Chapter 7
Summary and Outlook

7.1 Summary

We are about to reach the end of the textbook on EAM. Hopefully, it will not be the end but the beginning of your journey through Enterprise architecture. We did not cover the topic in its entirety but focused on central aspects in order to provide a kick-starter for your next steps.

Before diving into details about methods and tools, we addressed a central question: What do we want to achieve with Enterprise Architecture. Instead of applying a tool, EAM is still about providing value in an organisation. Consequently, we first need to understand its current situation, problems as well as the context. This will be the starting point for choosing appropriate tools serving a *purpose*.

Chapter 2 then provided concepts and visualisations for Business Architecture that helps with understanding the business (i.e. what an organisation is doing in order to provide value). It is always a good idea to reuse existing documents like business process models or similar documents. In case they are accepted and up to date, they provide a valuable reference for understanding the company. However, they are not available very often. We then can use proven concepts like *business capabilities* and *business objects* as simple but powerful tools. They cover a functional perspective on the business (business capabilities) together with a view on static objects (business objects). They can be complemented with further concepts for describing business motivation and business models.

A consistent business capability map can be used as a starting point for deriving an *application landscape* that fulfills a company's needs (as presented in Chap. 3). Software applications are the counterpart to business capabilities as they implement desired functionality. In the same way, business objects reflect a high-level picture on data objects maintained by business software. Applications and data objects are located in the Application Architecture, describing corporate information systems.

Business and Application Architecture are rather descriptive, providing transparency on information systems and their business context. They also provide

J. Jung, B. Fraunholz, *Masterclass Enterprise Architecture Management*,
https://doi.org/10.1007/978-3-030-78495-9_7

the information required for analysing and improving the application landscape. Enterprise architects are using a plethora of visual tools for identifying optimisation potential as depicted in Chap. 4. We further elaborated on the *business support matrix* for identifying typical concerns in the application architecture—like gaps or redundancies.

EA is subject to frequent changes caused by architecture optimisation or driven by business needs. These changes need to be managed properly and require a respective organisation. Classical organisational forms follow a top-down approach—i.e. EAM is driven by the management. Recent experiences within classical organisations show that a more *collaborative EAM* approach is required. A prototypical example was presented in Chap. 5 together with an outlook on further research.

Even though we did not want to publish a textbook non *EA frameworks*, this topic is still relevant for any enterprise architect. An overview on classical frameworks is given in Chap. 6—with a detailed view on TOGAF. In fact, I would like to encourage any enterprise architect to get familiar with at least one framework. They provide best practice methods and tools for documenting and improving an EA. However, you always need to be capable to adjust these tools with respect to given concerns or needs within your organisation. This is why we started the textbook with benefits expected from EA and EAM in Chap. 1.

7.2 Topics for Future Research

We only covered the very tip of the iceberg so that you, as a reader, can familiarise yourself with basic concepts of EA and EAM. There are still many topics open for future research. This section will not provide a comprehensive overview, but rather list some topics which you might consider for your next research project.

In 2017, Gampfer et al. performed a text analysis in order to reveal past, present and future trends of EA [1]. As a result of this study, they identified the following topics as future trends with respect to EA:

1. Cloud computing
2. Adaptive or agile enterprise architecture
3. Sustainability
4. Smart machines
5. Internet of things
6. Big data
7. Entrepreneurship
8. Complexity theory

Cloud computing refers to technologies that help with overcoming limitations of classic hosting models. It allows for a faster acquisition of services (on-demand self-service) and a more flexible and automatic adoption to variations in resource needs (elasticity). Computing resources are shared by many customers (resource pooling)

over a standard internet connection (broad network access). Customers only pay for the service level they actually used (measured services). Cloud computing might, therefore, shorten the time for performing changes in the application landscape. These changes may affect only only the underlying technology, but also allows for using software applications or even business processes as a cloud service (cf. [2, p. 14]). A discussion on related aspects (e.g. security and privacy) can be found in [1] and [3].

Agile software development is already established in professional institutions since the beginning of 2000s (cf. [4, 5]). Corresponding methods like *Scrum* or *eXtreme Programming* improve software projects by reducing risks and faster availability of results. However, it seems that short development cycles in software development do not match with methods addressing a long-term perspective. This may result in a conflict between EAM (long-term perspective) and flexible adaption to customers' needs in agile development. Some publications refer to this aspect of IT with two different modes of speed as *bimodal* IT (e.g. [6]). Furthermore, some authors aim at making EAM more agile. Examples for those approaches are *Architectural Thinking* [7, 8], *The Open Group Agile Architecture Standard* [9] opr the approaches presented in Sect. 5.3.

Sustainability with respect to the protection of our environment is one of the current big endeavors [1]. EAM can be regarded as a methodology not only considering the organisation but also its context (cf. Sect. 1.3.1). It therefore also incorporates the impact of a companies business on the environment and might, therefore, support ecological aspects. However, the term *sustainability* does not only have an ecological connotation but also refers to the impact of decisions in general.

The term *smart machine* refers to autonomous machines that are capable of adapting to their environment (cf. [10]). Similar to *Internet of Things* (IoT), they impose a new concept on the technology layer and its impact onto the business. In contrast to classical computer systems and network, they are mobile and adaptive. Consequently, people are proposing new ways of managing such IT devices as part of the EA (e.g. [11, 12]). These approaches need to cope with a large number of mobile devices which may frequently adopt their behaviour as required by their context.

Big data technologies are widely used today and allow for managing and analysing large amounts of (unstructured) data (cf. [13]). Its relevance for EA has two aspects: EA can help with setting up Big Data technologies based on data architecture. Big data may also provide solutions that help with managing data about EA. The classical manual way for maintaining data on EA requires a lot of manual data maintenance. Big data might help here with collecting data from various repositories and documents automatically. A similar approach is for example presented in [14]. A similar distinction will hold true for *Artificial Intelligence* (AI) in general. AI has the potential for significantly changing the business by improving efficiency or changing the way how business is done (e.g. new business models, products or markets). AI technology is also already evaluated with respect to changing EAM (cf. [15]).

Principles of *agile* and *lean* are nowadays also applied to organisations (*Entrepreneurship*). Management structures need to ba flat so that a company can easily adjust to changes [16]. Especially small and medium-sized companies as well as start-ups do not have resources for an elaborate EA organisation. Hence, further research is required on how to set up a minimal EA for small and potentially agile companies. This also involves ideas already presented in Sect. 5.3. An EA organisation should aim at providing value in the company as well as following a collaborative working mode.

The topics above are, obviously, not disjoint. There is an overlap between entrepreneurship and agile organisations. Big data is also often involved when implementing IoT solutions. All of them share an inherent *complexity* with respect to EA and its development over time. There are further studies identifying similar research topics (e.g. [3]). They mainly address EA organisation, methodology and tool support.

Further research is also conducted on benefits of EAM in an organisation. Even though it seems to be obvious on a hight level (cf. Sect. 1.2), EA teams still lack of presenting immediate benefits [17]. Consequently, academic research tries to understand tangible benefits from EAM (e.g. [18–21]) as well as why EA initiatives failed in the past (e.g. [22, 23]).

Also traditional methods and tools are still subject to academic research. One of the drawbacks is the plethora of EA visualisations as well as their complexity. people try to reduce the amount of maps (e.g. [24, 25]) or new ways for EA visualisation. Abandoning the two-dimensional sheet of paper may enable multi-dimensional and interactive views. Some example projects develop and evaluate prototypes using game engines (e.g. [26]) or augmented reality [27].

Research on the notion of *EA debts* adopts the concept of technical debts and applies them to EA (cf. [28]). In a similar way as technical debts, an EA debt represents an ad-hoc artefact (like a workaround or a low quality process or inadequate IT system) that hampers implementing an optimal solution. The research objective of this project is in developing a method for detecting and managing existing EA debts in an organisation.

7.3 Digital Transformation

Digital transformation refers to a radical change in society and companies through the adoption of digital technologies [29, 30]. It is motivated by by recent improvements in technologies and corresponding products and services. Many see it as an enabler for innovations in corporations as well as new business models. It has the potential for driving significant improvements in operational performance. Digital transformation is often presented as a technological topic.

The acronym *SMACIT* (Social, Mobile, Analytics, Cloud, Internet of Things) is used for referring to (so called disruptive) technologies enabling digital transformation [31]. According to Ross et al., there are even more technologies like for example

artificial intelligence and blockchain [32]. The acronym is pronounced *smack it* in order to underline their impact on digitisation of a company. However, it also may have a negative connotation as the affected change can have a negative impact on an organisation. Technology as a means on its own never solves a real-world problem. Only applying it appropriately does. Hence, organisational capabilities are required as well [33]. In fact, short-term successes for digital transformation can even be achieved by using conventional technology [34].

However, digital transformation is not (only) about technology, but about people, skills and strategy [35]. Tabrizi et al., therefore, highlight relevant aspects when planning for a digital transformation [36]: Digital transformation needs to be guided by a corresponding business strategy. It requires clear guidance and commitment to radical changes. The change also needs to be developed from within the organisation by existing staff. This further requires a change of skills and mindset. Changes need to be driven by customer experience from the outside in. It starts with an innovative product or business model for gaining new markets. This will then define the requirements on the technical solution.

Digital transformation and EAM share some commonalities. In fact, definitions seem to be similar to *enterprise ecological adaption* as presented in Sect. 1.3.1. They both need to be driven by the business and follow clear objectives (*purpose* in Sect. 1.2). They start with understanding the business based on strategy, capabilities and changes (Chap. 2 and Sect. 5.1). This will be the baseline for determining relevant software applications and technologies (Chap. 3). Changes need to be visualised, planned and monitored (Sects. 4.2, 1.4 and 5.1). It seems that both, Digital Transformation and EAM, might be two sides of the same coin …

References

1. F. Gampfer, A. Jürgens, M. Müller, R. Buchkremer, Past, current and future trends in enterprise architecture. A view beyond the horizon. Comput. Ind. **100**, 70–84 (2018)
2. N. Ruparelia, *Cloud Computing* (MIT Press, Cambridge, 2016)
3. S. Kaisler, F. Armour, 15 years of enterprise architecting at hicss: revisiting the critical problems, in *Proceedings of the 50th Hawaii International Conference on System Sciences*, January 4, 2017
4. A. Scheerer, *Coordination in Large-Scale Agile Software Development, Integrating Conditions and Configurations in Multiteam Systems* (Springer International Publishing, Berlin/Heidelberg, 2017)
5. P. Kruchten, S. Fraser, F. Coallier (eds.), *Agile Processes in Software Engineering and Extreme Programming*. Lecture Notes in Business Information Processing, vol. 355 (Springer International Publishing, New York, 2019)
6. B. Horlach, P. Drews, I. Schirmer, Bimodal it, Business-it alignment in the age of digital transformation, in *Multikonferenz Wirtschaftsinformatik (MKWI) 2016*, ed. by V. Nissen, D. Stelzer, S. Straßburger, D. Fischer (Universitätsverlag Ilmenau, Ilmenau, 2016), pp. 1417–1428
7. W. Goebl, Foundations of the architectural thinking framework, Aug. 9, 2018 [Online]. Available: https://architectural-thinking.com/wp-content/uploads/2018/09/Foundations-of-Architectural-Thinking.pdf (visited on 03/12/2021)
8. R. Winter, Architectural thinking. Bus. Inf. Syst. Eng. **6**(6), 361–364 (2014)