

MASTER'S THESIS

Enterprise Architecture Information during an organization's Digital Transformation: an empirical case study

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Enterprise Architecture Information during an organization's Digital Transformation: an empirical case study

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Abstract

Digital Transformations (DT) are continuous business transformations enabled by digital technologies. These changes are disruptive because they are discontinuous, unpredictable, and faster than organizations can respond. This leads to nonroutine, fundamental, and radical changes. During the Strategic Planning Process (SPP), organizations find ways to deal with these disruptions. The insights provided by Enterprise Architecture (EA) information enables decision-makers to formulate a suitable answer to the disruptions caused by DTs. However, it is still unclear which EA information is needed to fulfill the information needs of the SPP of DTs. Therefore, a systematic literature review, a case study with seven interviews, and document analysis were carried out to fill this knowledge gap. This research defined an SPP for DT, identified the purpose of empirically required and used EA information components, and identified the EA information components per artifact type. This study showed that the SPP for DTs is an unstructured process in terms of process phases and activities that go criss-cross. Furthermore, this study showed the purpose and found the usage of the information components technology target, environmental analysis and impact analysis, capabilities, requirements, deliverables, solutions and solution ideas, general trends and developments, market demands, priorities, and budgets and budget allocation.

Key terms

Digital transformation, strategic planning process, enterprise architecture, enterprise architecture artifacts, enterprise architecture information

Summary

This research investigated via a case study and document analysis what EA artifact information is used for which purpose during the Strategic Planning Process (SPP) of an organization’s Digital Transformation (DT). The reason for research is the knowledge gap in the existing literature about which EA information is needed to fulfill the information needs of the SPP of DTs. During the SPP, organizations must find ways to deal with the disruptions caused by DT. The insights provided by EA information enables decision-makers to formulate a suitable answer to the disruptions caused by DTs.

First, this research identified an SPP for DT. This process is described in Figure 1.

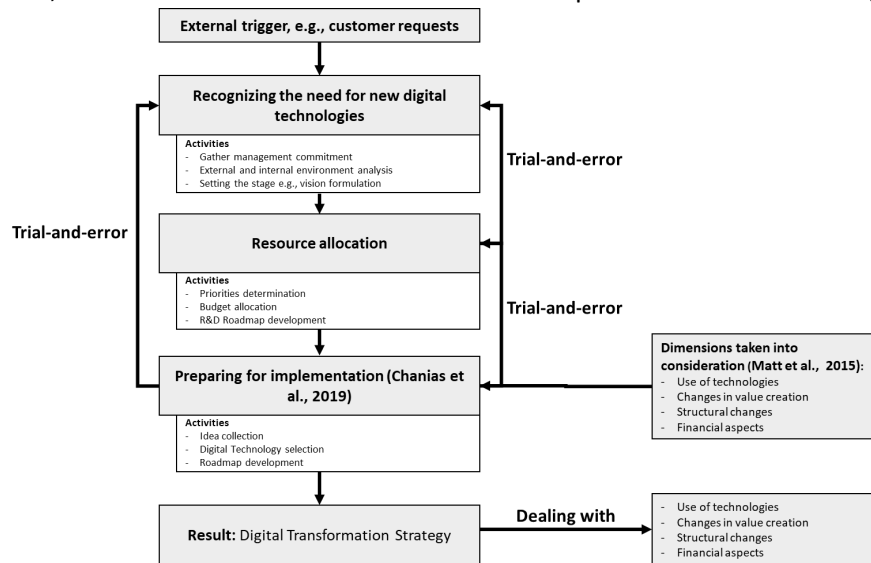


Figure 1 strategic planning process for digital transformations

Second, **Error! Reference source not found.** describes the purpose of the case organizations’ required and used information components during the SPP. The required information consists of both used information and missing information that could have been relevant during the SPP. A gap was identified between both the required and used information.

Table 1 Information purpose, need and usage

Information component	Purpose	Required	Used
Transformation benefits	Insight into the earning potential is used as an important decision criterion for determining how aggressive must be invested in a specific theme.		
Environmental information	Needed to determine where to focus on, what to do and what not to do. Should give insight into important key players, what is going on in the market, and what customers want to pay for specific solutions.		
Vision, mission, and strategy	Relevance assessment of a specific DiTe. Used for determining and aligning required actions for the SPP, and determining where and where not to play.		
Goals descriptions	Relevant for guidance during DT and knowing what and what not to do.		
Technology target	Used to get a clear image of the future situation and to visualize the set-up to get clear where everybody was talking about.		
Environmental analysis and impact analysis	Used to determine what is happening in the market and what the possible impact on the organization will be in a specific situation.		
Capabilities	Used to decide what type of capabilities should be acquired and what capabilities already are in place within the organization.		
Requirements	Used to select a specific DiTe. Type of requirements were mostly functional and non-functional requirements. Little attention was paid to IT requirements.		
Deliverables	Used to get insight into deliverables of the transformation project which was input for allocating and dividing allocated budget within the project.		
Solutions and solution ideas	Insight into the different solution types used during the selection of DiTe.		
General trends and developments	Used to assess and confirm a certain strategy that was chosen during the SPP.		
Market demands	Used to express the urgency and transformation need.		
Priorities	Used to express the urgency and transformation need.		
Budgets and budget allocation	Used to determine in what aspects of the DT can be invested and how much budget is available		

Third, Table 2 compares the theoretical and empirical EA information components per EA artifact and the purpose of the EA artifacts. It was decided to include all the identified information components. For some of the used EA artifacts use, the purpose is assumed based on the content if possible because it was not mentioned during interviews. The empirical results showed a total of 24 artifacts representing six different artifact types.

Table 2 Comparison between empirical and theoretical EA artifacts

EA Artifact	Empirical EA information	Theoretical EA information	Empirical EA artifact purpose	Theoretical EA artifact purpose (Grave, van de Wetering, & Kusters, 2021; Kotusev, 2019a; Kurnia et al., 2020)
Strategic Plan	<ul style="list-style-type: none"> - Strategy - Market demands - Mission - Vision - Financial aspects - Targets - Actions/important steps - Portfolio 	<ul style="list-style-type: none"> - Consistent goal description 	Sub-strategy for service only, no clear relation with organizational strategy. Primarily focused on market potential/situation, new product portfolios with the use of data and DiTe, and strategic actions. Document used during the first phase of the SPP for getting commitment and confirming the urgency. Usage during rest of SPP unclear.	Assessing if DiTe possibilities are in line with the organizational mission, vision, and strategic goals.
Roadmap (conceptual, financial)	<ul style="list-style-type: none"> - Strategy - Targets - Actions/important steps - Portfolio - Roles & Responsibilities - Planning - Deliverables - Dependencies between projects - Budgets - Budget allocation 	<ul style="list-style-type: none"> - Important steps - Dependencies between projects 	Strategy and targets for extension of the market with strategic actions and focus on where and where not to play. Total R&D budgets and budget allocation per R&D project, roles & responsibilities involved in the project, and set-up of remote support and planning of activities. Primarily used for budget allocation and identification of steps that have to be carried out and the who belongs to those actions.	Alignment, traceability, and linkage between business strategy and DTS. Gives insight into plans/schedules and required resources. Conceptual because dimensions of Figure 4 can be conceptual.
Analytical reports	<ul style="list-style-type: none"> - Trends - Important considerations - Growth markets - Success factors 	<ul style="list-style-type: none"> - Business Requirements 	Consisted of trends. Primarily used for the confirmation of a chosen strategy and as input for new ideas.	Identification of DiTe trends and assessment of the disruptive influence of recent technological opportunities.
Initiative proposals	<ul style="list-style-type: none"> - Roles & Responsibilities - Budget allocation - Planning - Deliverables - Important steps - Priorities - Budgets 	<ul style="list-style-type: none"> - Benefits of transformation 	Consists of priorities, available budget and allocated budget, and roles & responsibilities involved in the project and qualitative business need. Assumed that this was used to propose a specific direction.	Used to assess the potential business value of proposed DT initiative(s).
Conceptual architecture	<ul style="list-style-type: none"> - High-level technology overview - Architecture 	<ul style="list-style-type: none"> - Solution ideas (scenarios) 	This document contains conceptual high-level technical overviews of remote access primarily focusing on equipment to use. Consisted of different IT architecture possibilities both mentioned with pros and cons. Assumed that this was used for selecting DiTe.	Provide transparency, benefits and possible risks of different architectures, and a high-level overview of proposed initiatives. Is used to improve decision-making.
Solution design	<ul style="list-style-type: none"> - Requirements for remote access - Solutions 	<ul style="list-style-type: none"> - Important steps 	Consisted of different types of requirements and solutions, i.e. equipment that can be used. Also, explains why a specific cloud solution will be used. Used to decide on what DiTe to choose.	Used at implementation (preparation) stages of initiatives to deliver (IT) solutions.

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1. Introduction

1.1. Background

Continuous business transformations enabled by digital technologies (DiTe), such as social, mobile, analytics, and cloud are called Digital Transformations (DTs) (Sebastian et al., 2017; Van de Wetering, 2020; Vial, 2019). These changes are a series of disruptions because they are discontinuous, unpredictable, and faster than an organization's response, leading to nonroutine, fundamental, and radical changes (Korhonen & Halén, 2017; Labusch, Aier, & Winter, 2014). During the Strategic Planning Process (SPP), organizations must find ways to deal with these disruptions by innovating with combinations of technologies to drive better operational performance (Vial, 2019). The insights provided by Enterprise Architecture (EA) information enables decision-makers to formulate a suitable answer to the disruptions caused by DTs.

1.2. Exploration of the topic

Vial (2019) describes DT as a process where disruptions are created by DiTe forcing an organization to a strategic response to alter the value creation paths and dealing with the structural changes, organizational barriers, and positive and negative impacts of DT. The use of these technologies results in a series of disruptions, e.g., altering consumer behavior and expectations, changes in competitive landscape, and the increasing availability of data where an organization (strategically) has to deal with (Vial, 2019). These organizational changes are a type of Enterprise Transformations (ET) (Labusch et al., 2014). DT touches an organization in the customer experience, operational processes, business model areas, and its people, resulting in changed products, organizational structures, and architectures, and process automation (Blomqvist, Halén, & Helenius, 2015; Kotusev, 2019a; Sebastian et al., 2017).

The changing business environment and disruptions caused by DT require a strategic response, forcing organizations to continuously change their market position (Ahlemann, Stettiner, Messerschmidt, & Legner, 2012; Vial, 2019). Successful DTs can only be completed with a Digital Transformation Strategy (DTS) embracing the implications of DT, defining the value proposition inspired by the DiTe, and coordinating and prioritizing the independent DT threats (Matt, Hess, & Benlian, 2015; Sebastian et al., 2017; Vial, 2019). During the SPP an organization prepares a response to the changing business environment by identifying new business opportunities and threats, formulating strategies to deal with threats and embrace the opportunities, translating these strategic alternatives into tactical plans and actions, and aligning the strategic direction with the use of DiTe (Ahlemann et al., 2012; Kotusev, 2019b; Van de Wetering, 2020). Dynamic organizational EA capabilities play an important role during the SPP because this indicates how an organization exploits its EA to share assets and recompose organizational resources to achieve the strategic objects and desired organizational state under a rapidly changing business environment (van de Wetering, 2019, 2020).

The SPP results in an organization-wide plan, i.e., a DTS, to accomplish the required transformations. During the SPP a clear picture and overview of the current organizational state are important for knowing an organization's limitations (Blomqvist et al., 2015; Niemi & Pekkola, 2019). However, information requirements can differ per type of ET (Labusch et al., 2014). EA can help by fulfilling these information requirements by providing insights into for example business structure, capabilities, and processes. Kotusev (2019a, p. 1) describes EA as *"a description of an enterprise from an integrated business and IT perspective intended to bridge the communication gap between*

business and IT stakeholders and improve business and IT alignment". EA is a means that facilitates organizational innovation and sustainability because EA practice bridges the gap between strategic planning and implementation (Korhonen & Halén, 2017; Kotusev, 2019b). Simply said, EA consists of multiple artifacts describing various organizational aspects providing relevant EA information for decision making (Kotusev, 2019a). The EA information facilitates decision-makers with formulating a suitable answer, i.e., a DTS, to the massive disruptions caused by DTs and to effectively deploy the dynamic organizational EA capabilities.

1.3. Problem statement

Little empirically validated research is available concerning EA artifacts value and effective use of EA during a DT (Blomqvist et al., 2015; Kotusev, 2019a; Kotusev, Singh, & Storey, 2015). EA's role in fast-moving environments has to change from a plan, define and control role to a more supportive/consulting role (Drews, Schirmer, Horlach, & Tekaat, 2017). Because of this fast-moving environment, Drews et al. (2017) argue that EA artifact information has to change very often, which according to Kotusev et al. (2015) already is a problem in practice because EA artifacts are already hard to develop and maintain. Additionally, Kotusev (2019a) and Kotusev et al. (2015) are not convinced about EA artifacts usage in practice, because much of the comprehensive lists of EA artifacts have never been validated empirically and usage of EA artifacts in practice is poorly understood. Kotusev (2019a) also mentions that informational contents of EA artifacts differ substantially from the provided descriptions in EA frameworks, e.g. TOGAF and that used artifacts differ per organization. Labusch and Aier (2014) have investigated the relationship between information availability and influence on ET success and Labusch et al. (2014) created an "ET reference information model" for giving insight into information requirements during ETs. However, this ET reference information model is not complete because the model has not been empirically validated. Because of the many roles involved during the SPP, it is unclear if all and/or which information requirements are applicable during the SPP of DTs (Labusch et al., 2014). However, no definitions of SPP for DTs have not been found in the literature which makes determining information requirements difficult (Matt et al., 2015).

To summarize, there is a significant need for empirically validated research focusing on EA's value during DTs. Additionally, there is no consensus on which EA information is valuable during the SPP because used EA artifacts, their informational contents, and information requirements during the SPP could differ per role/organization (Kotusev, 2019a; Labusch et al., 2014). This raises the question of which EA information is necessary as input for the formulation of a suitable answer to DTs. To conclude, the problem statement is as follows: it is unclear which EA information is needed to fulfill the information needs of the SPP of DTs.

1.4. Research objective and questions

Given the previously mentioned problem description, the goal of this research is to determine what EA information is used for which purpose during the SPP of DT. This goal results in the following main research question:

"What EA artifact information is used for which purpose in the strategic planning process of an organization's digital transformation?"

The following sub-questions will be used to answer the main research questions:

1. What is the SPP for DTs?
2. What are the required EA information components for the SPP of DTs?

3. How is the EA information used by the organization during the SPP of DTs?
4. How is EA information processed/used in the various EA artifacts?

1.5. Motivation/relevance

For researchers, this research tries to fill the knowledge gap of used EA information during the SPP for DTs. For practitioners, such as managers and (EA) architects, this research delivers useful insights into important EA aspects to be described for the SPP of DTs. It gives insights into what type of information is important during the SPP to make decisions and fully benefit from the advantages of successfully implementing the DTS. By having insight into relevant EA information organizations can better define a suitable DTS.

1.6. Main lines of approach

This thesis proceeds as follows. Section 2 describes the theoretical framework which discusses related research for DTs, SPP, and EA informational contents. The research method is described in section 3. Section 4 describes the main research results. In section 5, the research results are compared with the literature to draw conclusions and recommendations for further research.

2. Theoretical framework

A systematic review was carried out for literature selection for the theoretical framework. The main steps of this review were: formulate review questions, locate and generate a list of potentially relevant literature, select and evaluate literature based on inclusion criteria, analyze and synthesize the selected literature and report the results (Saunders, Lewis, & Thornhill, 2019). Paragraph 2.1 describes the first and second steps, the third step is described partly in paragraphs 2.1 and 2.2, and the fourth and fifth steps are described in paragraph 2.3.

2.1. Research approach

The research aim consists of three main concepts: DT, SPP, and EA information. This results in the sub-questions to be answered using the literature. What is already known in literature about:

1. SPP steps for DTs?
2. What EA information EA artifacts should consist of during the SPP for DTs?
3. Useful EA artifacts during the SPP for DTs?

Primarily, the Open Universiteit (OU) library and the AIS database were used for finding literature with the building blocks method. The OU library is used because of the extensive search function, allowing searching in different databases for collecting a diverse collection of literature. The AIS database was used because of the high-quality literature in the area of information systems. Furthermore, Google Scholar was used as an additional secondary database for collecting literature on specific themes with the forward snowballing method. Primarily, the Building Blocks method was used for finding relevant literature. On a trial-and-error basis, the main building blocks DT, SPP, EA, and Information were used to search for literature. Multiple synonyms were defined for the main building blocks to collect more diverse literature and were then combined into a search planning for defining search queries, see appendix 1. On a trial-and-error basis, both methods delivered seventeen relevant queries, all described in appendix 1.

This study searched for journal articles and conference proceedings. Journal articles because much attention is paid to detail and verification and conference proceedings because they can provide very specific information if the conference and research theme match (Saunders et al., 2019). A timeframe of ten years was used to find the most recent literature. Literature from IS, business, and economics-related subjects was used because the research is carried out on the intersection of IS and the main research concepts are mostly focused on strategic level (business) and environmental conditions (economics). For the forward snowballing method the article of Labusch et al. (2014) was used because little literature was found on information provision during organizational changes and this article is focused on that subject. Only this article was used because literature analysis proved enough diverse literature.

Saunders et al. (2019) mention adequate research method description and clear data analysis as inclusion criteria for literature selection. Literature written in English and literature relevant for answering the research question were added as extra inclusion criteria for better selection. Saunders et al. (2019) describe title, abstract and full-text evaluation as a process to assess the inclusion criteria. Two extra process steps were added for gaining a better impression of relevant literature, see Figure 3.

2.2. Implementation

Searching according the building blocks method delivered, including query results that did not deliver any relevant literature, 81.467 hits. Figure 2 shows the search queries.

Query	Hits	Library	Used Method
(Digital Transformation) AND (Strategic Planning Process) AND (Enterprise Architecture) AND (Information)	873	Open Universiteit (OU) library	Building blocks
(Business Transformation) AND (Strategic Planning Process) AND (Enterprise Architecture) AND (Information)	2113	Open Universiteit (OU) library	Building blocks
(Digital Transformation) AND (Strategy making) AND (Information)	9315	Open Universiteit (OU) library	Building blocks
(Digital Transformation) AND (Strategic Planning) AND (Enterprise Architecture) AND (Artifacts)	130	Open Universiteit (OU) library	Building blocks
(Digital Transformation) AND (Transformation Strategy) AND (Enterprise Architecture) AND (Information)	1499	Open Universiteit (OU) library	Building blocks
(Enterprise Transformation) AND (Transformation Strategy) AND (Enterprise Architecture) AND (Information)	3872	Open Universiteit (OU) library	Building blocks
(Enterprise Transformation) AND (Transformation Strategy) AND (Enterprise Architecture Management) AND (Artifact)	543	Open Universiteit (OU) library	Building blocks
(Organizational Transformation) AND (Strategic Planning) AND (Enterprise Architecture) AND (Artifacts Usage)	114	Open Universiteit (OU) library	Building blocks
(Digital Transformation) AND (Strategic Planning Process) AND (Enterprise Architecture) AND (Information)	1267	Association for Information Systems (AIS)	Building blocks
(Digital Transformation) AND (Strategy making) AND (Information)	5837	Association for Information Systems (AIS)	Building blocks
(Digital Transformation) AND (Transformation Strategy) AND (Enterprise Architecture) AND (Information)	1733	Association for Information Systems (AIS)	Building blocks
(Organizational Transformation) AND (Strategic Planning) AND (Enterprise Architecture) AND (Artifacts Usage)	257	Association for Information Systems (AIS)	Building blocks
(Digital Transformation) AND (Transformation Strategy) AND (Information)	11300	Open Universiteit (OU) library	Building blocks
(Digital Transformation) AND (Transformation Strategy) AND (Information)	6067	Association for Information Systems (AIS)	Building blocks
(Enterprise Architecture) AND (Strategic Planning)	24578	Open Universiteit (OU) library	Building blocks
(Enterprise Architecture) AND (Strategic Planning)	2441	Association for Information Systems (AIS)	Building blocks

Figure 2 Building Blocks method Search Queries

The “sort on relevance” function was used to generate a manageable amount of relevant literature. On a trial-and-error basis, the first 50 hits proved to deliver the most relevant literature based on title relevance evaluation. Literature above the first 50 hits had limited relation with the research concepts. Sometimes, the first 50 hits consisted of duplicate literature compared with other search queries. The forward snowballing method resulted in 37 hits, all used for the systematic review. Figure 3 shows the results after applying the inclusion criteria. In total sixteen articles were selected for this research, expanded with ten articles provided by the research supervisor (excluded from the literature selection). These 26 articles form the basis for the theoretical framework. Each of the 48 selected studies after the title

relevance evaluation, were collected in a literature matrix to gain an overview of the selected literature, see appendix 2. Depending on the selection for further analysis, more information was collected. Next, the selected studies were analyzed in-depth and all relevant information is retrieved and summarized in an overview to first code on relevant subjects and second to label each code by the different research building blocks, see appendix 3.

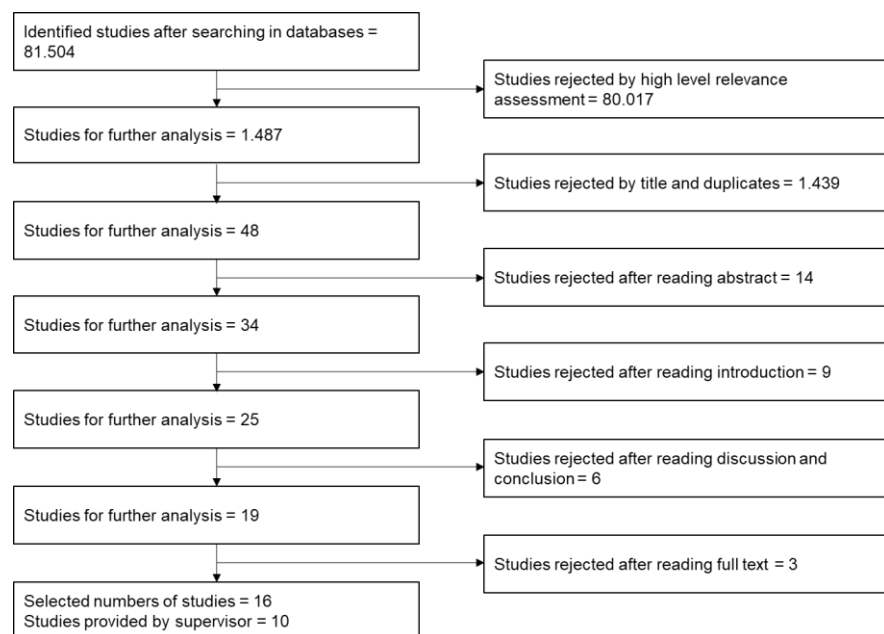


Figure 3 Systematic review flow

2.3. Results and conclusions

2.3.1. Strategic Planning Process for Digital Transformations

No definitions of SPP for DTs were found in the literature. Matt et al. (2015) specifically mentions a lack of specific guidelines for formulating, implementing, and evaluating a DTS. They describe the SPP for DTs as a strategy definition and decisions on future needed resources to accomplish a DTS but do not specify any of the different activities belonging to this process.

Azevedo, van Sinderen, Pires, and Almeida (2015), Peko, Dong, and Sundaram (2014), and Radeke (2011) describe SPP as organizational management activities focusing on creating, discussing, and evaluating different strategic options and future goals, and translating selected strategic options into strategic initiatives to describing what to do, why to do it, and how to do it, i.e., a DTS. Alternatively, Blomqvist et al. (2015) and Simon, Fischbach, and Schoder (2014) describe SPP as a process of different management stages such as strategy formulation (e.g., vision definition, external and internal assessments, and strategy comparison and selection), strategy implementation (e.g., objective formation, resource allocation, and implementation planning), and strategy evaluation (e.g. performance evaluation). The focus of SPP during this research is more on strategy formulation and strategy implementation planning.

Besides the lack of specific definitions of the SPP for DTs, Chanias, Myers, and Hess (2019) describe different phases of DTS formulation and implementation. Based on the different SPP definitions, a selection was made for phases that could indicate the SPP for DTs. These phases are summarized in Figure 4 included with the by Matt et al. (2015) described dimensions to be taken into consideration during DTS development. During this SPP the dynamic EA capabilities sensing, mobilizing, and transforming play an important role because this indicates how an organization exploits its EA to share assets and recompose organizational resources to achieve the strategic objects and desired organizational state under a changing business environment (van de Wetering, 2019, 2020).

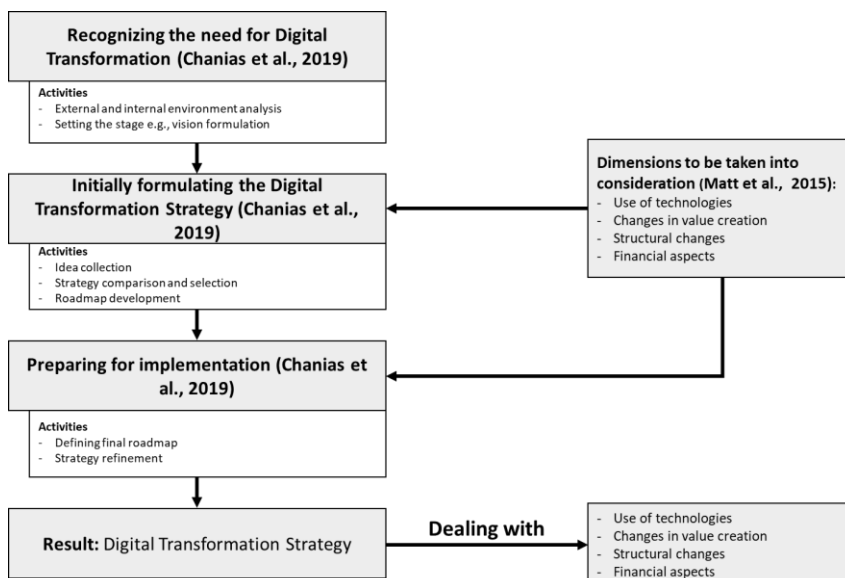


Figure 4 SPP for DT

2.3.2. EA information during the Strategic Planning Process for Digital Transformations

Different authors discuss EA's value during the SPP. EA information can help to provide the holistic overview that is required during the SPP and can support informed and coordinated decisions during ET (Korhonen & Halén, 2017; Niemi & Pekkola, 2019).

Blomqvist et al. (2015) and Niemi and Pekkola (2019) mention an important role for EA during internal and external assessments, strategy comparison, selection of strategic choices, and resource alignment. According to Radeke (2011) and Simon et al. (2014), EA supports strategic business and IT options assessment, strategic initiatives development and selection, updating of target architectures, ET readiness assessment, derivation of roadmaps, and assessing and prioritization of project portfolios. Azevedo et al. (2015) is skeptical about EA's value during SPP because of the lack of required information in current EA frameworks. However, he mentions an important role for EA during expressing goals relationships and its requirements, giving insight into required and current capabilities and resources, and required architectural transformations. To conclude, this research sees added value for EA during SPP for internal and external assessments, strategy comparison, selection of strategic choices, determining current and required capabilities, strategic analysis, readiness assessments, and implementation planning.

It remains unclear what EA information is necessary as input for formulating a DTS and what organizational aspects should be described to facilitate the SPP of DTs (Kotusev, 2019a; Kotusev et al., 2015; Matt et al., 2015). Appendix 4 describes the by Labusch and Aier (2014) researched information availability influencing ET success. Other authors recognized some of these information requirements. Hafsi and Assar (2016) mention stakeholder analysis for early identifying important key players. Radeke (2011) describes the importance of insight in the current architecture and the need for an overview with project interdependencies to prioritize and avoid conflicts. Dang and Vartiainen (2019), Gomes, Cruz, and Cruz (2019), and Simon et al. (2014) mention internal and external analysis to identify strengths, weaknesses, opportunities, and threats as important drivers and constraints of strategic choice. Interestingly, Labusch and Aier (2014) argue that no evidence is found for insight into organization capabilities, while Azevedo et al. (2015), Dang and Vartiainen (2019), Kurnia et al. (2020), Osmundsen, Iden, and Bygstad (2018), and Radeke (2011) mention insight in capabilities as important for knowing what the organization is capable of and what it should do to achieve the future state. Hafsi and Assar (2019) describe clear goals and roles as important during a DT.

To conclude, based on the analysis of EA's added value and the study of Labusch et al. (2014), strengthened by the findings in other studies, we defined, based on the ET type "strategic alignment", the information demands which EA could deliver. These demands were then linked to the different SPP phases based on Figure 4. Lastly, the study of Labusch and Aier (2014) was used to assess if the information EA could deliver, positively influences ET success, if yes, these information requirements were selected. This analysis results in Table 3.

Table 3 Information requirements per SPP phase

SPP Phase	ET reference model information demand (Labusch et al., 2014)	Information requirement influencing ET success (Labusch & Aier, 2014)
Recognizing the need for DT	Strategy	Consistent goal description
	Goals	Business Requirements
	Business Structure	Capabilities of the organization
Initially formulating the DTS	Goals	Important steps
	Design options	Solution ideas (scenarios)
	Business Structure	Processes
	Performance	Benefits of transformation
	Stakeholders	Stakeholders of the transformation
Preparing for implementation	Strategy	Important steps
	Project portfolio	Dependencies between projects

2.3.3. Useful EA artifacts during the Strategic Planning Process for Digital Transformations

EA information is captured in EA artifacts. EA artifacts can have different titles within different organizations with the same meaning (Kotusev, 2019a). Grave et al. (2021) argue for example technology and skills forecast and high-level operational concept, while the definitions of these artifacts have similarities with the by Kotusev (2019a) described Analytical Reports and Target state. See appendix 5 for the different EA artifacts titles with the same meaning.

Based on the results of Table 3, different articles were analyzed to find relevant EA artifacts for each SPP phase. The information requirements which EA can deliver per SPP phase and the activities belonging to that SPP phase were compared with the definitions of EA practice activities and artifacts belonging to those practice activities described by Kurnia et al. (2020). This research believes that the following EA practice activities of Kurnia et al. (2020) belong to the SPP of DTs: Business Capability Modeling, Road-mapping and Portfolio planning, IT asset management, Opportunity Assessment, Project Governance, and Communication and Coordination. Also, the analysis of EA artifacts' informational content and usage described by Kotusev (2019a) and Grave et al. (2021) was used to find relevant EA artifacts for the SPP phases. The selection of useful EA artifacts was done based on the EA information definitions by Labusch et al. (2014) and Labusch and Aier (2014) and the definitions and informational contents of EA artifacts by Kurnia et al. (2020), Kotusev (2019a), and Grave et al. (2021). This analysis results in Table 4.

Table 4 Used EA artifacts during the SPP for DTs

SPP Phase	Information requirement	EA artifacts	Authors describing EA artifacts			Relevance
			Kurnia et al. (2020)	Kotusev (2019a)	Grave et al. (2021)	
Recognizing the need for DT	Consistent goal description	Strategic Plan				Assessing if DiTe possibilities are in line with the organizational mission, vision, and strategic goals.
		Target states				
	Business Requirements	Analytical reports				Identification of DiTe trends and assessment of the disruptive influence of recent technological opportunities.
	Capabilities of the organization	Business Capability Models				Insight in current strategic business capabilities, useful to determine required future capabilities and prioritize them.
Initially formulating the DTS	Solution ideas (scenarios)	Options papers				Consists of various strategic directions based on internal and external assessment. Gives better clarity and transparency on possible business benefits and risks, used to improve decision-making.
		Conceptual architectures				Provide transparency, benefits and possible risks of different architectures, and a high-level overview of proposed initiatives used to improve decision-making.
	Processes	Landscape diagrams				Insight in current IT-landscape state and related limitations used to assess an organization's readiness for DT. Based on this analysis measures can be defined.
		Technology reference models				Used to select appropriate technologies for (IT) initiatives.
	Benefits of transformation	Initiative proposals				Used to assess the potential business value of proposed DT initiative(s).
	Stakeholders of the transformation	Stakeholder communication plan				Used to effectively communicate information to the right stakeholders at the right time relevant for the DT.
	Important steps	Conceptual Roadmaps				Alignment, traceability, and linkage between business strategy and DTS. Gives insight into plans/schedules and required resources. Conceptual because dimensions SPP can be conceptual.
Preparing for implementation	Important steps	Solution designs				Used at implementation (preparation) stages of initiatives to deliver (IT) solutions.
		Final Roadmaps				Same as explanation "conceptual roadmap". Final because SPP dimensions are finalized.
	Dependencies between projects					

2.4. Objective of the follow-up research

As described in the previous paragraph there is no clear definition of the SPP for DTs and it is unclear what EA information is described in EA artifacts. The main objective of this research is to explore what EA information supports the SPP for DTs and discuss the findings based on the theoretical framework. By empirically validating these elements we try to solve the following knowledge gap: it is unclear which EA information is needed to fulfill the information needs of the SPP of DTs.

3. Methodology

This chapter describes the research design, data analysis methods, and measures to assure validity, reliability, and ethical aspects.

3.1. Conceptual design

This research's goal is to determine what EA information is used for which purpose during the SPP of DT. This research's nature is exploratory and empirical research because the research question begins with "what". It is an open question to gain insight about a topic of interest, EA information during SPP for DT, and it focuses on EA information used in practice during the SPP for DT (Saunders et al., 2019).

For answering the research question, a case study was performed because it is carried out empirically and focuses on gaining in-depth insights about a topic of interest. According to Saunders et al. (2019), case studies are time-consuming and results are difficultly generalizable. Besides, a case study is a good research method for a mixed methods research design and for investigating a phenomenon within a real-life context, leading to rich empirical descriptions and theory development (Gelderman, 2013; Saunders et al., 2019). The research was carried out within one organization, consisting of one case with one unit of analysis to keep the research more manageable and because the SPP influences the organization as a whole, i.e., a holistic single case study approach (Saunders et al., 2019). The case was selected because the organization made decisions and still makes decisions for using new DiTe, e.g. cloud and analytics technologies, at least seven decision-making stakeholders were involved during the SPP for this DT, and the organization was willing to participate and to provide access to relevant documents. Selection criteria for interviewees were: decision-maker/influence in SPP for selected DT, voluntary participation, and no risk for negative consequences by research participation. The case and interview selection criteria are described in appendix 6 and the case is described in appendix 7.

3.2. Technical design

Research data was primarily gathered with semi-structured interviews. Semi-structured interviews are frequently used for the current research type because it provides important background for finding out what is happening in what context (Saunders et al., 2019). Semi-structured interviews were chosen because it allows going into depth at some points and following the same consistent approach for every interview which allows better comparison of the different interview results (Saunders et al., 2019).

To collect information relevant to the research theme, first, an interview guide was prepared to list topics and possible questions that will be covered in the interviews. This interview guide helped by identifying and testing relationships between the different research themes (Saunders et al., 2019). Second, interviews of approximately 60 minutes were carried out with seven interviewees. Third, triangulation was done by using secondary data to confirm the credibility of the collected research information (Saunders et al., 2019). This secondary data consisted of documents (EA artifacts), more specifically consisting of text data e.g. reports and files (Saunders et al., 2019).

3.3. Data analysis

The interviews were prepared for data analysis by transcribing. The thematic analysis approach described by Saunders et al. (2019) was used: become familiar with the data, code the data, search for themes and recognize relationships, and refining themes. Only the relevant sections were coded.

This study combined data-driven and theory-driven coding types. First, the relevant sections were labeled based on the content of an interview section. Second, those labels were linked to a specific code, i.e., “a priori” code, resulting from the literature, e.g., SPP, EA artifacts, and EA information. In the appendix, the codes can be found for coding the interviews. The same approach was repeated for the coding of the artifacts, but these are only coded on EA artifacts type and EA information because it was not possible to determine to what SPP activity they belong to. Also, a relevance check of the artifacts was carried out to select if they were used during the SPP. See appendix 8 for the coding categories of the interviews and artifacts.

A thematic analysis was carried out because this approach is suitable for finding patterns in the data and because data items are coded first before the search for interpretative themes begins, preventing shaping the direction of the research during the analysis (Saunders et al., 2019). Also, the thematic analysis is not tied to a particular research philosophy which makes it more flexible than other analysis types. A risk of this analysis is information usage that is not relevant to the research.

3.4. Validity, reliability, and ethical aspects

To assure construct validity, triangulation of research outcomes was carried out. Interview results were compared with other interview outcomes and secondary data to verify interview statements. Explanation of the interview topics was done at the beginning of each interview and an interview guide was prepared, all based on the different research themes. Also, each interview was audio recorded to listen back afterward. To ensure that answers were understood correctly, the interview transcripts were sent afterward to each interviewee.

To assure internal validity, all interview outcomes were compared with each other, using the methods as described in paragraph 3.3, to find relations between the different research themes. The theoretical framework formed the basis for finding these relations because this was used for theoretical pattern matching. Also, contradictory results were addressed in the discussion of this research.

Measures related to external validity were looking for replications within the different cases, done with the data analysis methods described in paragraph 3.3 (Gelderman, 2013). Also, the research findings were compared with the developed theoretical framework. However, generalizability was difficult because it is a limitation of case study methods.

To ensure this research’s reliability, all decisions and carried out measures are documented as much as possible. An interview guide was prepared to guide the interviews and make sure that for the research relevant questions are asked. Especially looking at the data analysis methods, where only relevant interview parts were transcribed, relevant interview parts were selected on a trial-and-error basis. During the selection of theory, arguments were described in the literature matrix why some of the articles are excluded from the research. Assumptions were described explicitly.

Special attention was paid to ethical aspects during this research. First, every interviewee took part voluntarily by requesting their participation in this research. Second, interview recordings were only done when an interviewee agreed with it. This was done by asking for recording permissions and by explaining the privacy measures. To assure the privacy of each interviewee, only job titles were used. Interview transcripts were sent to the interviewees to make them familiar with the way of transcribing allowing them to agree or disagree with the way of transcription.

4. Results

This chapter describes the results obtained by analyzing seven interviews and 24 artifacts. Paragraph 4.1 describes general information about the case organization and involved interviewees. Paragraph 4.2 describes the results of the SPP for DTs. Paragraph 4.3 describes the results of the EA information needs during the SPP and how EA information was used by the organization during the SPP. Paragraph 4.4 describes the result of how the EA information is processed/used in EA artifacts.

4.1. Case organization and involved interviewees

The case organization is a multinational engineering and technology company headquartered in Germany. It employs almost 400.000 employees with a revue of over 70.000 billion Euro in 2020. This study took place in a Dutch division of the organization's business unit (BU). Figure 5 describes the interviewed stakeholders.

Interviewee	Interviewee name	Work role	Interview location
Interviewee 1	Manager 1	Sales Manager Services	Skype for Business
Interviewee 2	Manager 2	Strategy & Portfolio Manager	Physical
Interviewee 3	Director 1	Director Service	Physical
Interviewee 4	Manager 3	Business Development Manager Digitalization & Automation	Microsoft Teams
Interviewee 5	Vice President 1	Business Unit Vice President & Managing Director	Skype for Business
Interviewee 6	Manager 4	Business Development Manager	Skype for Business
Interviewee 7	Director 2	Director Strategy & Portfolio Management	Skype for Business

Figure 5 Interviewed stakeholders

4.2. Strategic Planning Process for Digital Transformations

This paragraph describes the SPP for the DT of the organization and relates to the question: “what is the SPP for DTs?”. The results are based on analyzing seven interviews. Artifacts did not deliver any relevant insights.

During the interviews, it became clear that there was no structured and formalized process for DTs. Interviewee 2 expressed: “the strategic planning process is actually a process which goes criss-cross, fed with market feedback from the sales department and impulses coming from other initiatives.” There was no overarching strategic plan of the organization. According to interviewee 7 “decisions for this DT were made on experience and gut feeling. The question was always: where is my strategy document where I can find what we want to support remotely in the broadest sense of the word?”

For the SPP of this DT, two important periods in time are important to consider because two SPP took place for the same DT. The first SPP got stuck in 2020 and was ‘restarted’ at a later point in time by the second SPP. The interview focus was mainly on the second SPP because the first SPP was not relevant anymore. The only relevant part of the first SPP was the reasoning behind the set-up of remote support which forms the basis for the second SPP.

The first SPP started three years ago with an external customer request that was pitched within the service organization by interviewee 6. Interviewee 3 expressed the reasoning for the DT as “various customer requests were received by sales to offer a completely new way of working with remote support. That was how it all started and nothing else.” The initiative of the DT was set up via a bottom-up approach and pitched by interviewee 3 to the board of management. A separate department was set up to further develop a strategy for remote support and to implement this strategy. Around summer 2020 this department was dissolved. Interviewee 2 explained the reason why the SPP got stuck “during the first SPP, or also at the moment, it is sometimes not entirely clear why we do the things we do. The person who was working on the initial set up of remote support

was doing very well by looking at the technical developments, but focused too little on the target markets for the technologies we offer.”

The second SPP started after summer 2020 continuing on the insights gained during the first SPP. The topic remote support became part of an R&D cycle where Director Engineering, interviewee 7, and interviewee 5 were involved. They determined priorities and realized budget allocation. To make one central entity responsible, the activities were linked to a strategic project which was focusing on increasing service revenue. According to interviewee 2, this was done in a non-formalized way. In parallel with the R&D cycle, separate meetings were organized by interviewee 7 with a multidisciplinary committee to define ideas, selecting a direction, and determine in more detail how the allocated budget could be spent. Interviewee 7 expressed “we certainly had a “product management cycle” in which we tackled various alternatives and considered certain choices related to remote support. Of course, there is much room for improvement in this planning process. We have evaluated different scenarios and individually assessed the possible solutions on some criteria. Of course, this was less structured as it should be, but in fact, we went through some type of a process”.

Interviewee 4 argued, “Interviewee 7 gathered a team within the BU with people that have common ground with this topic and me as “external” of the BU. This resulted in four meetings where we looked at, for example, the organization’s portfolio. During these meetings we tried to ask questions like: what are solutions that fit within the BU’s market, what is the status of these solutions, and now we are at the point that we want to offer condition monitoring solutions and that we ask ourselves: how? From my point of view, this was a fairly technical exploration.” By asking more questions, interviewee 4 also mentioned “from my point of view, the somewhat older way of thinking (technology-driven) is still leading. No hard feelings, that is just an observation from my side. Also, I have the feeling that the first step of doing a market analysis for knowing what the market wants, is skipped. I have the feeling that it went like this: we have a customer for whom we have made beautiful solutions and let's see what new technologies we can implement and what type of data we can collect”.

Interviewee 5 somehow confirmed this statement by expressing “what you notice, from my perspective, and that is where our strategic planning process has its shortcomings, is that we have a gut feeling and that we know that we are technically capable to accomplish the requirements, but we have no idea how to look at the whole remote support theme from a commercial perspective. For example, we do not know what it is worth to customers.” Later in the interview, he argues “what we want to know when we choose a particular technology is: what are customers willing to pay for these solutions and why? We do have the gut feeling and the technical solutions, but how can we make money with these technologies? This is just a gap in our planning process. This results in a situation where we stay in very abstract thoughts without making translations to concrete actions. Instead of doing that, we immediately jump into technical solutions.”

Multiple interviews argue that there was no direct relationship with the strategy. Interviewee 7 argues “there should be a relationship to the strategy, but that is very limited within our company. There was no clear strategy per sector which argues: we need to focus more attention on this subject and therefore invest more in the development to generate new opportunities and business potential in the markets.”

During the SPP, the focus was mainly on the SPP dimensions financial aspects, and use of technologies. The focus on what technologies to use was mainly handled by the involved

multidisciplinary committee. Besides no benefits in terms of future revenue potential could be found, the organization paid attention to the financial aspects during the SPP by allocating budget.

To summarize, the process described above is a non-formalized process course. Although the process is not formalized, there are some phases distinguished consisting of different activities. The SPP is a process of periods with trials-and-errors and ups and downs indicating something like a continuous “plan, do, check, and act” cycle. Analyses are made in a retrospective manner which seems to indicate that certain steps are carried out more on a reactive instead of a pro-active basis, this could also indicate that for doing these analyses the SPP has to go back in phase. This SPP is visualized in Figure 6.

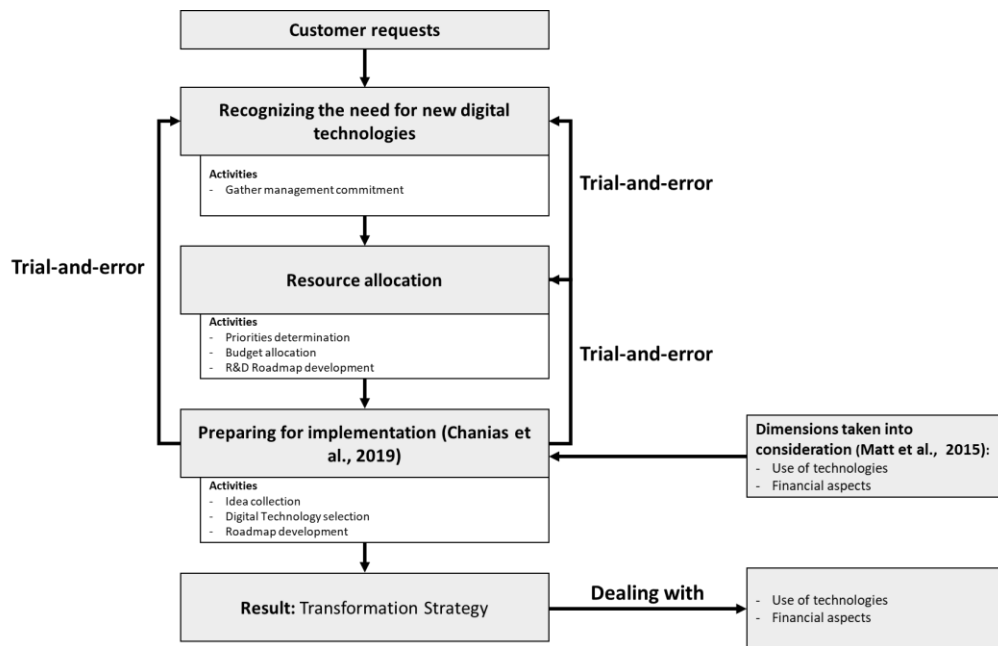


Figure 6 Empirical SPP for the DT

4.3. EA information needs and usage during the Strategic Planning Process

This paragraph describes the organizations' required information during the SPP and the used information and relates to the questions:

1. What are the required EA information components for the SPP of DTs?
2. How is the EA information used by the organization during the SPP of DTs?

4.3.1. Required information

The organizations' required information is obtained by analyzing seven interviews. This required information consists of both used information and missing information that could have been relevant during the SPP. We found that the organization requires information regarding transformation benefits, insight into the market and market trends, the organizational vision, mission, and strategy, deliverables, goal descriptions, and capabilities.

Benefits are important for budget allocation and emphasize the importance of a transformation within an organization, argued by interviewees 1, 3, and 5. This research believes that transformation benefits can also be seen as revenue models. Interviewee 5 argues “with commercial aspects you get

a feeling how much your earning potential can be. Business potential is herewith an important decision criteria for determining how aggressive investments have to be made in a specific theme”.

Market insight can be captured under “environmental information” and is important to have in place for decision-making to determine where to focus on, what to do, and what not to do. It should be used to identify important key players, what is going on in the market, and what customers want to pay for specific solutions, argued by interviewees 1, 2, 4, 5, and 7. Interviewee 2 expressed “if we know the market needs, then we can indicate what is needed and we can pay attention to that.”.

Vision, mission, and strategy can be used in assessing the relevance of a specific DiTe, for determining and aligning the required actions for the SPP, and determining where to play and where not to play, argued by interviewees 2, 3, and 6. Interviewee 7 expressed “in the end, I say: where is my strategy document where I can find information about what we want as an organization, what we want with remote support in the broadest sense of the word, what elements it should consist of and what we see in the market to play a role”.

DT **deliverables** are relevant because they can be used as input for decision-making related to budget allocation and prioritization, argued by interviewees 2, 5, and 7.

Goals descriptions are relevant for guidance and knowing what to do and what not to do. Without clear goals, it is not clear what will be achieved. Interviewees 1, 6, and interviewee 7 argue that these insights are important to know why things will be done and to decide the possible direction.

Capabilities are relevant for identifying the gap between what the organization already can achieve and what cannot be achieved, argued by interviewees 4 and 7. Based on this, actions can be defined. Interviewee 4 mentions “relevant to know is what we can as an organization and how we differentiate ourselves in the market.”

4.3.2. Used information

The used information was obtained by analyzing seven interviews and 24 artifacts. A gap was identified between the organizations’ required information and the used information. Multiple interviewees argue that little information was used for decision-making. Besides that, analysis of the different interviewees and artifacts showed different information components used during the SPP. We found out that informational components that were used and can be confirmed by both interviews and analysis of the artifact are environmental analysis and impact analysis, capabilities, requirements, deliverables, solutions and solution ideas, general trends and developments market demands, priorities, and budgets and budget allocation. The information component that was mentioned frequently but was not confirmed via interviews was technology target and has therefore be taken into consideration.

Technology target information was used to form an image of the direction to guide to with the technologies and the required (customer) infrastructure behind, mentioned by interviewee 2. It was used to get a clear image of the future situation and to visualize the setup to get clear where everybody was talking about.

Environmental analysis and impact analysis information was used to determine if investments were necessary into a specific DiTe, mentioned by interviewee 3. The environmental analysis information was used to determine what is happening in the market and the impact analysis information about the possible impact on the organization. Interviewee 3 argued “I made presentations about how we as a service organization had to respond to industry 4.0, etc. This is just about shaping the modern

need in a modern world. It was the basis for deciding what to do because traditionally continuing the business will follow a certain line downhill and we had to act on that.”

Capabilities information was used to decide what type of capabilities should be acquired and what capabilities the organization already has, this was mentioned by interviewee 3.

Requirements information was used to select a specific DiTe and to decide if development should be done within or outside the organization, mentioned by interviewee 4. The requirements types were mostly functional, e.g. logging on different speeds, and non-functional requirements, e.g. following offshore directives. Little attention was paid to IT requirements, e.g. cloud environment for saving data. No attention was paid to business requirements.

Deliverables gave insight into the deliverables of the transformation project. Used to divide the budget which was allocated to the transformation project, mentioned by interviewee 2.

Solutions and solution idea information gave insight into the different solution types. Under this type of information also portfolio is captured in terms of solutions. The information was used to decide the direction where to go, mentioned by interviewee 7.

General trends and developments information was used to assess and confirm a certain strategy that was chosen during the SPP, mentioned by interviewees 4 and 7. Under this type of information the information aspects trends, important considerations, growth markets, and success factors are summarized. This type of information was not used much, but more as inspiration for what to do and how to do something.

Market demands information was mainly used to express the urgency and the need for transformation, mentioned by interviewees 3, 4, and 7. Interviewee 3 argued: “it was more about the fact that if we keep going in the traditional way of working, then we follow a certain line downwards and to avoid that, we had to act.”

Priorities were used budget allocation to decide what is relevant and what is not, mentioned by interviewee 5.

Budgets and budget allocation information were used to determine in what aspects of remote support should be invested and how much money is available mentioned by interviewees 5 and 7.

The 24 analyzed artifacts also showed fourteen additional information components not mentioned during the interviews, but are relevant to share. The purpose of the information components during the SPP is not clear. These components are strategy, mission, vision, targets, actions/important steps, roles & responsibilities, planning, architecture, dependencies between projects, process, standards, high-level technology overview, lessons learned, and financial aspects (transformation benefits).

4.4. Used EA artifacts during the Strategic Planning Process

This paragraph describes the results related to the question “How is EA information processed/used in the various EA artifacts?” based on analyzing seven interviews and 24 artifacts. Some interviewees mention that little documentation was used during the SPP. The results indicate that artifacts are created based on the need for such a document, meaning that analysis and documents are made in a retrospective manner on a more reactive basis. Interviewee 2 expressed ‘from my point of view, no documentation or information is used’ by asking further questions if the direction of remote support is based on no artifacts he argued “that is right. And then still determine a direction. That is strange.

Feels like going on a holiday without knowing where to go, but we are already driving to the South.” Interviewee 7 also argues “the problem is that we are quite thin in what we use in terms of information and documentation and how we use this effectively in the sense that there is such a holistic view on the formation of strategies.” Although few artifacts were used for decision-making, the type of artifacts that were shared and used are described in Table 5. Some of the artifacts have multiple EA artifact types. For some of the used EA artifacts, the purpose was unclear because they were not mentioned in the interview. Therefore, the purpose is assumed based on the content.

Table 5 Used EA Artifacts

EA Artifact type	Number Artifacts	Information aspects	Mentioned in interviews	Purpose
Strategic Plan	2	<ul style="list-style-type: none"> - Strategy - Market demands - Mission - Vision - Financial aspects - Targets - Actions/important steps - Portfolio 	Yes	Sub-strategy for service only, no clear relation with organizational strategy. Document used during the first phase of the SPP for getting commitment and confirming the urgency. Usage during rest of SPP unclear.
Roadmap (conceptual, financial)	5	<ul style="list-style-type: none"> - Strategy - Targets - Actions/important steps - Portfolio - Roles & Responsibilities - Planning - Deliverables - Dependencies between projects - Budgets - Budget allocation 	Yes	Used for budget allocation and identification of steps that have to be carried out and to who the actions belong.
Analytical Reports	10	<ul style="list-style-type: none"> - Trends - Important considerations - Growth markets - Success factors 	Yes	Used for the confirmation of chosen strategy and as input for new ideas.
Initiative proposals	2	<ul style="list-style-type: none"> - Roles & Responsibilities - Budget allocation - Planning - Deliverables - Capabilities - Important steps - Priorities - Budgets 	No	Assumed that this was used to propose a specific direction.
Guideline	1	<ul style="list-style-type: none"> - Process - Roles & Responsibilities - Standards 	No	Assumed that this was used to standardize the R&D cycle.
Conceptual architecture	2	<ul style="list-style-type: none"> - High-level technology overview - Architecture 	Yes	Assumed that this was used for selecting DiTe.
Solution design	3	<ul style="list-style-type: none"> - Requirements for remote access - Solutions 	Yes	Used to decide on what DiTe to choose.
Lessons Learned	1	<ul style="list-style-type: none"> - Lessons Learned 	No	Unclear how this was used.

5. Discussion, conclusions, and recommendations

This research investigated via a holistic single case study approach and document analysis what EA artifact information is used for which purpose during the SPP of an organization's DT. The reason for research is the knowledge gap in the existing literature about which EA information is needed to fulfill the information needs of the SPP of DTs. This chapter describes the interpretation of the case study results from chapter 4 and compares the results with the theoretical framework of chapter 2. Also, the research limitations and recommendations for practice and further research are described in this chapter.

5.1. Discussion - reflection

This paragraph compares and discusses the theoretical findings of chapter 2 with the empirical findings of chapter 4.

5.1.1. Strategic Planning Process for Digital Transformation

Both the empirical and the theoretical SPP for DT are visualized in Figure 7.

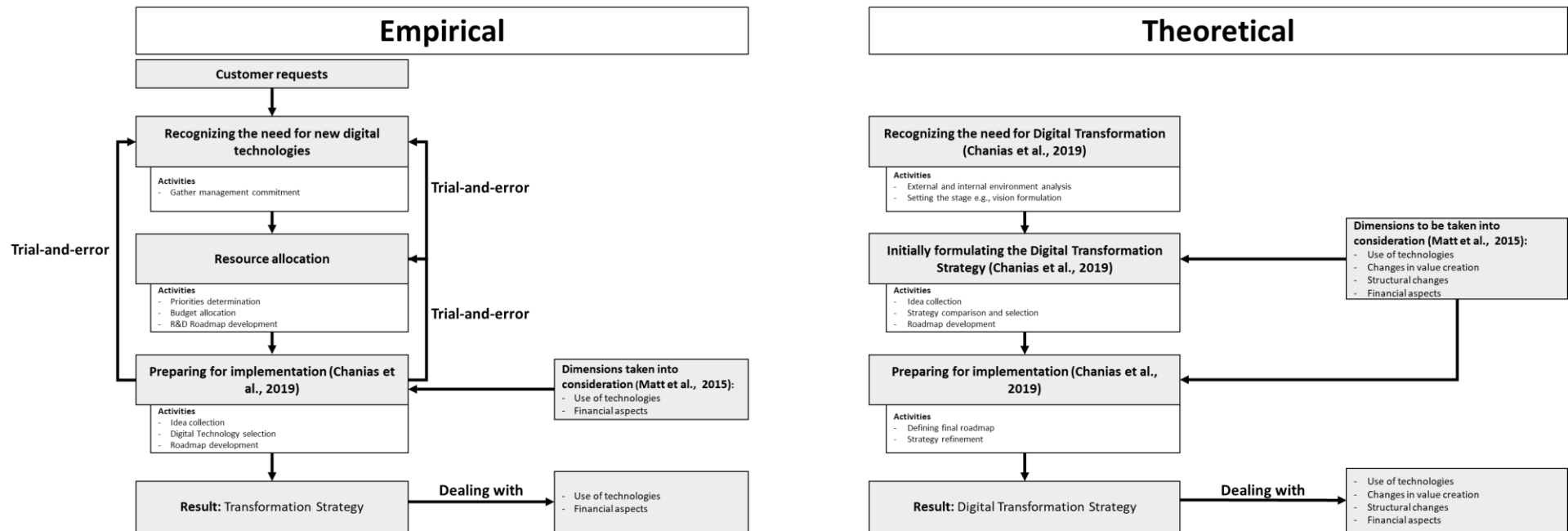


Figure 7 Empirical and theoretical SPP for DT

Figure 7 shows the differences between the empirical and theoretical SPP. The empirical SPP starts with a transformation trigger, i.e., a customer request, and herewith confirms the finding of Vial (2019) who mentions that one of the disruptions that trigger a strategic response is altering consumer behavior and expectations. The rest of the phases and activities are slightly different compared with the theoretical SPP. The first phase of the empirical SPP started with gathering management engagement to have them as sponsors for the DT. This step seems logical because Matt et al. (2015) describe top management engagement as necessary to succeed in a transformation cause DT's affect the whole organization. The empirical SPP does not result in a DTS but in a transformation strategy only dealing with the by Matt et al. (2015) described dimensions use of technologies and financial aspects. The empirical SPP lacks activities focusing on environmental analysis and vision formulation. A possible explanation could be a lack of the dynamic EA capability "sensing". According to Grave et al. (2021), based on the EA artifacts they recommend, a part of this sensing capability is focused on external and internal analysis and forecasting technologies and skills. Another explanation might be that the SPP started from a bottom-up approach where the organization immediately jumped into action.

Although Figure 7 describes a structured empirical SPP, the process in practice was unstructured, better explained as activities went criss-cross. This can be clarified by some findings in the literature. First, DTs are seen as a series of disruptions (Korhonen & Halén, 2017; Labusch et al., 2014). During the SPP an organization finds ways to deal with these disruptions by innovating with combinations of technologies to drive better operational performance (Vial, 2019). Second, no definition was found in the literature for the SPP of a DT, also Matt et al. (2015) recognized a lack of specific guidelines for formulating, implementing, and evaluating a DTS. The combinations of disruptive transformations and lack of specific guidelines in literature result in a situation where the process can be very unstructured.

Matt et al. (2015) describe that during the SPP attention must be paid to four different dimensions, see Figure 7. However, he does not mention what he means with "paying attention", i.e., what will be done for each dimension. This research fills this knowledge gap. During the empirical SPP, the organization focused on the dimensions use of technologies and financial aspects. This research identified that the use of technologies is a technical exploration looking for what solutions fit within the market, what the development status is, and how these solutions should be used. Financial aspects mean paying attention to budget allocation. Also, benefits in terms of future revenue potential could be an aspect but could not be confirmed.

Blomqvist et al. (2015), Simon et al. (2014), and Chanas et al. (2019) mention that recognizing the need for DT also starts with "setting the stage", e.g. vision formulation as a strategic starting point. However, this could not be confirmed with the empirical findings because no vision was formulated at all. Maybe this was caused because of the bottom-up approach and that therefore some activities were not done or skipped.

According to Chanas et al. (2019), the SPP for DT is a continuously repeated process with a moving target. The empirical process confirmed that the SPP is a continuously repeated process facing multiple periods of trial-and-error and repeated process steps. The first empirical SPP somehow "failed" in achieving the required purpose and after that "failure" the second SPP was started.

The empirical SPP was a fairly technological exploration instead of strategical. This is interesting because Azevedo et al. (2015), Peko et al. (2014), and Radeke (2011) describe SPP as a set of organizational management activities, and Blomqvist et al. (2015) and Simon et al. (2014) talk about different management stages. This fairly technological exploration could be caused by the absence

of a clear process description for the SPP, the type of stakeholders involved, and/or the mechanical engineering organization type.

To summarize, based on the findings of this research, it is believed that the SPP of a DT should be conceptualized as shown in Figure 8.

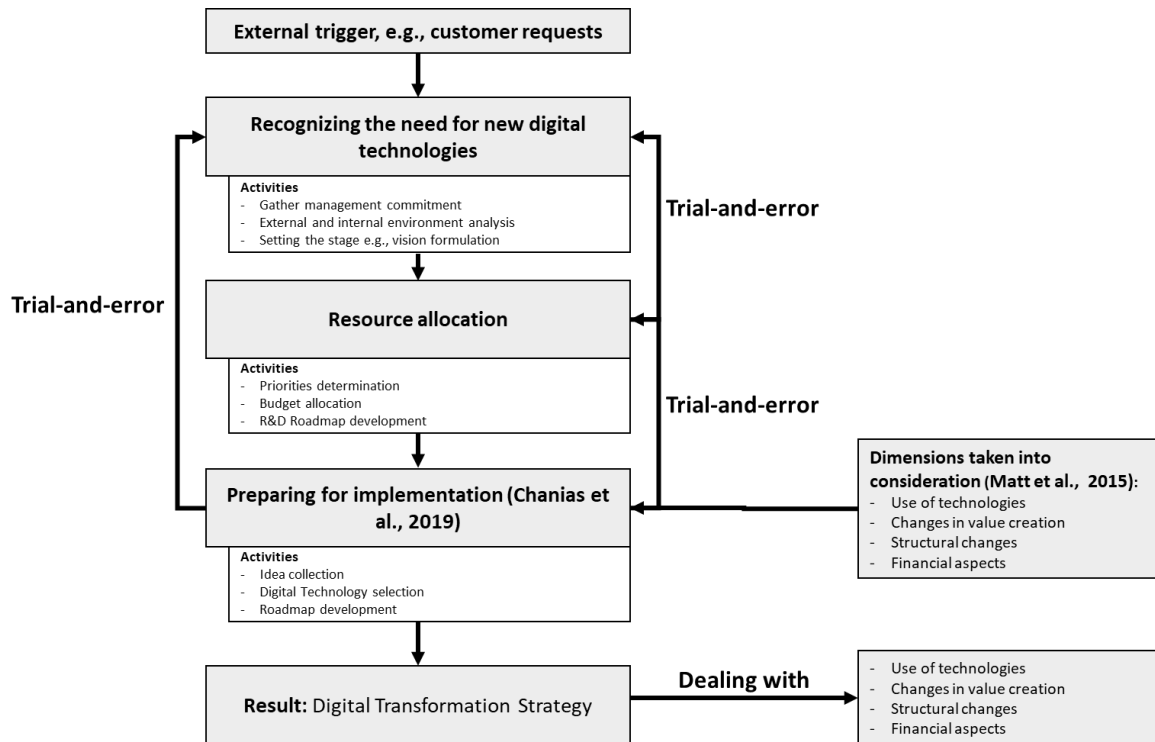


Figure 8 Final SPP for DT

5.1.2. EA information during the Strategic Planning Process for Digital Transformations

EA's added value during the SPP is argued by different authors such as Korhonen and Halén (2017) and Niemi and Pekkola (2019). Although EA information seems to be important for better decision-making, the case study showed the opposite because little information was used for decision-making. This could be caused by the organizations' low EA management maturity level. Based on the measurement model of van den Berg, Slot, Steenbergen, Faasse, and Vliet (2019) the organization finds itself in the lower maturity levels, because there is no clear focus on objectives for architecture developments, little alignment with business strategy, and low commitment and motivation to spend budget and time to pro-actively develop EA artifacts. It all seems to happen on an initial basis, meaning that, although no formal assessment was carried out, the organization might be in the EA management maturity level 0. However, in Figure 9 a comparison was made between the empirical used EA information and the EA information that, according to Labusch and Aier (2014), influences the success of a DT.

Strategic Planning Process Phase		Theoretical									
		Recognizing the need for DT			Initially formulating the DTS				Preparing for implementation		
EA Information		Consistent goal description	Business requirements	Capabilities of the organization	Important steps	Solution ideas (scenarios)	Processes	Benefits of transformation	Stakeholders of the transformation	Important steps	Dependencies between projects
Empirical	Technology target	Partly confirmed and used information									
	Environmental analysis and impact analysis										
	Capabilities			Fully confirmed and used information							
	Requirements										
	Deliverables										
	Solutions and solution ideas					Fully confirmed and used information					
	General trends and developments										
	Market demands										
	Priorities										
	Budgets and budget allocation										

Legend	
Fully confirmed and used information	Fully confirmed and used information
Partly confirmed and used information	Partly confirmed and used information
Not confirmed	Not confirmed

Figure 9 Comparison between theoretical and empirical information usage

This research partly confirms consistent goal description from Labusch and Aier (2014) with empirical usage of technology target information. According to Labusch et al. (2014), consistent goal descriptions address the strategic aspects of the DT. The technology target instead describes the “goal” with a more technical orientation and was mainly used to form an image of the direction DiTe and required infrastructure.

Some used and required information was related to the market, e.g., environmental analysis and impact analysis, general trends and developments. Labusch and Aier (2014) categorize this information as “market situation”, arguing that having and using that type of information does not influence transformation success. However, although this information was limited, having this information proved to be relevant for determining if investments were necessary into a specific DiTe, what is happening in the market, and what impact this has for the organization. Also, usage of general trends and developments information proved to help confirm a certain strategy and chosen direction.

Labusch and Aier (2014) and Labusch et al. (2014) describe different information components that organizations can use during DTs, but their research lacks clear descriptions of how each information component will be used during an SPP. This research enriches the theory by summarizing in Table 6 how and with what purpose each information component will be used.

Table 6 Information purpose, need, and usage

Information component	Purpose	Required	Used
Transformation benefits	Insight into the earning potential is used as an important decision criterion for determining how aggressive must be invested in a specific theme.		
Environmental information	Needed to determine where to focus on, what to do and what not to do. Should give insight into important key players, what is going on in the market, and what customers want to pay for specific solutions.		
Vision, mission, and strategy	Relevance assessment of a specific DiTe. Used for determining and aligning required actions for the SPP, and determining where and where not to play.		
Goals descriptions	Relevant for guidance during DT and knowing what and what not to do.		
Technology target	Used to get a clear image of the future situation and to visualize the set-up to get clear where everybody was talking about.		
Environmental analysis and impact analysis	Used to determine what is happening in the market and what the possible impact on the organization will be in a specific situation.		
Capabilities	Used to decide what type of capabilities should be acquired and what capabilities already are in place within the organization.		
Requirements	Used to select a specific DiTe. Type of requirements were mostly functional and non-functional requirements. Little attention was paid to IT requirements.		
Deliverables	Used to get insight into deliverables of the transformation project which was input for allocating and dividing allocated budget within the project.		
Solutions and solution ideas	Insight into the different solution types used during the selection of DiTe.		
General trends and developments	Used to assess and confirm a certain strategy that was chosen during the SPP.		
Market demands	Used to express the urgency and transformation need.		
Priorities	Used to express the urgency and transformation need.		
Budgets and budget allocation	Used to determine in what aspects of the DT can be invested and how much budget is available		

5.1.3. EA artifacts during the Strategic Planning Process for Digital Transformations

EA information is captured in different EA artifacts. However, Kotusev (2019a) describes that organizations have EA artifacts with different titles but with essentially the same meaning (Kotusev, 2019a). He also mentions that organizations use approximately 10,7 artifacts during an SPP. The empirical results showed a total of 24 artifacts representing eight different artifact types, see Table 7. The artifacts are categorized according to the definitions of Kotusev (2019a), Grave et al. (2021), Kurnia et al. (2020), and Table 4. Also, the organizational level of the artifact information was added.

Table 7 Artifact conversion table

Artifact name	Filetype	Received from	EA Artifact	Organizational level
Smart Service Strategy LP 07_2018	PowerPoint	Director Service	Strategic plan	Strategic, sub-organizational part
LP Service Strategy update	PowerPoint	Director Service	Strategic plan, roadmap	Strategic, sub-organizational part
RD Planning 2021	Excel	Business Unit Vice President & Managing Director	Rodmap (financial)	Strategic, organization wide
Development roadmap_SPM_Sector Services_v1	PowerPoint	Strategy & Portfolio Manager	Conceptual Roadmap, initiative proposal	Strategic, sub-organizational part
Service Strategy_LP_v7	PowerPoint	Strategy & Portfolio Manager	Conceptual Roadmap	Strategic, sub-organizational part
The Industrial Internet of Things	PDF	Business Development Manager Digitalization & Automation	Analytical Reports	N/A
ABN-AMRO-Rapport-Industrial-Internet-of-Things	PDF	Business Development Manager Digitalization & Automation	Analytical Reports	N/A
ABN AMRO-Digitalisering is motor achter ketenconsolidatie	PDF	Business Development Manager Digitalization & Automation	Analytical Reports	N/A
ING_my-smart-industry	PDF	Business Development Manager Digitalization & Automation	Analytical Reports	N/A
mckinsey_industry_40_2016	PDF	Business Development Manager Digitalization & Automation	Analytical Reports	N/A
Rabobank Cijfers & Trends	PDF	Business Development Manager Digitalization & Automation	Analytical Reports	N/A
RandD budget 2021 - Prioritization and agreement	PowerPoint	Business Unit Vice President & Managing Director	Roadmap, initiative proposal	Strategic, organization wide
DCPD 15405-050 - Innovation Management	PDF	Business Unit Vice President & Managing Director	Guideline	Strategic, organization wide
Accenture_Blueprint for Service Success	PDF	Director Strategy & Portfolio Management	Analytical Reports	N/A
Quick Wins and Long-term Results with Remote Monitoring	Internet	Director Strategy & Portfolio Management	Analytical Reports	N/A
wbr-fsusa-2020-cutting-edge-technology-in-field-service	PDF	Director Strategy & Portfolio Management	Analytical Reports	N/A
Why Connectivity Is the Key to Manufacturing Digital Transformation	Internet	Director Strategy & Portfolio Management	Analytical Reports	N/A
EAS_Presentatie Remote access	PowerPoint	Director Strategy & Portfolio Management	Conceptual architecture	Operational
Summary remote support product development strategy_20210104	PowerPoint	Director Strategy & Portfolio Management	Roadmap	Tactical
Reqs RA & datalogger	PowerPoint	Director Strategy & Portfolio Management	Solution design	Operational
Digitalization Project - MCS meeting_28-9-2020 v2.0	PowerPoint	Director Strategy & Portfolio Management	Lessons Learned	Operational
Sales Packages_DRAFT	PowerPoint	Director Strategy & Portfolio Management	Solution design	Operational
CBM-research	PowerPoint	Director Strategy & Portfolio Management	Conceptual architecture	Operational
FW_BIMA Architecture Decision - AWS for IoT and Cloud Layer	Wikipage	Director Strategy & Portfolio Management	Solution design	Operational

Figure 10 compares the empirically used artifact types with the theoretically expected artifacts.

		Theoretical												
Strategic Planning Process Phase		Recognizing the need for DT				Initially formulating the DTS						Preparing for implementation		
EA artifacts		Strategic plan	Target states	Analytical reports	Business capability models	Options papers	Conceptual architectures	Landscape diagrams	Technology reference models	Initiative proposals	Stakeholder communication plan	Conceptual roadmaps	Solution designs	Final roadmaps
Empirical	Strategic Plan	Yellow												
	Roadmap (conceptual, financial)											Green		Green
	Analytical reports			Green										
	Initiative proposals									Yellow				
	Guideline													
	Conceptual architecture						Green							
	Solution design												Green	
	Lessons Learned													

Legend	
Fully confirmed and usage clear	Green
Partly confirmed and usage unclear/assumed	Yellow
Not confirmed and not used	White

Figure 10 Comparison between theoretical and empirical EA artifacts

Kotusev (2019a) argues that artifacts are created for a specific purpose instead of “just” describing elements of the organization. This study conforms to this finding. The used/made artifacts are based on the needs of having such a document, e.g. the documents are created in a retrospective manner because there was a need for such an artifact to base decisions on for example. The organization did not use any of the EA frameworks because it is not familiar with EA at all. This confirms Kotusev (2019a) finding that EA artifacts do not depend on the use of EA frameworks.

Comparing the theoretical EA information with the empirical EA information per artifact showed a significant gap. In practice, almost all artifacts had more information aspects than the theoretical artifacts. This could have been caused that this research theoretical framework only depended on the informational components of the research of Labusch and Aier (2014) and Labusch et al. (2014) because they described the relevant type of information per DT and the information components that influence a DT. Grave et al. (2021), Kotusev (2019a), and Kurnia et al. (2020) also described different information components belonging to different EA artifacts, however, it was not clear if these information components influence a DTs success. Table 8 compares the theoretical and empirical EA information components and EA artifact purpose.

Table 8 Comparison between empirical and theoretical EA artifacts purpose and content

EA Artifact	Empirical EA information	Theoretical EA information	Empirical EA artifact purpose	Theoretical EA artifact purpose (Grave et al., 2021; Kotusev, 2019a; Kurnia et al., 2020)
Strategic Plan	<ul style="list-style-type: none"> - Strategy - Market demands - Mission - Vision - Financial aspects - Targets - Actions/important steps - Portfolio 	<ul style="list-style-type: none"> - Consistent goal description 	Sub-strategy for service only, no clear relation with organizational strategy. Primarily focused on market potential/situation, new product portfolios with the use of data and DiTe, and strategic actions. Document used during the first phase of the SPP for getting commitment and confirming the urgency. Usage during rest of SPP unclear.	Assessing if DiTe possibilities are in line with the organizational mission, vision, and strategic goals.
Roadmap (conceptual, financial)	<ul style="list-style-type: none"> - Strategy - Targets - Actions/important steps - Portfolio - Roles & Responsibilities - Planning - Deliverables - Dependencies between projects - Budgets - Budget allocation 	<ul style="list-style-type: none"> - Important steps - Dependencies between projects 	Strategy and targets for extension of the market with strategic actions and focus on where and where not to play. Total R&D budgets and budget allocation per R&D project, roles & responsibilities involved in the project, and set-up of remote support and planning of activities. Primarily used for budget allocation and identification of steps that have to be carried out and the who belongs to those actions.	Alignment, traceability, and linkage between business strategy and DTS. Gives insight into plans/schedules and required resources. Conceptual because dimensions of Figure 4 can be conceptual.
Analytical reports	<ul style="list-style-type: none"> - Trends - Important considerations - Growth markets - Success factors 	<ul style="list-style-type: none"> - Business Requirements 	Consisted of trends. Primarily used for the confirmation of a chosen strategy and as input for new ideas.	Identification of DiTe trends and assessment of the disruptive influence of recent technological opportunities.
Initiative proposals	<ul style="list-style-type: none"> - Roles & Responsibilities - Budget allocation - Planning - Deliverables - Important steps - Priorities - Budgets 	<ul style="list-style-type: none"> - Benefits of transformation 	Consists of priorities, available budget and allocated budget, and roles & responsibilities involved in the project and qualitative business need. Assumed that this was used to propose a specific direction.	Used to assess the potential business value of proposed DT initiative(s).
Conceptual architecture	<ul style="list-style-type: none"> - High-level technology overview - Architecture 	<ul style="list-style-type: none"> - Solution ideas (scenarios) 	This document contains conceptual high-level technical overviews of remote access primarily focusing on equipment to use. Consisted of different IT architecture possibilities both mentioned with pros and cons. Assumed that this was used for selecting DiTe.	Provide transparency, benefits and possible risks of different architectures, and a high-level overview of proposed initiatives. Is used to improve decision-making.
Solution design	<ul style="list-style-type: none"> - Requirements for remote access - Solutions 	<ul style="list-style-type: none"> - Important steps 	Consisted of different types of requirements and solutions, i.e. equipment that can be used. Also, explains why a specific cloud solution will be used. Used to decide on what DiTe to choose.	Used at implementation (preparation) stages of initiatives to deliver (IT) solutions.

5.1.4. Limitations of this research

The organization had no standardized and formalized process for the SPP of DT, making it difficult to zoom in on informational components and artifacts that have been used during each activity/phase.

During the SPP little information was used for decision-making. The artifacts that are studied are used, but results could have been different if the artifacts had been used more actively.

The DT is still in pilot phase. Because of this, it might be that not all information components and artifacts were identified because some of the existing artifacts will be updated or new artifacts will be created. This makes it difficult to determine if all informational components are identified and delivered value. To conclude, a limitation of this research is the generalizability of the research outcomes caused by both the single case study approach and the DT that is still in a pilot phase.

Within the organization, none of the interviewees were familiar with the concepts of EA and EA artifacts.

This research was conducted within an organization actively focusing on the mechanical engineering industry. According to Goerzig and Bauernhansl (2017) companies in that area of the industry mostly focus on innovation of their technologies and products. Within the organization, there is less focus on IT-related innovations and therefore, results could differ if the research will be carried out within organizations that operate in another market/industry.

5.2. Conclusions

This research investigated via a case study and document analysis what EA artifact information is used for which purpose during the SPP of an organization's DT. The reason for research is the knowledge gap in the existing literature about which EA information is needed to fulfill the information needs of the SPP of DTs. During the SPP, organizations must find ways to deal with the disruptions caused by DT. The insights provided by EA information enables decision-makers to formulate a suitable answer to the disruptions caused by DTs. This study showed the purpose and found the usage of the information components technology target information, environmental analysis and impact analysis, capabilities, requirements, deliverables, solutions and solution ideas, general trends and developments, market demands, priorities, and budgets and budget allocation during the SPP of a DT.

The SPP for DT in practice appeared to be an unstructured process with activities and phases that go criss-cross. The SPP starts with an external trigger, e.g. a customer request. The first phase consists of recognized the need for a new DiTe. The next phase focuses on resource allocation and priority determination. The last phase prepares for implementation. The SPP output is a DTS.

The organization's required information found in practice are transformation benefits, insights into the market and market trends, organizational vision, mission, and strategy, deliverables, goals descriptions, and capabilities. This required information consists of both used information and missing information that could have been relevant during the SPP.

A gap was identified between the organizations required and used information. The organization made little use of information during the SPP. It was not possible to clarify how and what information was used per SPP phase. Only three of the ten theoretical information components could be confirmed via interviews and document analysis. The purpose was identified for the used information components technology target, environmental analysis and impact analysis, capabilities requirements, deliverables, general trends and developments, market demands, priorities, and budgets and budget allocation.

The empirical results showed 24 used artifacts representing eight different artifact types. It occurred that artifacts in most cases consisted of multiple information components. Seven of the thirteen theoretical artifacts could somehow be confirmed. Sometimes multiple theoretical artifacts were captured into one empirical artifact.

5.3. Recommendations for practice

For practitioners, this research recommends organizations to start with creating a clear overall strategic plan so that the DT initiatives and artifacts can be aligned with the organizations' strategic goals. Also, organizations should invest time to proactively define standardized artifacts that can be used in multiple initiatives, e.g. environmental analysis and business capabilities. Insights into the benefits of the transformation should be created and described so that urgency for a transformation can be proved. Organizations should formalize and standardize the SPP and the high-level activities belonging to that process to have more consistency in the approach. The organization should also have a balance between top-down, strategically planned, and bottom-up initiatives to have better strategical focus. Finally, formulate a separate DTS that pays attention to the dimensions use of technologies, changes in value creation, structural changes, and financial aspects.

5.4. Recommendations for further research

For researchers, this research recommends first, more research on phases and activities belonging to the SPP for DTs because this process appeared to be very unstructured and lacks of theoretical foundation. Second, research on EA information components that deliver value per SPP phase and how information is used because this research did not find those relationships. Third, the influence of actively practicing EA and successful DT because this relation is unclear. Fourth, the different information requirements per organizational entity, e.g. IT and business, and per organizational level, e.g. strategic, tactical, and operational. Finally, the value of EA information during SPP and if this information leads to better decision-making because this relation in both empiric and theory is unclear.

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Appendix 1 Search Planning Form and Search Queries

In this appendix, both the Search planning form with the different synonyms for the main building blocks and the search queries are described. In Figure 11 the search planning form is described and in Figure 12 the different search queries which are based on the different synonyms for the building blocks. The search queries only consist of queries that deliver relevant results.

Data of Search:	19-10-2020						
Research Question:	Which aspects of an organization should be described in <u>EA artifacts</u> and how is this <u>information</u> used during the <u>Strategic Planning Process</u> of an organizations <u>Digital Transformation</u> ?"						
	Concept 1	AND	Concept 2	AND	Concept 3	AND	Concept 4
	Digital Transformation		Strategic Planning Process		Enterprise Architecture		Information
Synonyms / different spellings / Alternative- / Controlled keywords	Search Terms		Search Terms		Search Terms	AND	Search Terms
	Digital Transformation	AND	Strategic Planning Process	AND	Enterprise Architecture		Information
	OR		OR		OR		OR
	Enterprise Transformation		Strategic Planning		Enterprise Architecture Management		Artifacts
	OR		OR		OR		OR
	Organizational Transformation		Transformation Strategy		EA		Artefacts
	OR		OR		OR		OR
	Business Transformation		Strategic Response		EAM		Artifacts usage
			OR				
			Strategy making				
Source/Database:	Open Universiteit (OU) library, Association for Information Systems (AIS) & Google Scholar						
Search limits:							
Study type:	Journal Article, Conference proceedings						
Search field:	all fields						
Age range:	19-10-2010 to 19-10-2020						
Other	Limit search to (AIS Electronic Library) for AIS library						
Other	Results sorted on relevance (top 50)						
Search discipline (in OU library):	Business, Economics (OU)						

Figure 11 Search planning form

Query No.	Query	Hits	Library	Used Method	Relevant Results	Additional note
Query 1	(Digital Transformation) AND (Strategic Planning Process) AND (Enterprise Architecture) AND (Information)	873	Open Universiteit (OU) library	Building blocks	TRUE	
Query 2	(Business Transformation) AND (Strategic Planning Process) AND (Enterprise Architecture) AND (Information)	2113	Open Universiteit (OU) library	Building blocks	TRUE	
Query 3	(Digital Transformation) AND (Strategy making) AND (Information)	9315	Open Universiteit (OU) library	Building blocks	TRUE	
Query 4	(Digital Transformation) AND (Strategic Planning) AND (Enterprise Architecture) AND (Artifacts)	130	Open Universiteit (OU) library	Building blocks	TRUE	
Query 6	(Digital Transformation) AND (Transformation Strategy) AND (Enterprise Architecture) AND (Information)	1499	Open Universiteit (OU) library	Building blocks	TRUE	
Query 8	(Enterprise Transformation) AND (Transformation Strategy) AND (Enterprise Architecture Management) AND (Information)	3872	Open Universiteit (OU) library	Building blocks	TRUE	
Query 9	(Enterprise Transformation) AND (Transformation Strategy) AND (Enterprise Architecture Management) AND (Artifact)	543	Open Universiteit (OU) library	Building blocks	TRUE	
Query 12	(Organizational Transformation) AND (Strategic Planning) AND (Enterprise Architecture) AND (Artifacts Usage)	114	Open Universiteit (OU) library	Building blocks	TRUE	
Query 13	(Digital Transformation) AND (Strategic Planning Process) AND (Enterprise Architecture) AND (Information)	1267	Association for Information Systems (AIS)	Building blocks	TRUE	
Query 15	(Digital Transformation) AND (Strategy making) AND (Information)	5837	Association for Information Systems (AIS)	Building blocks	TRUE	
Query 18	(Digital Transformation) AND (Transformation Strategy) AND (Enterprise Architecture) AND (Information)	1733	Association for Information Systems (AIS)	Building blocks	TRUE	
Query 24	(Organizational Transformation) AND (Strategic Planning) AND (Enterprise Architecture) AND (Artifacts Usage)	257	Association for Information Systems (AIS)	Building blocks	TRUE	
Query 25	(Digital Transformation) AND (Transformation Strategy) AND (Information)	11300	Open Universiteit (OU) library	Building blocks	TRUE	
Query 26	(Digital Transformation) AND (Transformation Strategy) AND (Information)	6067	Association for Information Systems (AIS)	Building blocks	TRUE	Checkbox "results from other sources" = TRUE, no selection of search discipline
Query 27	(Enterprise Architecture) AND (Strategic Planning)	24578	Open Universiteit (OU) library	Building blocks	TRUE	
Query 28	(Enterprise Architecture) AND (Strategic Planning)	2441	Association for Information Systems (AIS)	Building blocks	TRUE	
Query 29	Used google scholar with supervisor article: "A Reference Model for the Information-Based Support of Enterprise Transformations"	37	Google Scholar	Forward Snowballing	TRUE	Forward snowballing method.
	Total of hits (relevant results TRUE and FALSE)	81504				

Figure 12 Search Queries

Appendix 2 Literature Matrix

The literature matrix was used to analyze the different articles and collect and summarize the relevant information of each article. The information that was captured in the literature matrix consisted of: article no, article name, year of article, status, category tag, excluded, query, argumentation, search date, abstract, introduction (research aim), research methods, conclusion, discussion/limitations, main insights/results, and relevant quotes. In Figure 13 an example of the literature matrix is visualized consisting of both excluded (in red) and selected articles (in white).

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
No.	Article Name	Year	Status	Category tag	Exclude	Query	Argumentation	Search Date	Abstract	Introduction (research aim)	Research Methods	Conclusion	Discussion/limitations	Main insights/result	Relevant Quotes	
1	Implementing a Digital Strategy	2020	4-Conclusion & Discussion		TRUE	Query 1	This is too much focussed on collecting field data. Nothing about EA, Strategic Planning or artifacts	19-10-2020	The rapid growth of digital technologies and the extraordinary amount of data that devices and applications collect each day are increasingly driving companies to radically transform the business models through which they create and appropriate value. However, companies may fail to extract value from digital transformation due to the disconnection between strategy formulation and strategy implementation. Through the analysis of three case studies of firms that digitally transformed their business this article presents a framework that can help companies implement their digital transformation strategy and thereby renovate their business model.	This research aims at providing a framework for digital strategy implementation and visualizes what is important (maybe the information requirements will explained?)						
2	ICT-based innovation and its competitive outcomes: the role of information intensity	2018	2-Summary		TRUE	Query 1	This article is ICT investment focussed.	19-10-2020								
3	Institutional Perspectives on the Process of Enterprise Architecture Adoption	2018	2-Summary		TRUE	Query 1	Is focussing on the adoption of EA by institutional pressure.	19-10-2020								
4	The Benefits of Enterprise Architecture in Organizational Transformation	2019	6-Selected	Digital Transformation, EA Information	FALSE	Query 1		19-10-2020	Organizations constantly adjust their activities to meet ever-changing circumstances, continuous business transformation is taking place. However, planning and steering this transformation can be a daunting task as complexity has been built into the organization over the years. Enterprise Architecture (EA) has been widely adapted as a planning and governance approach to manage the complexity and constant change, and to align the organization toward a common goal. This article studies the EA benefit-realization process by clarifying how EA benefits are realized. Specifically, the focus is on the strategies, resources, and practices which the EA benefits stem from.	Clarifying how EA benefits are realized, it will thereby focus on the strategies, resources and practices where EA benefits stem from.	Single qualitative case study	Our results indicate that EA benefits stem from solid EA processes, as well as from the appropriate use of EA products and services. Social and cultural factors also play an important role in the process. The results also shed light to the time dimension of EA benefit realization. Organizations can benefit from EA from day one, when comprehensive understanding starts to form, until the later years, when measurable outcomes—cost savings and so on—materialize.	Public sector organization Single case study Maybe risk of generalizability	Added value of EA during transformations. Different types of EA.	"EA is there to serve the stakeholders, not the other way around [see also Kotasev 2017]"	
5	Understanding Digital Transformation Initiatives: Case Studies Analysis	2020	4-Conclusion & Discussion		TRUE	Query 1	Case study in Croatia, maybe results are not generalizable	19-10-2020	Complexity of the digital transformation (Digital Transformation) paradigm and its relation to the fourth technological revolution face companies with serious challenges when it comes to keeping up with the competition or becoming a leader in operating industries. Objectives: The goal of our research is to systematize, analyze and evaluate technological and business concepts of Digital Transformation, in order to identify and investigate Digital Transformation initiatives.	Research question: -What is the relevance of background factors describing the context of digital transformation initiatives? -How organizations perform digital transformation initiatives?						
6	Enterprise architecture management and its role in corporate strategic management	2014	6-Selected	Strategic Planning, EA Information	FALSE	Query 2		19-10-2020	A considerable number of organizations continually face difficulties bringing strategy to execution, and suffer from a lack of structure and transparency in corporate strategic management. Yet, enterprise architecture as a fundamental exercise to achieve a structured description of the enterprise and its relationships appears far from being adopted in the strategic management arena. To move the adoption process along, this paper develops a comprehensive business architecture framework that assimilates and extends prior research and applies the framework to selected scenarios in corporate strategic management. This paper also presents the approach in practice, based on a qualitative appraisal of interviews with strategic directors across different industries.	Survey the requirements of strategic management practitioners. Two main questions: - What support can EAM provide within corporate strategic management and on what conception of the business architecture is this based? - In what areas does EA management need to develop to permeate corporate strategic	Literature review and empirical semi-structured interviews for empirical analysis	EA has been applied to key tasks of corporate strategic management: strategic analyses, strategic choice, business execution design, business transformation readiness assessment, strategy implementation planning, strategy review, and strategic governance.	Too model-based because of the short amount of time and few interview statements	Strategic Planning Process steps, role of EA and required informational insight based on empirical research.	"EA was thus described as a more powerful tool for describing the hard [strategy, structure, systems] than the soft elements [shared values, skills, style."	

Figure 13 Example of literature matrix

Appendix 3 Coding categories for literature analysis

Figure 14 describes the coding categories and the used codes for the analysis of the literature.

Digital Transformation	Strategic Planning Process	Enterprise Architecture	EA (artifact) information
Transformation Challenge	Transformation Approach	EA benefit	EA information
Transformation Approach	Organizational Vision	EA definition	EA products
Digital Transformation Definition	Architecture Vision	EA management	Organizational Environment
Digital Transformation Impact	Stakeholder Analysis	EA products	Organizational Vision
Digital Transformation Challenge	Focus areas Digital Transformation	EA doubts	Artifact categories
Digital Strategy Aspects	Organizational definition	EA stages	Initiative insight
Digital Transformation Success Factors	Strategy types	EA shortcomings	Information need
Digital Transformation Drivers	Context adaption	EA information framework	Architecture Vision
Digital Transformation objectives	Performance Lifecycle	EA practice	Architectural information classes
Digital Transformation need	Management requirements	EA domains	Stakeholder analysis
Transformation Challenge	Organizational Learning	EA artifact observations	Context adaption
Transformation Success Factors	Traditional Strategy Thinking	EA levels	Business Models
Transformation Definition	Strategic change schools	EA trends	Value Flows
Transformation type	Strategic Planning		Vision
Digital Transformation Building Blocks	Digital Strategy Definition		Internal Analysis
Digital Transformation Disruptions	Strategy Challenges		External Analysis
Digital Transformation pre-conditions	Strategic Success Factors		Organizational Capabilities
	Strategy Design		Capabilities
	Strategy Impact		Insight need
	Strategic Planning Categories		Transparency
	Involvement		EA artifact usage
	Roadmap		EA artifact
	Strategy Selection		Business Models
	Strategic Analysis		EA artifact information
	Readiness Assessment		
	Business Design		
	Strategic Planning Characteristics		
	Stakeholder Involvement		
	Strategic Alignment		
	Strategic Response		

Figure 14 Coding categories for the analysis of the literature

Appendix 4 The availability of Information influencing ET success

Figure 15 and Figure 16 visualize the by Labusch and Aier (2014) researched information availability and influence on ETs success. To summarize, they argue that the following availability of information influences ETs success:

1. **General goal descriptions:** consistent goal descriptions and important steps (e.g., roadmap).
2. **Detailed goal descriptions:** business requirements, solution ideas (scenarios), and plan costs (budget).
3. **Existing business structures:** processes, organizational structures, and business functions.
4. **Program management:** stakeholders of the transformation, overview of projects, and dependencies between projects.
5. **Design options to achieve the goals:** consolidation potentials.
6. **Method competence:** transformation methods.
7. **Change management:** stakeholder characteristics, communication strategy, trainings, and transformation history.
8. **Performance management:** benefits of transformation, as-is costs, quantitative success control, and qualitative success control.
9. **External stakeholders:** master agreements and contracts
10. **Risk management:** risk assessment, legal regulations, security aspects, and internal guidelines/standards.

Category	Information	Mean Availability	Regression Coefficient	R ²	Significance
1. Information concerning general goal descriptions	Consistent goal description	4.04	.220	.104*	0.0307
	Important steps (e.g. roadmaps)	3.87	.218	.101*	0.0337
	Market situation	3.04	.163	.082	0.0594
	Drivers	3.89	.128	.042	0.1780
	Business Strategy	3.52	.005	.000	0.9570
2. Information concerning detailed goal descriptions	Business requirements	3.64	.383	.259**	0.0005
	Solution ideas (scenarios)	3.61	.236	.110*	0.0318
	Plan costs (budget)	3.05	.204	.169**	0.0068
	Business case for the transformation	2.86	.047	.006	0.6163
3. Information concerning existing business structures	Processes	3.18	.250	.174**	0.0054
	Organizational structure	3.98	.252	.156**	0.0088
	Product portfolio	3.91	.107	.028	0.2806
	Locations / location concept	3.60	.109	.046	0.1674
	Business functions	3.56	.303	.257**	0.0005
	Capabilities of the organization	2.98	-.028	.002	0.7822

** Significance < 0.01

* Significance < 0.05

Figure 15 The availability of information with influence on ET success (Labusch & Aier, 2014)

Category	Information	Mean Availability	Regression Coefficient	R ²	Significance
4. Information concerning program management	Stakeholders of the transformation	3.91	.196	.094*	0.0434
	Overview of projects	3.23	.273	.261**	0.0006
	Redundancies between projects	2.87	.135	.060	0.1080
	Dependencies between projects / initiatives	3.11	.172	.104*	0.0347
	Project roles (including ownership)	3.59	.155	.083	0.0582
	Skills of employees	3.13	.109	.027	0.2884
5. Information concerning design options to achieve the goals	Outsourcing potentials	2.65	.033	.004	0.6982
	Evaluations of technology	2.80	.109	.048	0.1574
	Consolidation potentials	2.96	.169	.097*	0.0419
6. Information concerning method competence	Concrete methods for transformations	2.77	.176	.095*	0.0475
	Outsourcing support	2.12	.056	.007	0.6061
7. Information concerning change management	Stakeholder characteristics	2.96	.174	.096*	0.0405
	Cultural change	3.00	.021	.001	0.8189
	Common language	3.02	.080	.015*	0.4378
	Communication strategy	2.91	.263	.189**	0.0036
	Trainings	3.07	.296	.294**	0.0002
	Transformation history ("Good Practices" and "Lessons Learned")	2.11	.259	.157**	0.0085
	Organizational culture	2.64	.027	.002	0.7700
8. Information concerning performance management	Benefits of the transformation	3.14	.164	.098*	0.0461
	As-Is costs	3.21	.177	.117*	0.0287
	(qualitative) success control (e.g. Expert opinion)	2.91	.246	.189**	0.0045
	(quantitative) success control e.g. measure "process time")	3.07	.251	.217**	0.0021
9. Information concerning external stakeholders	Business partners	3.09	.087	.027	0.2938
	Shareholders/investors/owner structure	3.07	.063	.016	0.4240
	Suppliers	2.79	.098	.030	0.2754
	Customers	3.05	.043	.006	0.6265
	Master agreements/contracts	3.09	.244	.202**	0.0032
10. Information concerning risk management	Risk assessments	3.23	.392	.426**	0.0000
	Legal regulations	3.26	.328	.396**	0.0000
	Security aspects	3.02	.204	.147*	0.0132
	Internal guideline/standards	3.39	.261	.227**	0.0014
11. Information concerning IT	Data structures	3.29	.170	.099	0.0514
	Applications (incl. interfaces)	3.32	.097	.038	0.2362
	IT-Infrastructure	3.29	.123	.052	0.1569
	IT-Security aspects	3.00	.154	.076	0.0850

** Significance < 0.01

Figure 16 The availability of information with influence on ET success (Labusch & Aier, 2014)

Appendix 5 Analysis of different EA artifacts titles with the same meaning

EA information is captured in EA artifacts. EA artifacts can have different titles within different organizations with the same meaning (Kotusev, 2019a). Grave et al. (2021) argue for example technology and skills forecast and high-level operational concept, while the definitions of these artifacts have similarities with the by Kotusev (2019a) described Analytical Reports and Target state. Table 9 describes the different EA artifact titles with the same meaning. Not applicable (N/A) means that the author does not describe an artifact in his/her research.

Table 9 Different titles with the same meaning

SPP Phase	Information requirement	Selected EA artifacts name	EA artifacts names described by authors		
			Kurnia et al. (2020)	Kotusev (2019a)	Grave et al. (2021)
Recognizing the need for DT	Consistent goal description	Strategic Plan	N/A	N/A	Strategic plan
		Target states	N/A	Target states	High-level operational concept
	Business Requirements	Analytical reports	N/A	Analytical reports	Technology and skill forecast
	Capabilities of the organization	Business Capability Models	Business Capability Models	Business Capability Models	Capability development plan
Initially formulating the DTS	Solution ideas (scenarios)	Options papers	Options papers	Options Assessments	N/A
		Conceptual architectures	Conceptual architectures and solution architectures	Solution overviews	N/A
	Processes	Landscape diagrams	Architectural Repositories	Landscape diagrams	N/A
		Technology reference models	Asset registers and current state diagrams	Technology reference model	Technology standards list
	Benefits of transformation	Initiative proposals	N/A	Initiative proposals	N/A
	Stakeholders of the transformation	Stakeholder communication plan	N/A	N/A	Stakeholder communication plan
	Important steps	Conceptual Roadmaps	Various roadmaps	Roadmaps	N/A
Preparing for implementation	Important steps	Solution designs	N/A	Solution designs	N/A
		Final Roadmaps	Various roadmaps	Roadmaps	N/A
	Dependencies between projects				

Appendix 6 Case and Interviewees Selection Criteria

Case selection criteria:

- The case organization must provide access to at least seven decision-making stakeholders.
- The case organization is currently making a decision or recently decided for using new digital technologies.
- The organization is willing to participate in the research.
- The case organization must provide access to relevant documentation (Enterprise Architecture artifacts) used during decision-making.

The selection criteria for interviewees:

- The interviewee is a decision-maker during the Strategic Planning Process (SPP) for Digital Transformations (DT) or influences the decision-making process.
- The interviewee is a proxy of a decision-maker.
- The interviewee wants to participate voluntarily.
- The interviewee does not risk negative consequences by participating in the research.

Appendix 7 Case description

Purpose: exploratory research, getting insight into a specific topic of interest, namely: EA information guidance during the Strategic Planning Process (SPP) for a Digital Transformation (DT).

Unit of analysis: the research was carried out within one organization, consisting of one case with one unit of analysis to keep the research more manageable and because the SPP influences the organization as a whole i.e. a holistic single case study approach (Saunders et al., 2019). Unit of analysis was the usage of EA information, i.e. “What EA artifact information is used for which purpose in the strategic planning process of an organization’s digital transformation?”

Advantage case study approach: better theoretical replication-possibilities.

Currently, the organization is restructuring itself as a result of market changes and COVID-19. A strategical theme where the case organization is currently focusing on is remote support. The case organization has set the goal for itself to use digital technologies (1) to be able to provide more remote services and (2) to be able to offer a completely new type of services. These changes have an impact on the case organizations’ “value creation paths”, specifically its “value propositions”. The company is going to make adjustments to its revenue model. Initially, the focus was on realizing as much billable hours for service engineers as possible through physical service and presence at a customer's location. This physical service will shift to a more remote service (reactive) and preventive service (proactive). The organization calls this “remote support”. The following main themes can be distinguished within remote support:

- Remote services: offering remote services through VR glasses and data logging. For this specific theme, 1 pilot was done with a customer.
- Condition monitoring: offering preventive maintenance through data analytics. For this specific theme 2 pilots are planned with potential customers.

A diversity of themes still has to be implemented in practice. However, a solid operational backbone is needed to set up and realize the above-mentioned digital transformation. This transformation is part of the strategic project SpeedX. This project is aimed at realizing more income through services. The chosen case and the digital transformation is very similar to the Sebastian et al. (2017) described “Digitized Solutions Strategy” in which the company reformulates its value propositions by integrating a combination of products, services, and data.

Appendix 8 Coding categories for interviews and artifacts analysis

Figure 17 describes the coding categories and the used codes for the analysis of the interviews.

Strategic Planning Process	Category	EA Artifacts	Category	EA information need	Category	EA information usage	Category
Recognizing the need	Process phase	No formal descriptions	Characteristics	Benefits of transformation	Business benefits	Solution idea's	Concepts
Strategic Planning success factor	Success factor	Goal descriptions	Strategy documents	Goal descriptions	Strategy	Sketch	Presentation
No formal process	Process course	Business model canvas	Strategy documents	Business requirements	Goals	Visual	Presentation
Just start	Process course	Analytical reports	Trend	Market trends	Environment	Mission statement	Strategy
Bottom-up approach	Process course	Roadmap	Plan	Strategy	Strategy	Market trends	Environment
Involved stakeholders	Approach	R&D roadmap	Plan	Important steps	Plan	Market insights	Environment
Multidisciplinary stakeholder involvement	Success factor	Mission and vision statement	Strategy	Vision	Strategy	Capabilities	Structure
Changing value creation paths	Dimensions	Operational roadmap	Plan	Deliverables	Plan	sub-strategy	Strategy
Use of technologies	Dimensions			Market insights	Environment	Deliverables	Plan
Structural changes	Dimensions			Business elements	Internal	Market knowledge	Environment
Financial aspects	Dimensions			Objective information	Strategy	Business requirements	Goals
Management commitment	Success factor			Value proposition	Business benefits	PMC strategy	Strategy
Management sponshorship	Success factor						
Priority determination	Activities						
Trial-and-error	Process course						
Central responsibility	Success factor						
Unstructured	Process course						
Strategic project	Process course						
Team effort	Success factor						
Piloting	Approach						
No structured process	Process course						
Budget allocation	Activities						
Technical focus	Characteristics						
Strategic focus	Characteristics						
Experience based decisions	Characteristics						
Structured process	Process course						
Categorization	Activities						
No strategic relation	Characteristics						
Setting the stage	Activities						
Preparing for implementation	Process phase						
Idea collection	Activities						
Strategy comparison and seletion	Activities						
Paying attention to soft skills	Wish						
Product management cyclus	Approach						

Figure 17 Coding categories for the analysis of the interviews

Figure 18 describes the coding categories and the used codes for the analysis of the artifacts.

EA Artifact	EA Information
Strategic Plan	Strategy
Roadmap	Market demands
Roadmap (financial)	Mission
Conceptual roadmap	Vision
Analytical reports	Financial aspects
Initiative proposal	Targets
Guideline	Actions/important steps
Conceptual architecture	Portfolio
Solution design	Budgets
Lessons Learned	Roles & Responsibilities
	Budget allocation
	Planning
	Deliverables
	Architecture
	Dependencies between projects
	Trends
	Important considerations
	Priorities
	Process
	Standards
	Growth markets
	Success factors
	High-level technology overview
	Requirements for remote access
	Lessons Learned
	Solutions

Figure 18 Coding categories for the analysis of the artifacts