Enterprise Service Bus (technology + integration layer).
SOA Architecture (API).pdf	09/2020	The Event-driven API framework description.
Data_management_visie.docx	06/2020	UAS' vision on data management.
Data_governance_aanzet.docx	05/2020	The first draft regarding data governance.
Strategie_concreet_naar_ICT.docx	05/2019	An elaboration on business strategy/IT strategy.
Voorstelling_project_INDIGO.pptx	07/2019	A kickoff EA initiative.
Processen_servicemanagement.docx	06/2015	The activity diagrams about service management processes.
UAS_Integration_Report.docx	01/2020	A detailed architectural description of the technology and data layer regarding Enterprise Service Messaging.
Program_Management_AHS.PPTX	04/2020	An explanation about a new program management approach in UAS.

Schildpadden_FIN_HRM_PERS_PROF.docx	03/2014	The detailed process model regarding current business capabilities.
Sharepoint_IT_Governance_Rules	09/2017	An overview of current IT governance rules.
Artevelde_flyer.pdf	06/2020	Contains a description of the case organization.
Welkom_aan_de_Arteveldehogeschool.docx	09/2020	Contains a detailed description of the case organization.
Strategisch_instellingsplan_2019_2024	09/2019	Formal presentation of UAS's goals, strategy, and target for the next upcoming five years.
Visie_ICT.docx	09/2017	Formal document regarding IT strategy, mission, goals, and outcome.
ITScore_Business_Process_Management.docx	8/2014	Company business documentation regarding management buy-in and business process management.
KPI's voor dienst ICT.docx	05/2016	Defined KPIs and deliverables of the IT department.
Architectuur_Workshop.pptx	09/2019	Workshop regarding applicability EA in HEI.
Visie_Enterprise_Archictuur.docx	07/2018	Long term vision Enterprise Architecture UAS.
Analyse_API_Architectuur.docx	04/2019	Requirements 2-be API architecture UAS.
Project_Charter_Definition_Manual.docx	03_2017	PID document project definition manual.

Business_analytics_roadmap.pptx	08/2020	Vision translated into a practical roadmap regarding EA architecture en business analytics.
Visie_en_roadmap_EA_data_BI.docx	06/2020	Practical project (agile) approach depiction of generation of EA/BI roadmap.
Data_assessment_UAS.docx	06/2020	Matrix with assessment as-is data situation concerning different domains.

8.4. List of interview respondents

The below table depicts the respondents (including role elaboration) that were interviewed in this research.

Table 3 – a list of interviewees

Name	Role	Date	Relation with EA
respondent_B	Team lead Application and Software Development Team.	Week 06/04	Promotor of EA Program ("INDIGO"), extensive knowledge and experience of application layer, drivers and challenges EAF.
respondent _N	Head of IT department.	Week 06/04	Extensive knowledge and experience regarding strategy (enterprise).
respondent _S	Service manager (team lead).	Week 27/04	Extensive knowledge and experience of change management, monitoring and governance.
respondent _V	Business analyst.	Week 20/04	Extensive knowledge and experience of the process layer.
respondent _E	ERP program manager.	Week 04/05	Extensive knowledge and experience of the process layer and the data layer.

8.5. Case organization

As confirmed by all respondents and stated in “flyer.pdf,” and “brochure.pdf,”, the Artevelde University of Applied Sciences (AUS)—with 14,000 registered students and located in Ghent—is one of the leading educational institutions in Belgium. The AUS offers study programs in teacher training, business and graphic education, health care, and social work. More specifically, the AUS offers 18-degree programs and four advanced bachelor programs. In addition, it offers six international semester programs. It is a knowledge center for education, research, and services, where students, staff, and strategic partners cooperate and develop their talents in a stimulating and internationally oriented environment. The AUS, a member of the Ghent University Association (AU GENT) is one of Flanders’ largest university colleges.

8.6. Coding results

The semi-structured interviews are coded by thematical analysis. interviews were held in Dutch; coding has been executed in English. Due to privacy reasons, interview raw data has not been included, but it can be formally requested. Below table also contains coding of relevant data (concerning research topic) from the different case document to be found back in 8.4.

Table 4 data coding

ID	Text	Source	Code	Category	Theme
1	There should be more a business phased approach, while now project initiatives are being sparked by early technology adopters in the IT department (the business should be driver for process transparency, optimization, gap detection, etc.)	respondent_E; Strategisch_Instellingsplan_2019_2022.pptx	business phased approach, IT viewpoint.	Business-driven	Key requirements for successful EAF adoption
2	There is initiative regarding universal data governance and API-management, event-driven model, but these are all driven from within IT-department and lack business support, with the possible side effect of losing focus	respondent_E;	data governance and API-management IT driven.	business-driven	Key requirements for successful EAF adoption

	within a certain amount of time.				
3	The risk with a bottom-up approach is that when the people are gone, the initiatives are also gone.		Bottom-up approach decreases sustainability.	Centralized EA vision	Key requirements for successful EAF adoption
4	A few years ago, there was a first attempt of process documentation, due to the introduction of a new ERP system. This caused a heavy burden on personnel but also on the budget, afterwards this faded away, no management, process was to sequential, too much in too little time, no monitoring afterwards.	Respondent_E; Schildpadden_FIN_HRM_PERS_PROF.docx	challenges EAF, root causes	Centralized EA vision	Key requirements for successful EAF adoption
5	More investment in long-term vision.	respondent_E	long-term investment	Centralized EA vision	Key requirements for successful EAF adoption
6	Nowadays the HEI works to much project-based, once the project is finished, there is no domain management afterwards.	respondent_E	HEI is too much project based.	Centralized EA vision	Key requirements for successful EAF adoption

7	Communication and publication of a common approach is a big issue and challenge, to go toward a suitable EA model.	respondent_E	challenges towards common EA, frameworks, and policies	Communication/evangelization	Key requirements for successful EAF adoption
8	Education people are very open minded and flexible but difficult to assign to one specific 'way of working'. This means, a slow bottom-up approach, diplomatic with a focus on consensus.	respondent_E	HEI is open-minded.	Open organizational culture	Key requirements for successful EAF adoption
9	EA initiatives are not coordinated, no bigger picture is present, no holistic view.	respondent_N; Strategie_Naar_Concreet_ICT.pptx	no holistic view, no central coordination	Central decision authority	Key requirements for successful EAF adoption
10	The buy-in of central management is missing for the moment in the UAS, as there is no formal belief in mgmt. regarding the introduction of a full-blown Enterprise Architecture framework.	respondent_N	management buy-in is missing	management buy-in	Key requirements for successful EAF adoption

11	There is currently low EA maturity and commitment.	respondent_S; Strategie_naar_concreet_ICT.pptx	low EA maturity, low commitment	Tailoring	Key requirements for successful EAF adoption
12	There is no clear view on the decision-making criteria of management.	respondent_B	decision-making criteria not visible	EA maturity	Key requirements for successful EAF adoption
13	In private industry a top-down approach would be possible and is also preferred.	respondent_E	private industry, top-down approach	Open organizational culture	Key requirements for successful EAF adoption
14	EAF and EA can only work if there are fixed resources permanently assigned with a specific role and sufficient company mandate. This means monitoring current architecture, identifying gaps and alignment check and coordination of project initiatives (high-level).	respondent_E	fixed resources, RASCI, mandate	EA resources	Key requirements for successful EAF adoption
15	It is important that the quick return mindset needs to be abandoned, and for this a formal EA-mindset is needed at C-level.	respondent_E	EA-mindset at corporate level	management buy-in	Key requirements for successful EAF adoption

16	In the past we have worked with Gartner, but this did not work out well as it was to abstract and conceptual and the focus was on terminology.	respondent_N;	Gartner is too conceptual.	Tailoring	Key requirements for successful EAF adoption
17	Complicated EA tools will be a huge disadvantage.	respondent_S	Complicated EA tools will be a huge disadvantage.	Tailoring	Key requirements for successful EAF adoption
18	The complexity and cost of the EAF will be a huge challenge to counter.	respondent_S	EAF complexity	Tailoring	Key requirements for successful EAF adoption
19	The architectural role is now unclear, and balances between internal quality assurance, shadow-it and IT.	respondent_S	shadow-IT, unclear architectural role enterprise architect	Sufficient EA resources	Key requirements for successful EAF adoption
20	External service providers will always use blueprints for all kinds of artifacts (security, data mgmt., BI, etc.), but the real challenge is how you can get this realized into the UAS and adopted for all personnel within the UAS?	respondent_B	Blueprints and HEI adoption.	Stakeholder participation	Key requirements for successful EAF adoption

21	The EAF cannot impose to many restrictions as we are bound by law to public tenders, and we need to give all suppliers a fair chance of competing.	respondent_N	public tender restrictions	Open organizational Culture	Key requirements for successful EAF adoption
25	There is an urgency to mapping the data and application layer and we do not have control over it. An increase in data management is needed and this is a gigantic challenge.	respondent_N	mapping of data and application layer, increase in dmg is needed	Tailoring	Key requirements for successful EAF adoption
26	EA is like ITIL, but on an organizational level.	respondent_B; processen_servicemanagement.docx	EA definition, ITIL	Tailoring	EAF knowledge
27	The lack of resources compared with private industry is a reason for our current low EA maturity level and the feasibility of working with formal frameworks.	respondent_N	lack of resources, private industry	leveraging via outsourcing	Key requirements for successful EAF adoption
28	Process analysis is being triggered by ad hoc project request, non-holistic.	respondent_N	ad hoc projects are drivers EAF maturation	Business driven	Key requirements for successful EAF adoption

29	There exists an organ IKZ (internal quality assurance) that has the official role of improving the organization architecture and keeping an overview of abilities and services. Unfortunately, that organ is currently overburdened with other responsibilities, which means that there is a gap to fill. The manager of IT services and the team leaders of each IT service meet on a regular basis to map out improvements, which then get passed to the director digital transformation.	respondent_V; kwaliteitszorg.docx	internal quality assurance, digital transformation	Sufficient EA resources	Key requirements for successful EAF adoption
30	There are different initiatives, but without any coherence.	respondent_B	different initiatives, no coherence	Sufficient EA resources	Key requirements for successful EAF adoption
31	The director and head of department identify the changes, prioritize them, and then operationalize	respondent_B	project lifecycle, program management	Tailoring	Key requirements for successful EAF adoption

	them through project and program management.				
32	The setup of EA, Biztalk and API was without a management driver.	respondent_B; Biztalk_Architectuur.PDF	management buy-in is missing	Management buy-in	Key requirements for successful EAF adoption
33	The TOGAD ADM cycle has already been implemented loosely by our own project structure (SharePoint list).	respondent_B	EA adoption (tailoring)	Tailoring (blending)	Key requirements for successful EAF adoption
34	The focus on "EA initiatives" has always been from a data transmission viewpoint, but there needs to be a shift to the processes.	respondent_E	focus EA, data transmission viewpoint, shift to processes	Sufficient EA resources	Key requirements for successful EAF adoption
35	The process owner assignment is missing, and this should be the trigger and monitor for new projects and events.	respondent_E	process owner role	Sufficient EA resources	Key requirements for successful EAF adoption
36	A reactive approach is dominant right now.	respondent_E	reactive approach	Sufficient EA resources	Key requirements for successful EAF adoption
37	There is a non-consistent overview of roles, assignments, responsibilities, and	respondent_E	no overview of roles and descriptions	Sufficient EA resources	Key requirements for successful EAF adoption

	profile descriptions (maturity HEI).				
38	When introducing a new application and framework, there needs to be a more structured checkup with the current strategic challenges, Do they match? Is this wat we really need; wat is the ROI? (business case)	respondent_E	project lifecycle	Central decision authority	Key requirements for successful EAF adoption
39	The business layer is also underdeveloped, product, talent and service portfolio are missing.	respondent_N	business layer underdeveloped	Tailoring	Key requirements for successful EAF adoption
40	Enterprise Architects, or a specialized group or unit, is not present now.	respondent_N	Enterprise Architect not present	Sufficient EA resources	Key requirements for successful EAF adoption
41	For the moment, a reactive approach is being used regarding business and processes, and information systems (data, application, integration).	respondent_N	reactive approach	Tailoring	Key requirements for successful EAF adoption
42	EA and frameworks are not formally visible in the UAS.	respondent_N	EAF not visible in HEI	Tailoring	Key requirements for successful EAF adoption

43	All software that is now being procured is based on existing frameworks (ITIL) and best practices (Microsoft, etc.).	respondent_N;processen_servicemanagement_docx	software based frameworks	Leveraging via outsourcing	Key requirements for successful EAF adoption.
44	Project INDIGO is an incitement to documentation/blueprint of application architecture.	respondent_V; Project_Indigo_voorstelling.pptx	INDIGO, blueprint of application architecture	Tailoring	Key requirements for successful EAF adoption
45	The UAS has moved from self-contained locally hosted systems to SAAS, in which API and interoperability is of huge importance.	respondent_V; SOA_Architecture(API).PDF	API and interoperability	Leveraging via outsourcing	Key requirements for successful EAF adoption
46	There is a shift to SAAS application, of the shelf available based on best practices, existing frameworks (for example ITIL).	respondent_V;processen_servicemanagement_docx	shift to SAAS	Leveraging via outsourcing	Key requirements for successful EAF adoption.
47	EA is implicitly already available and partially visible due to different loosely coupled/detached project initiatives.	respondent_B	EA maturity in HEI	Tailoring	Key requirements for successful EAF adoption.
48	Application, system, and technology architecture are better	respondent_B	The technology layer is more	Tailoring	Key requirements for successful EAF adoption.

	documented than processes (lower short-term ROI). Resources are naturally pushed more towards the "technical layers".		documented than processes		
49	There is no insight in coherent of current applications, data, and integrations.	respondent_E; project_INDIGO_voorstelling.pptx	no coherence in application, data, integration	Centralized EA vision	Key requirements for successful EAF adoption.
50	There is no full worked out architectural blueprint of master data and applications.	respondent_E	premature architectural blueprint	Tailoring (blending)	Key requirements for successful EAF adoption.
51	The data and data architecture are underdeveloped.	respondent_E	data architecture is underdeveloped	Tailoring (blending)	Key requirements for successful EAF adoption.
52	There is no single unit who guards the different layers. For example, processes.	respondent_V	gateways for layers is missing	Sufficient EA resources	Key requirements for successful EAF adoption.
53	RACI is missing, a potential issue for service management.	respondent_S	rasci is missing	Sufficient EA resources	Key requirements for successful EAF adoption.

54	There is no separate data management team.	respondent_E; data-management_visie.docx	no formal DMG [14]team	Tailoring (blending)	Key requirements for successful EAF adoption.
55	There is no high-level picture of all existing processes.	respondent_N	no high-level model	Centralized EA vision	Key requirements for successful EAF adoption.
56	Service portfolio and formal written and accessible business rules are missing.	respondent_S	no service portfolio	Tailoring (blending)	Key requirements for successful EAF adoption.
57	There is no recollection of similar architecture in other universities.	respondent_N	other universities have similar maturity	other universities	HEI complexity
58	Process solutions are nowadays always individual projects, non-holistic, without collaboration with internal quality assurance.	respondent_V; kwaliteitszorg.docx	internal quality assurance, digital transformatio n	Centralized EA vision	Key requirements for successful EAF adoption.
59	Business process quality criteria are currently missing, there needs to be more synergy between internal quality assurance and IT project development.	respondent_E; kwaliteitszorg.docx	more synergy between IQA [15]en ITP	EA maturity	Key requirements for successful EAF adoption.

[14] Data Management
[15] Internal Quality Assurance

60	Company culture is also a critical factor of success regarding successful EA adoption.	respondent_E	Company culture	Open organizational culture	Key requirements for successful EAF adoption.
61	The business needs to be in charge, in the driver's seat (key elements).	respondent_E	business in driver's seat	business driven	Key requirements for successful EAF adoption.
62	An EAF should be agile, lean, low effort and low budget via flexible and phased approach.	respondent_N	agile, lean, phased approach	agile approach	Key requirements for successful EAF adoption.
63	EA is linked with the maturity model, phased approach is advised, key elements of improvements need to be selected.	respondent_B	EA, maturity model	agile approach	Key requirements for successful EAF adoption.
64	EAFs are possible within the context and structure of a classic HEI, but only the bear minimum.	respondent_B	minimum viable product of EA	agile approach	Key requirements for successful EAF adoption.
65	Linking the maturity model where we identify the maturity of the different components and prioritize, in combination with agile, creating an MVP, lean and	respondent_B;respondent_S;Respondent_E	maturity model, agile, lean, iterations, cyclical approach	agile approach	Key requirements for successful EAF adoption.

	iterations, should work just fine.				
66	A good approach would be phased approach, with stakeholder involvement, process owner in driver seat, IT as support role.	respondent_E	phased approach, stakeholder involvement	agile approach	Key requirements for successful EAF adoption.
67	If stakeholder buy-in is available, a phased and iterative approach of EA via the e.g., TOGAF ADM cycle could be a realistic pathway for the future.	respondent_N; Architecture_Workshop.pptx	iterative phased approach, e.g., TOGAF	agile approach	Key requirements for successful EAF adoption.
68	There is no central coordination between products, processes, applications, and people. Separate initiatives such as intro of ERP/ITSM/API are triggers for further process elaboration and data governance. But without a holistic view.				
	"This is the collateral advantage of projects."	respondent_N; digitale_transformatie.PPTX; data.governance.docx;	collateral advantage of projects	Stakeholder participatie	Key requirements for successful EAF adoption.

69	An architect on our scale is possibly not realistic but the creation of an internal reflection channel.	respondent_N	Enterprise Architect as sound board	Tailoring (blending)	Key requirements for successful EAF adoption.
70	The introduction of an EAF is only possible in an open culture.	respondent_B	open culture as a condition of success	Open organizational culture	Key requirements for successful EAF adoption.
71	To execute IT projects which are aligned with business requirements, Enterprise Architecture Frameworks could help with this by providing a documented general business vision and IT vision, architecture of the different layers, so a checkup can be made the decision-making model still matches within the UAS.	respondent_N	document vision, blueprints, documented layers	Centralized EA vision	Key requirements for successful EAF adoption.
72	An enterprise architect should not be a goal, but a means to get to and end (improve	respondent_N	Enterprise Architect, not a goal but a means	Central decision authority	Key requirements for successful EAF adoption.

	efficiency, agility, etc.)				
73	The allocation of an Enterprise Architect who monitors centrally all high-level projects centrally and who can assess the impact on the different layers would be beneficiary for the UAS.	respondent_B	enterprise architect who monitors centrally	Sufficient EA resources	Key requirements for successful EAF adoption.
74	An explicit definition and assignment of the roles application manager and program manager could facilitate a common EA.	respondent_E;program_management.pptx	RASCI is missing, program manager	Sufficient EA resources	Key requirements for successful EAF adoption.
75	IS is an enabler of organization change and business process redesign.	respondent_N	IS instigates change and bpm	Business driven	Key requirements for successful EAF adoption.
76	There are initiatives regarding data identification, structuring mapping, these also are enabled of EA.	respondent_N	DMG is an enabler for EA	Business driven	Key requirements for successful EAF adoption.
77	Loose project-based initiatives such as ERP, Enterprise Service Messaging	respondent_N;SOA.Architecture(API).pdf	ERP and ITSM introduction	Evangelization (key-influencers)	key elements

	and API are enablers of Enterprise Architecture.		are enablers for EA		
78	IT is a natural bell whistler of gaps and processes issues and instigator for process automation projects.	respondent_V	process improvement, synergy	Open organizational culture	adoption
79	EAF is interesting as a monitoring tool for guarding the IT strategy and business vision, but less as a formal repository for best practices.	respondent_N	EA is less usable as a formal repository	Tailoring (blending)	benefits
80	Lightweight processes, short lead time, management buy-in, sufficient resources and involvement of relevant stakeholders are critical success factors for the introduction of EA(F).	respondent_S	Lightweight frameworks, stakeholder involvement	Tailoring (blending	Key requirements for successful EAF adoption.
81	"It is interesting to look at different frameworks and get the best out of it (cherry-picking)".	respondent_N	Cherry-picking different formal frameworks	Tailoring (blending)	Key requirements for successful EAF adoption.

82	The best approach in the UAS would be the combination of hybrid and lightweight frameworks.	respondent_N	hybrid and lightweight frameworks	Tailoring (blending)	Key requirements for successful EAF adoption.
83	Formal Frameworks can be used but they need to be able to be approached pragmatically (low effort, low maintenance).	respondent_N	pragmatic approach of formal frameworks	Tailoring (blending)	Key requirements for successful EAF adoption.
84	Cherry-picking best practices and guidelines regarding security, testing and user experience are already being executed and facilitated by external partners (who also use a specific framework). These are measurable and easily provable of benefits.	respondent_N	Cherry-picking, leveraged by external suppliers	Tailoring (blending)	Key requirements for successful EAF adoption.
85	The UAS will never walk the extremities of an EAF.	respondent_N	extremities of EAF	Tailoring (blending)	Key requirements for successful EAF adoption.
86	An EAF should be able to be abstracted to a certain level of understanding.	respondent_S	abstraction of EA	Tailoring (blending)	Key requirements for successful EAF adoption.

87	The technical components of EA and EAF will be more easily maintained, in contrast to the conceptual components (business rules, guidelines, data and IT governance), as these need to be confirmed by management.	respondent_B;sharepoint_IT_Governance_rules.docx	Technological components are more easy to be maintained.	Tailoring (blending)	Key requirements for successful EAF adoption.
88	Program management approach where best practices regarding security, project lifecycle, application performance, testing, coding, and so on… are being centrally managed but provisioned via separate initiatives/projects are a good way of tailoring EAF.	respondent_B;programmamanagement_AHS.pptx	EAF adoption (tailoring), cherry-picking, Program management	Tailoring (blending)	Key requirements for successful EAF adoption.
89	Improvement of agility because of the EAF introduction will be difficult to prove.	respondent_N	agility is non-measurable	Tangible deliverables	adoption

90	An important key performance indicator regarding the introduction of frameworks is the short and long-term increase of student satisfaction.	respondent_N	KPI	Management buy-in	Key requirements for successful EAF adoption.
91	The ROI with introducing EA cannot be seen on short-term, and because of this less feasible for approval of management. Management wants clear deliverables, measurable benefits.	respondent_N; Biztalk.Architectuur.PDF	EA is not a short-term ROI, low feasibility mgmt. approval	Management buy-in	Key requirements for successful EAF adoption.
92	The former Biztalk deployment had failed, due to improper stakeholder management, analysis, and involvement and improper bottom-up approach and lack appreciative culture. The focus was technology inspired (ERP needs a Biztalk integration) and that is the wrong focus.	respondent_E; Biztalk_Architectuur.PDF	IT viewpoint, no stakeholder involvement, promotor missing	Centralized EA vision	Key requirements for successful EAF adoption.

93	As maturity will be rising, and the different detached initiatives are being liked by management, credibility and evangelization of EA could arise within management.	respondent_N	maturation of projects, increase of EA credibility with management	Stakeholder participation	Key requirements for successful EAF adoption.
94	The introduction of new frameworks can only work with management buy-in, collaborative approach with a bottom-up perspective (proper decision rights for all stakeholders). Ownership, agile and iterative via sprints.	respondent_V	conditions to success, critical success factors	Management buy-in	Key requirements for successful EAF adoption.
95	The director of digital transformation acts as an instigator in mapping our current processes and applications.	respondent_V	digital transformation, instigator of mapping	Management buy-in	Key requirements for successful EAF adoption.
96	The digital transformation plan developed by our director should act as a catalyst for process	respondent_V	digital transformation as a catalyst	Management buy-in	enablers

	automation and improvement.				
97	Stakeholder buy-in is essential, and the director needs sufficient time available.	respondent_B	stakeholders' buy-in	Management buy-in	key elements
98	EA support by EAF should grow organically from different - loosely coupled - projects.	respondent_N	EAF grows organically	Business driven	Key requirements for successful EAF adoption.
99	The IT vision must be created internally (EAF repositories could be interesting as a source of soundboard of inspiration), but the facilitation of this vision can be fostered by external partners who use existing EA frameworks, as we do not have the time or materials to execute this by ourselves.	respondent_N	IT vision, external partners, outsourcing, manage resources	Leveraging via outsourcing	Key requirements for successful EAF adoption.
100	EA and EAF need to be provisioned by an external company (outsourcing), Internal resources should be used for	respondent_B	EAF facilitated by outsourcing	Leveraging via outsourcing	key elements

	EAM and provide EA data input. The EA and EAF setup need to be a time-restricted trajectory.				
101	Leveraging by outsourcing is a valid and sustainable approach as company budgeting is more flexible towards this approach.	respondent_E	leveraging by outsourcing, flexible budget outsourcing	Leveraging via outsourcing	Key requirements for successful EAF adoption.
102	Low process maturity, not documented, not flexible and not based on industry standards.	respondent_S	low process maturity	Tailoring (blending)	Key requirements for successful EAF adoption.
103	"Most of the import processes are in the heads of the people."	respondent_B	process not well documented	Sufficient EA resources	Key requirements for successful EAF adoption.
104	"Current processes are based on internal and historical knowledge, in the long term this should change to industry standards and lean, clear and transparent and unambiguous processes."	respondent_B	process is based on custom, legacy knowledge	Avoid over-standardization	Key requirements for successful EAF adoption.
105	The current project lifecycle in the UAS follows a light	respondent_B	TOGAF adm cycle	Tailoring (blending)	Key requirements for successful EAF adoption.

	version of the TOGAF ADM cycle.				
106	There is a strong need for IT governance rules and data governance rules to increase efficiency and provide transparency and guidance.	respondent_N;Sharepoint_IT_Governance_rules	strong need of IT governance rules	Tailoring (blending)	Key requirements for successful EAF adoption.
107	There is a strong need for secure and flexible business processes.	respondent_N	need of flexible business processes	Tailoring (blending)	Key requirements for successful EAF adoption.
108	Constantly looking for ways how we can be more flexible, and arm against disruption. Specifically, question old processes and legacy tools.	respondent_V	arm against disruption	Tailoring (blending)	Key requirements for successful EAF adoption.
109	Software is a complex matter, and out of economic interest it is better to share this with other companies. This means less flexibility but economically more affordable and efficient software frameworks. Nonacademic	respondent_V	outsourcing non-academical software	Leveraging via outsourcing	Key requirements for successful EAF adoption.

	software should also be outsourced.				
110	From the service management viewpoint there is an urgent need for the visibility of the different layers within the UAS.	respondent_S	service management and EA layers	Tailoring (blending)	Key requirements for successful EAF adoption.
111	Governance rules regarding BYOD [16]are missing, and this would really help.	respondent_S;Sharepoint_IT_Governance_Rules	BYOD	Tailoring (blending)	Key requirements for successful EAF adoption.
112	A definition manual which consists of an approved list of terminology being used at the UAS is missing.	respondent_E; project_charter_definition_manual.docx	definition manual	Tailoring (blending)	Key requirements for successful EAF adoption.
113	There is a strong need for documented business process logic (now not available, logic must be "rebuilt").	respondent_E	utility and value of EAF	Tailoring (blending)	Key requirements for successful EAF adoption.
114	An internal quality manual is not present and is missing, containing the	respondent_E; digitale_transformatie.pptx	quality manual missing, needs of HEI	Tailoring (blending)	Key requirements for successful EAF adoption.

[16] Bring Your Own Device

	necessary quality criteria.				
115	There is a big demand of frames and guidelines to design and realize products, process, organization, information provisioning and infrastructure (needs of HEI) -> EAF.	Conclusion; digitale_transformatie.pptx		Tailoring (blending)	Key requirements for successful EAF adoption.
116	The HEI wants safe, transparent, scalable, sustainable, and flexible/modular applications and systems.	respondent_E; digitale_transformatie.pptx; EA_workshop.pptx	safe, sustainable, flexible, and loosely coupled	Tailoring (blending)	Key requirements for successful EAF adoption.
117	The HEI wants cost effective and sustainable, loosely coupled components with a focus on integration.	respondent_E; digitale_transformatie.pptx	cost effective HEI	Tailoring (blending)	Key requirements for successful EAF adoption.
118	The HEI wants easy and accessible data (uniform and transparent).	respondent_E; digitale_transformatie.pptx	easily accessible data	Tailoring (blending)	Key requirements for successful EAF adoption.
119	There is a huge demand for a general process manual (HEI need).	respondent_E	process manual	Tailoring (blending)	Key requirements for successful EAF adoption.

120	A formal decision tree is missing regarding application and/or framework selection (external/bespoke).	respondent_E	formal decision tree is missing	Tailoring (blending)	business case HEI
121	There is a need for a change advisory board with C-level stakeholders presents, including EA to discuss viability and feasibility of new projects.	respondent_E	needs of HEI, EAF adoption	Central decision authority	business case HEI
122	Important long-term challenges for the UAS are flexible, secure, and sustainable systems, loosely coupled services, decreasing monolithic applications.	respondent_N, Architecture_Workshop.pptx	Long-term challenges	Tailoring (blending)	Key requirements for successful EAF adoption.
123	An important goal is to improve efficiency in all departments, IT can serve as a role model, by basing its own processes on existing frameworks (E.g., ITIL).	respondent_V; processen_servicemanagement.docx	IT role model, process-based frameworks, ITIL	Avoid over-standardization	Key requirements for successful EAF adoption.

124	The final goal is to increase the efficiency and productivity of the people.	respondent_V	increase efficiency	Centralized EA vision	Key requirements for successful EAF adoption.
125	An Enterprise Architect, seen as a separate group with sufficient mandate (management buy-in) could provide benefits by identifying gaps and issues in our current processes.	respondent_N	Enterprise Architects, mgmt. buy-in	Management buy-in	Key requirements for successful EAF adoption.
126	Example models and best practices regarding different topics such as business processes and project management can be interesting and give added value.	respondent_N	example models and best practices	Tailoring (blending)	Key requirements for successful EAF adoption.
127	Synergy can be found within departments by using the same tools and methods.	respondent_V	synergy, same tools and methods	Tailoring (blending)	Key requirements for successful EAF adoption.
128	Improved decision-making by provisioning reportable management data.	respondent_V	unlocking unified data	Tailoring (blending)	Key requirements for successful EAF adoption.

129	Working with standardized packages (based on existing repositories) has a positive impact on the organization and its processes, for example based on ITIL.	respondent_S	Working with repositories has a positive impact	Avoid over-standardization	Key requirements for successful EAF adoption.
130	Industry based standard tools, products and methods are more easily introduced in the overall organization.	respondent_S	industry based standard tools	Management buy-in	Key requirements for successful EAF adoption.
131	Framework-based applications, OOTB, receive a quicker UA and have higher sustainability in the overall organization.	respondent_S	OOTB quick UA, sustainability	Agile phased approach	Key requirements for successful EAF adoption.
132	The allocation of an Enterprise Architect who monitors centrally all high-level projects and who can assess the impact on the different layers would be beneficiary for the UAS.	respondent_B	Enterprise Architect, tailoring	Central decision authority	Key requirements for successful EAF adoption.
133	As quality is nowadays individually based,	respondent_B	EAF to balance and improve	Tailoring (blending)	Key requirements for successful EAF adoption.

	EAF could help to equilibrate and improve general quality.		general quality		
134	Big structural changes, there needs to be more support for that, a form of secure flexibility is missing.	respondent_E	utility and value of EAF	Tailoring (blending)	Key requirements for successful EAF adoption.
135	Outsourcing external expertise	Strategie_Naar_Concreet_ICT.pptx	Towards a flexible environment	Leveraging via outsourcing	Key requirements of successful EAF adoption.
136	Key goals are an agile (IT) environment, doing the right things, doing the things right, being connected and fostering a digital expert center.	Strategie_Naar_Concreet_ICT.pptx	Doing things right	Tailoring (blending)	Key requirements of successful EAF adoption.
137	Installment of Enterprise Architecture as critical success factor on reaching goals of the HEI (creating an agile environment)	Strategie_Naaar_Concreet_ICT.pptx	Doing the right things	Agile implementation approach	Key requirements of successful EAF adoption.
138	The UAS is going for an open culture, flexible, student is central, less rigid.	Strategisch_instellingsplan_2019_2024.docx	Flexible HEI environment	Open organizational culture	Key requirements of successful EAF adoption.

139	"Culture eats strategy for breakfast."	Strategie_Naar_Concreet_ICT.pptx	Flexible HEI environment	Open organizational culture	Key requirements of successful EAF adoption.
140	The installation of an innovative culture is a requirement for success in digital transformation planning for the UAS.				
140	Some of the relevant CSF of the UAS are "investment in IT and infrastructure", change management (bottom-up), creating a future proof organization.	Strategisch_instellingsplan_2019_2024.docx	Flexible HEI environment	Stakeholder participation	Key requirements of successful EAF adoption.
141	Enterprise Architecture is seen as a CSF for the fostering of digital transformation.	Strategisch_instellingsplan_2019_2024.docx	Flexible HEI environment	Management buy-in	Key requirements of successful adoption.
142	There will be a focus on outsourcing for non-academic activities, SAAS installments seem promising for these use cases.	Strategisch_instellingsplan_2019_2024.docx; visie_ict.docx	SAAS	Leveraging via Outsourcing	Key requirements of successful adoption.
142	Digital transformation will put the student central and will focus	Strategisch_instellingsplan_2019_2024.docx; visie_ict.docx	Happy flow, IT governance	EA maturity	Key requirements of successful adoption.

	on happy flow use cases and transparent and efficient IT governance.				
143	Use executive sponsors to blast political roadblocks that undermine BPM projects.	ITScore_BPM_docx	Buy-in	Management buy-in	Key requirements of successful adoption
144	KPIs are grouped by commodities, direct service, managerial and project operation.	KPIS_voor_dienst_ICT.docx	KPI	Clear KPI and deliverables	Key requirements of successful adoption
145	Stakeholder satisfaction, student performance and quality are imports managerial KPIs.	KPIS_voor_dienst_ICT.docx	KPI	Clear KPI and deliverables	Key requirements of successful adoption.
146	Strategical EA goals must be operationalized bottom-up, bottom-up promotion.	Business_analytics_roadmap.pptx	Bottom-up	Stakeholder participation	Key requirements of successful adoption.
147	Stakeholder participation is a critical success factor regarding the creation of a future proof HEI organization.	Strategisch_instellingsplan.docx	Bottom-up	Stakeholder participation	Key requirements of successful adoption.
148	Tailoring of existing/selected framework is necessary for	Topdesk_Project_Approach.docx	Tailor to suit the needs	Usage of lightweight EA frameworks	Key requirements of successful adoption.

	successful adoption to suit HEI needs.				
149	Lean and agile phased project approach is advised as key technique regarding operationalizing strategical (EA) goals	Lean_Agile.PPTX	Agile	Agile and lean approach	Key requirements of successful adoption.
150	Agile project approach, cyclical and iterative, prioritizing key elements and startup of MVP.	Visie_en_roadmap_EA_data_BI.docx	Agile	Agile and lean approach	Key requirements of successful adoption.
151	No strict application of EA frameworks. Blending frameworks to suit HEI needs.	Workshop_EA.pptx	Blending EA frameworks	Tailoring to suit the needs	Key requirements of successful adoption.
152	Blending EA frameworks by picking the processes, practices and artifacts that are the most relevant for their business needs.	Workshop_EA.pptx	EA practices	Tailoring to suit the needs	Key requirements of successful adoption.
153	Think of happy flow, students are central, focusing on	Digitale_Transformatie_versie_ICT-Def.pptx	Standardization	Avoid over standardization	Key requirements of successful adoption.

	successful user adoption.				
154	BI and data management are done in non-aligned projects; no best practices (governance)	Assessment_data_UAS.docx	EA maturity	No central EA vision, business driven	Key requirements of successful adoption
155	There is a diverse set of tools and architecture but not the standard of enterprise wide	Assessment_data_UAS.docx	EA maturity	No central EA vision, business driven	Key requirements of successful adoption
156	Information model is present, but domain specific, no enterprise-wide model	Assessment_data_UAS.docx	EA maturity	No central EA vision; business driven	Key requirements of successful adoption
157	Reporting usage is omni-present	Assessment_data_UAS.docx	EA maturity	No central EA vision	Key requirements of successful adoption

158	AI not in place, no perspective on use-cases	Assessment_data_UAS.docx	EA maturity	No central EA vision	Key requirements of successful adoption
159	EAF quick wins should be identified by participatory development and stakeholder analysis.	Visie_en_roadmap_Data_BI.docx; all respondents	Quick Wins	Stakeholder cooperation	Key Requirements of successful adoption.
160	The selection of tangible deliverables could ideally be made by assessing the current maturity model with EAF and prioritizing and creating a realistic and visible roadmap, which must be approved by the board of directors.	Respondent_E, Respondent_B; Visie_en_roadmap_Data_BI.docx;	Agile, MVP	Unambiguous deliverables, KPIs	Key requirements of successful adoption.