

Enterprise architecture artifacts facilitating digital transformations' strategic planning process

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ENTERPRISE ARCHITECTURE ARTIFACTS FACILITATING DIGITAL TRANSFORMATIONS' STRATEGIC PLANNING PROCESS

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ABSTRACT

The exploitation of new value propositions enabled by disruptive digital technologies—also known as digital transformations—influences firms' configurations of people, processes, and technology and must be considered in the enterprise's strategy. Strategic planning, i.e., the process that determines strategy, is facilitated by enterprise architecture (EA). Hence, strategic plans are reflected in EA documents called artifacts. Our objective is to construct an overview of essential EA artifacts that are used to facilitate the strategic planning process for digital transformations. Therefore, we analyzed popular EA sources, performed a systematic literature review, and organized an expert session using the Metaplan method. Building on EA's current knowledge, we propose 15 EA artifacts that facilitate digital transformations' strategic planning process.

KEYWORDS

Enterprise Architecture, Digital Transformation, Strategic Planning, Artifacts, Frameworks

1. INTRODUCTION

Integrating and exploiting new digital technologies into an organization's value propositions as a response to digital disruption requires organizations to leverage digital capabilities (Ross, Beath, & Mocker, 2019; Vial, 2019). These digital capabilities are delivered using digital technologies. Furthermore, new digital technologies, such as analytics, cloud, Internet of Things, cyber-physical, and related technologies, present both game-changing opportunities and existential threats (Sebastian et al., 2017). Digital transformation (DT) is a process that aims to create new value propositions by triggering significant changes to the properties of an organization through combinations of information, computing, communication, and connectivity technologies (Vial, 2019). In other words, DT defines value propositions made possible by the capabilities of digital technologies (Ross et al., 2019). The enterprise architecture (EA) is affected by strategic initiatives that utilize these technologies for DTs (Ahlemann et al., 2012). Therefore, EA's practice attempts to bridge the gap between strategic planning and implementation efforts (Bernard, 2012; Gong & Janssen, 2019; Kotusev, 2018; Radeke, 2011; Simon, Fischbach, & Schoder, 2014). EA artifacts are used to facilitate transformations by describing the enterprise from an integrated business and IT perspective. EA artifacts are documents that describe the fundamental organization of an enterprise as a socio-technical system, along with the principles governing its design and development (Ahlemann et al., 2012).

However, until today, EA has had a strong framework orientation. Very little is known about the practices that are used and followed, how well they fit with their purposes, what the challenges are, and how different stakeholders act in successful EA practices (Gong & Janssen, 2019; Kotusev, 2018). Moreover, our theoretical and practical understanding of how EA can be leveraged to create business value for firms remains limited (Van de Wetering, 2020). Popular frameworks, such as The Open Group Architecture Framework (TOGAF) (The Open Group, 2018) and the Department of Defense Architecture Framework (DoDAF) (United States Department of Defense [DoD], 2010) introduce EA artifacts but give no insight into which EA artifacts are fundamental for facilitating DTs.

A major problem seems to be the absence of empirically validated best practices for EA artifacts (Gong & Janssen, 2019; Kotusev, 2018; Roth et al., 2013). Kotusev (2018) essentially invalidates the conceptualization of EA as a set of business, information, application, and technology architectures and the conceptualization of EA as a current state, future state, and transition roadmap. Hence, framework conceptualizations, such as TOGAF and DoDAF, contradict empirical evidence from numerous established EA practices (Kotusev, 2018). Overall, there is a scarcity of studies that provide a clear, up-to-date description of EA artifacts—such as repositories, maps, objects, or models—and which elucidate the use of these artifacts.

Additionally, there is a call for a reconceptualization of EA that should focus on new realistic models that align with genuine industry best practices (Kotusev, 2018) and fill the research gap on leveraging EA for DTs (Hafsi & Assar, 2016). Our research aims to understand the set of EA artifacts that are used by organizations to support the strategic planning process for DTs. Moreover, we want to establish the purposes for creating EA artifacts, and how they are used. Therefore, our research aims to explore and synthesize current knowledge on EA artifacts that facilitate DT's strategic planning process. Thus, our research question is as follows:

RQ: What is currently known about EA artifacts that facilitate the strategic planning process for digital transformations?

We analyzed popular EA sources, conducted a systematic literature review, and organized an expert session as an initial empirical validation of the results of our synthesis of popular EA sources and the literature review.

This paper is structured as follows. First, in Section 2 we give more background information about our research subject. Next, Section 3 describes the methodology for our study. We present and discuss the results in Section 4. Then, Section 5 provides a discussion on the implications for practice and theory. Finally, Section 6 presents our conclusions, limitations, and suggestions for future research.

2. BACKGROUND

EA is a collection of documents describing an organization from an integrated business and IT perspective (Bernard, 2012; Kotusev, 2018). EA documents, also known as EA artifacts, describe the EA in its current, future, or transition states. Additionally, these artifacts can contain principles, and they always serve a purpose (Bernard, 2012; Kotusev, 2018; The Open Group, 2018). Examples of EA artifacts are landscape diagrams, catalogs with principles, solution designs, and application/data matrixes. EA artifacts are the products of an EA practice (Kotusev, 2018). An EA practice delivers EA artifacts to facilitate strategic planning, technology optimization, project delivery, and operations to achieve business-IT alignment (BITA) (Kotusev, 2018). With this, we define BITA as a state where IT is applied in an appropriate and timely way (Luftman & Kempaiah, 2007). Thus, EA artifacts are used to align strategic business objectives with state-of-the-art technologies (Ross, Weill, & Robertson, 2006; Van de Wetering, 2020).

A business strategy promotes creating future competitive advantage faster than one's competitors (Johnson, Scholes, & Whittington, 2008). Generally, the business strategy's strategic function can be divided into strategy planning, strategy implementation, and strategy evaluation (Ahlemann et al., 2012; Simon et al., 2014). The goal of the strategy planning process, in particular, is to formulate the long-term future course of action (Ahlemann et al., 2012; Kotusev, 2018; Simon et al., 2014).

EA-based capabilities are the capabilities that organize and use organization-specific resources to align strategic objectives with the use of technology (Kotusev, 2018; Van de Wetering, 2020). In other words, EA-based capabilities promote BITA and do so by producing EA artifacts that facilitate decision-making about standardizing processes, integrating data, standardizing applications, and standardizing the IT infrastructure (Ross et al., 2006; Van de Wetering, Kurnia, & Kotusev, 2020). However, DTs concern changes that are so fast that traditional EA-based capabilities cannot cope with them (Drews, Schirmer, Horlach, & Tekaath, 2017). The current digital technologies and DTs era has created a marketplace that demands speed and flexibility (Ross et al., 2019). Hence, there is an apparent tension between standardization and flexibility. For this reason, two types of EA-based capabilities have emerged: specifically, a traditional type and a fast type (Drews et al., 2017; Ross et al., 2019). However, it is unclear how digital transformation changes EA artifacts' role (Korhonen & Halén, 2017). Moreover, studies, such as (Kotusev, 2020), state that it is implausible that EA is based on strategy.

3. METHOD

In line with our research question's breadth, we used a broad range of sources to establish a list of EA artifacts that facilitate DTs' strategic planning process. First, we analyzed popular EA sources. Next, we performed a systematic literature review (SLR), and finally, we organized a Metaplan session with experts to deepen our understanding of the literature review results. Our method's goal was to synthesize existing knowledge, identify gaps in current research, and provide a background to appropriately position new research activities (Kitchenham, 2007) on EA artifacts that facilitate DTs' strategic planning process.

As a starting point, we used the following popular EA sources: Zachman (1987), Spewak and Hill (1992) Van den Berg and Van Steenberg (2004), Ross et al., (2006), DoD (2010), Bernard (2012), United States Office of Budget and Management [OMB] (2013), and The Open Group (2018). We analyzed these popular EA sources and synthesized twelve EA artifacts we believe are relevant for the strategic planning process for DT's.

Following the analysis of popular EA sources, we performed an SLR. Therefore, we used online database searches in scientific databases and assumed that the major research results in books and reports are also usually described or referenced in scientific papers. We used the ACM Digital Library, AIS, EBSCO Host, IEEE Xplore, Science Direct, Springer Link, and Web of Science databases to perform our search. These seven databases provide access to many journals and publications with a high rating in ranking lists and include the essential articles from journals and proceedings. The AISel database, for instance, focuses mainly on scholarly publications, and the contents of IEEE Xplore tend to be more focused on practice. We generated search terms based on the research question. Next, we paired the search terms to create appropriate search strings. This led to the search strings "enterprise architecture" AND ("artifact" OR "document"), "enterprise architecture" AND "strategic planning," "enterprise architecture" AND "digital transformation", and "digital transformation" AND "strategic planning." Finally, we performed a title search on the four strings in Google Scholar to determine if we had covered all the relevant articles. The search was conducted between December 7, 2019, and December 13, 2019. The selection of studies was performed through the following processes. First, we performed a search in the databases to identify relevant studies. We performed the database search in the title, keywords, and abstract fields, except Google Scholar, where we only searched the titles. This search resulted in 1,080 articles for the next step in the process. Second, we removed duplicate studies. Third, we excluded irrelevant studies based on an analysis of their titles and if titles were not in English. We scanned all article titles for the likelihood of containing relevant information as described in the inclusion criteria. Fourth, we excluded irrelevant studies based on the analysis of their abstracts, introductions, and conclusions. We scanned all abstracts, introductions, and conclusions of the articles that were still included after the previous step for their likelihood to contain relevant information described in the inclusion criteria. Fifth, we evaluated the selected studies based on a full-text read. Finally, we obtained the primary studies that resulted after the fifth step. Moreover, we evaluated each paper, using questions to assess quality in qualitative research suggested by Mays and Pope (Mays & Pope, 2000). Our explorative research aims to establish a set of EA artifacts that can be used to facilitate the strategic planning process for DT. Each paper was evaluated by reviewing the clarity of the research aims and objectives, design of the research, research process, data display concerning the interpretations and conclusions, and appropriateness of the method. Finally, 39 articles remained after the quality assessment. From these 39 articles, we extracted the source and full references, EA artifacts listed in the article, strategic planning process characteristics, and DT characteristics. We extracted the data by identifying text segments that were related to the research questions. Next, we adapted the steps for thematic synthesis, as recommended by Cruzes and Diba (Cruzes & Dyba, 2011), to analyze the extracted data. First, we read each article; then, we identified specific text segments that could be relevant for answering our research question; next, we labeled the text segments; and after that, we reduced overlap and translated codes into themes. Finally, we analyzed the themes and linked them with our relevant theoretical theme families, i.e., strategic planning, digital transformation, EA, and EA artifacts. The SLR did not result in any additional EA artifacts, but it did add to our understanding of the relation between the different EA artifacts and the strategic planning process for DTs.

As an initial empirical validation and to further deepen our knowledge of EA artifacts, we conducted an expert session using the Metaplan method (Metaplan, 2009). The Metaplan method is a card sorting technique based on a group discussion that facilitates a structured classification process. The team that performed the Metaplan session consisted of a full professor, an associate professor, two Ph.D. candidates,

and three Master's students who are all highly knowledgeable in the area of EA. Before the session, we prepared a document to inform the participants of the session's goal and give background information on the subject and the literature review findings. The session itself was divided into the following phases: (1) Describe the goal. (2) Present the findings of the literature review. (3) Brainstorm EA artifacts that facilitate DT's strategic planning process (4) Determine a final list of EA artifacts. (5) Recap and conclude. The Metaplan session resulted in three additional EA artifacts and, additionally, we agreed to rename an artifact in line with the participants' practical experience.

4. RESULTS

4.1 EA Artifacts from Popular EA Sources

The list of EA artifacts that follows is the result of our analysis and synthesis of popular EA sources. We synthesized a total of 12 different EA artifacts that facilitate the strategic planning process for DTs and briefly describe their goal and use here.

Future development will be affected by the anticipation of emerging technologies, software/hardware products, and skills expected to be available in a given time frame. The purpose of the **technology and skills forecast** artifact is to facilitate the reduction of dependence on legacy systems and technologies, to improve the technical efficiency and reliability of the IT landscape, to make use of newly available possibilities, and to serve as input for SWOT analyses (DoD, 2010; Bernard, 2012; OMB, 2013; Kotusev, 2018).

A **SWOT analysis** is a view of the organization's position in terms of strengths, weaknesses, opportunities, and threats to provide a foundation for the strategic plan (Bernard, 2012; OMB, 2013). This analysis analyzes internal and external factors to determine areas the enterprise should focus on to exploit strengths and take advantage of opportunities and areas where the enterprise should reduce threats and remove weaknesses (Bernard, 2012).

A **strategic plan** is a document containing the mission, vision, and strategic goals of an organization (Zachman, 1987; Spewak & Hill, 1992; DoD, 2010; Bernard, 2012; OMB, 2013; Kotusev, 2018; The Open Group, 2018). The overall vision for transformational endeavors provides a strategic context for digital transformation with a high-level scope. Furthermore, the strategic plan facilitates conceptual consistency between general business and IT directions. It also presents the composition of and relationships among organizational performers (organization model), business drivers, and competitor analysis. Thus, the strategic plan serves as input for a high-level operational context and a business function development plan.

A **high-level operational concept** is a high-level graphical and/or textual description of the future state of the operational concept, including the organizational context, role, or other relationships among organizations (Zachman, 1987; Spewak & Hill, 1992; Van den Berg & Van Steenberg, 2004; Ross et al., 2006; DoD, 2010; Bernard, 2012; OMB, 2013; Kotusev, 2018; The Open Group, 2018). This is a one-page picture with a high-level view of processes, data, and technologies. It is used mostly to plan the implementation of new solutions and their integration into the current environment, and it is periodically updated to reflect the evolution of the organizational landscape—for example, after new IT systems are deployed. It provides a common context for discussions between business and IT leaders and facilitates strategic dialog and alignment. Furthermore, a high-level operational concept helps architects understand, analyze, and modify the enterprise landscape structure.

A **capability development plan** provides structured views of all organizational business capabilities on a single page, sometimes together with other supporting information such as business strategy, objectives, main customers, and partners (Spewak & Hill, 1992; DoD, 2010; Kotusev, 2018; The Open Group, 2018). The purpose of this artifact is to facilitate the alignment of strategic business goals with priorities for IT investments and thereby improve strategic business and IT alignment.

The purpose of an **operating model** is to determine the necessary level of business process integration and standardization for delivering goods and services to customers (Ross et al., 2006). An operating model describes how a company aspires to thrive and grow by providing a more stable and actionable view of the company than strategy. The operating model drives the design of the foundation for execution.

Common or infrastructural components are tackled by joint developments that deliver results to specific capabilities. To be able to do this, a form of overall enterprise architecture is needed in the form of an **enterprise portfolio** (Zachman, 1987; Spewak & Hill, 1992; Van den Berg & Van Steenbergen, 2004; Bernard, 2012; OMB, 2013; Kotusev, 2018; The Open Group, 2018). An enterprise portfolio provides information about the architecture as a whole, including interrelations among the involved components. This artifact aims to align developments based on the content of the developments, control the duplication and reuse of IT assets, and facilitate the analysis of the IT landscape and its overall organizational fitness.

A **conceptual data model** contains abstract definitions of the main data entities that are critical for an organization's business and their relationships (Zachman, 1987; Spewak & Hill, 1992; DoD, 2010; Kotusev, 2018; The Open Group, 2018). The purpose of this artifact is to achieve better global data consistency and uniform handling of information in all IT systems.

Principles and guidelines are high-level global guidelines that influence all decision-making and planning in an organization and IT-specific implementation-level prescriptions applicable in narrow technology-specific areas or domains (Kotusev, 2018; The Open Group, 2018). This artifact facilitates the reuse of proven best practices and reduces the general technical complexity of the IT landscape. Additionally, principles and guidelines promote consistent approaches to IT and facilitate better conceptual homogeneity of IT-related decision-making.

A **security and privacy plan** provides both high-level and detailed descriptions of the security program that is in effect throughout the enterprise (Bernard, 2012; OMB, 2013). This includes physical data, personnel, and operational security elements and procedures. It constitutes a description of the agency's enterprise security and privacy programs, policies, and procedures. The purpose of this artifact is to improve security, compliance, and overall conceptual consistency.

A **stakeholder communication plan** is a plan which elaborates the "what, when, how, and by whom" relating to communicating about architecture in order to facilitate correct, complete, and timely communication with all relevant stakeholders (Van den Berg & Van Steenbergen, 2004; The Open Group, 2018). The purpose of this artifact is to foster effective communication of targeted information to the right stakeholders at the right time.

A **technology standards list** is a list of all technologies used in an organization. It includes generic reusable solutions to commonly occurring problems in the design of IT systems (Spewak & Hill, 1992; DoD, 2010; Bernard, 2012; OMB, 2013; Kotusev, 2018; The Open Group, 2018). This artifact aims to reduce technical risks and heterogeneity of the IT landscape, achieve better technological consistency, and reduce the complexity of the IT landscape.

4.2 SLR Results

Although the SLR did not lead to any additional EA artifacts, it did produce insights into the strategic planning process for DT's and its relation to EA practice processes. We synthesized the strategic planning process for DTs based on Johnson et al. (2008), Ahlemann et al. (2012), Simon et al. (2014), Chanas, Myers and Hess (2019), Ross et al. (2019) and Vial (2019). This process starts sensing disruptions, followed by creating or adjusting the digital transformation strategy and ends with conceptualizing digital transformations. Furthermore, to enable development teams to do their work, they need a governance framework describing decision rights and accountabilities, insights into stakeholders, technological standards, a conceptual data model, and security and privacy guidelines. The EA practice processes are based on Drews et al. (2017), Korhonen and Halén (2017), Sebastian et al. (2017), and Chanas et al. (2019). Three EA practice processes facilitate the strategic planning process for digital transformation. The first EA practice process is surveillance, technology watch, and business watch. This process leverages technology to sense and make sense of information to support and facilitate a strategic response. This first EA practice process is achieved through technology and business foresight, continuous supervision of signals, identification of events, data synthesis, and evaluation (Drews et al., 2017; Korhonen & Halén, 2017). The surveillance, technology watch, and business watch process facilitates sensing disruptions and delivers input for creating or adjusting a DT strategy. The second EA practice process is impacting analysis and simulations. This EA practice runs impact analyses and simulations on hypothetical change scenarios (Chanas et al., 2019; Korhonen & Halén, 2017). This process facilitates the design aspect of creating or adjusting a DT strategy and conceptualizing DTs. Finally, the third EA practice process is distributed

decision-making facilitation. Rules, guidelines, and principles support decision-making to make flexible use of promising and unexpected opportunities as they present themselves (Drews et al., 2017; Korhonen & Halén, 2017; Sebastian et al., 2017). This process facilitates the decision-making aspect of creating or adjusting a DT strategy and conceptualizing DTs.

4.3 Metaplan Session Results

The Metaplan session resulted in an adjustment of the name of an EA artifact and three additional EA artifacts.

The participants of the Metaplan session agreed that in practice, the term ‘function’ is more common than the term ‘capability’. Therefore, we changed the name **capability development plan** to the **business function development plan**.

Furthermore, we added the **impact and risk assessment** EA artifact. New facts may come to light that invalidate existing aspects of the architecture. This EA artifact assesses the current EA to identify changes that should be made and its implications to identify an architectural adjustment’s impacts and risks. Risks can be regarded to be additional constraints on the architecture engagement—for example, upcoming organizational changes, other programs and initiatives running in parallel, or the use of unproven technology.

Moreover, a **governance structure document** specifies decision rights and accountability to encourage desirable behavior (Ross et al., 2006). We did not recognize this EA artifact to be relevant for the strategic planning process for DTs due to our literature review. However, the Metaplan session participants proposed to include this EA artifact because of the importance of transparency in decision rights and accountability.

Finally, the **services and products overview** maps the lifecycle of each revenue-producing service or product that the enterprise produces for business lines that support one or more phases of the service/product life cycle. We did not recognize this EA artifact to be relevant for the strategic planning process for DTs as a result of our literature review. Nonetheless, the Metaplan session participants proposed this EA artifact because this overview allows the enterprise to see where the vertical and horizontal (crosscutting) business service/product activities are located and help define ownership of those processes.

5. DISCUSSION: IMPLICATIONS FOR PRACTICE AND THEORY

Driven by the call for a reconceptualization of EA, this study shows how EA practice and EA artifacts can facilitate DTs’ strategic planning process. In doing so, we make various substantial contributions to the information systems practice and literature.

A SWOT analysis and technology and skills forecast can help with sensing disruptions. Moreover, these two artifacts deliver input for creating or adjusting a DT strategy.

Furthermore, the DT strategy, which is created in the DT strategy creation or adjustment sub-process as part of the strategic planning process, is assumed to consist of a strategic plan, a high-level operational concept, and a business function development plan. Also, an impact and risk assessment help to make explicit the impact and risk of DTs. The EA artifacts that are outputs of the DT strategy creation or adjustment sub-process guide developers by providing them with boundaries. Moreover, these four artifacts are products of the impact analysis and simulation EA practice process and provide input for the DT conceptualization sub-process from the strategic planning process.

Finally, the majority of EA artifacts facilitate distributed decision-making to enable development teams to conceptualize DTs. The enterprise portfolio facilitates alignment among different development teams. Moreover, principles and guidelines provide best practices and help to manage the complexity of the IT landscape. Additionally, the governance structure provides clarity on who can make any particular decisions. Furthermore, the conceptual data model assures the enterprise-wide use of the right data definitions. Besides, the security and privacy plan delivers the security and privacy rules to which the development team needs to adhere. The services and product overview informs teams about who owns which services and or products.

Moreover, the technology standards are a toolbox for developers, which they can use. Subsequently, the stakeholder’s communications plan helps to involve the right stakeholder at the right time. Hence, all the EA artifacts from the distributed decision-making facilitation process contribute to conditions that enable emergent, bottom-up strategic planning. Table 1 summarizes the EA practice processes and the EA artifacts they produce.

Table 1. EA practice processes related to the EA artifacts they produce

EA practice process	EA artifacts
Surveillance, technology watch, and business wat	1. SWOT analysis 2. Technology and skills forecast
Impact analysis and simulations	1. Business function development plan 2. Operating model 3. High-level operational concept 4. Impact and risk assessment 5. Strategic plan
Distributed decision-making facilitation	1. Conceptual data model 2. Enterprise portfolio 3. Governance structure 4. Principles and guidelines 5. Security and privacy plan 6. Services and products overview 7. Stakeholder communication plan 8. Technology standards

6. CONCLUSIONS AND LIMITATIONS

Our research on EA artifacts that facilitate DTs' strategic planning process highlights a fragmented body of literature. Our findings underline the changing role of EA to support fast IT provisioning with a fast EA-based capability that co-exists with the traditional EA-based capability. Based on a discussion of DTs' strategic planning process, we proposed a strategic planning process for DTs. The strategic planning process senses disruptions creates or adjusts the DT strategy, and conceptualizes DTs. Additionally, founded on a broad range of EA artifacts sources, we presented a list of EA artifacts that facilitate DT's strategic planning process. The list of 15 EA artifacts can be used as a guideline to facilitate the strategic planning process for DTs. Moreover, we derived three EA practice processes that facilitate strategic planning for DTs. These three processes have been related to the strategic planning process, providing insight into EA practice processes' facilitating role for DTs' strategic planning process. Finally, we related the EA artifacts with the EA practice processes that produce them.

We believe the initial set of EA artifacts and the proposed EA practice processes may serve as a basis for future empirical studies. Consequently, this study has a limitation in that only the Metadata session participants empirically validated the EA artifacts and EA practice processes. Thus, despite using a large body of literature and validation of results by an expert team, future research needs to examine the real, practical value of our results.

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