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Enterprise Architecture Models and Capabilities as a Strategic Domain

Is TOGAF enough? Design Science Research

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ABSTRACT:

With the digitalization of the world, it would be thought that Enterprise Architecture (EA) is the desired solution. Accordingly, it would also be believed that it is an even more ready framework and EA is a more mature discipline within information systems (IS). However, a substantial number of EA projects fail and are stopped or are not perceived to give value. Since digitalization has made more and more comprehensive information possible, this will be a strategic development point for more and more organizations. Thus, EA should receive the appropriate support and resources. Since this is not the case, this work has investigated why this is the case and why this also happens with the most common EA Framework – The Open Group Architecture Framework (TOGAF), even though it gets high ratings. This study analyzes the problems that have arisen in connection with EA and how TOGAF is able to take these into account and prevent them. The research is design science research (DSR), and thus, the primary goal is to produce an artifact for this complex problem. The kernel theory of the study is systems thinking, which can be used to combine several mid-theory parts to form information systems design theory (ISDT). The study's secondary goal is to demonstrate the DSR approach with the help of the design relevant explanatory/predictive theory (DREPT) framework. It clarifies the ISDT "how" part by "why," explaining why the artifact has the effect it does. The research produces a combined two-part artifact. EA Preflight ensures the possibility of an EA by verifying the feasibility of the EA vision and key stakeholders' EA school of thought, and HR Architecture forms a comprehensive plan for EA capability's EA life cycle that is missing from TOGAF.

KEYWORDS: Enterprise Architecture, EA Capability, EA school of thought, DSR, DREPT

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Introduction

Enterprise architecture (EA) has maintained its interest in research as it offers rational solutions for problems that ever-increasing information technology (IT) complexity and dynamic business environments face. According to Luftman and Ben-Zvi (2010), EA contexted issues, i.e., IT and business alignment and business agility, are in the top five management concerns.

However, it is widely acknowledged that projects related to information technology have a tendency to fall short of expectations, delivering less value than initially promised (Alter 2013, Ross et al. 2006, Kotusev 2017 & 2021, Kaisler & Armour 2017, Kaisler et al. 2005, Hope et al. 2017). EA is generally associated with a poorly successful IT project and has a bad reputation in some organizations. Wide information systems (IS) investments are very expensive, and problems are widely reported in the News, especially on the public side, where systems are generally large. Here in Finland, Uusimaa, two public projects (Helsinki city payroll systems and Apotti ERP system for healthcare) have been widely covered in the media due to problems.

According to the literature, commitment and attitudes toward EA are dismissive, and many implementations and EA initiatives fail or give poor results (e.g., Hope, Chew & Sharma, 2017; Dang & Pekkola, 2016; Enagi & Ochoche, 2013; Seppänen, 2009). EA has not (yet) gained its expected value (Hacks, Höfert, Salentin, Yeong, & Lichter, 2019). Over 40% of the GEA programs will be terminated by 2012 due to poor execution. Common barriers identified in the study of the 27 GEA programs in US federal agencies include cultural resistance, organizational parochialism, lack of understanding by top management, and insufficient human capital and funds (Ojo, Janowski & Estevez, 2012, p. 4260).

Even if EA looks to be a proper solution for enterprise-wide IS systems, problems have emerged in executing EA. Only a few enterprises reported finding the value of EA (e.g.,

Hope, Chew & Sharma, 2017; Potts, 2010; Ross, Weill & Robertson, 2006; Shekkerman 2005; Kaisler, Armour & Valivullah, 2005).

The problem broadly expressed is: “Where is the value of EA, and why does EA fail?” This study shows that “lack” of value and failure are interconnected and avoidable.

As a complex system, EA has no single decisive factor for success or failure. There are many researched reasons for failing and many prior studies about EA problems and critical success factors (CSF). However, few studies have developed concrete artifacts, i.e., methods or theories for better EA work. The vast majority of EA research has focused on a reductionist approach and tried to explain EA issues by reducing complex problems to their simplest component parts, even if it has claimed that the approach is holistic. No doubt, whenever EA is considered, it is a system, and it is part of a more extensive system. Russell Ackoff (1981) defines a system as a set of two or more elements that satisfies the following three conditions:

1. The behaviour of each element has an effect on the haviour of the whole.
2. The behaviour of the elements and their effects on the whole are interdependent.
3. However subgroups of the elements are formed, all have an effect on the behaviour of the whole, but none has an independent effect on it.

From this perspective, linear problem-solving is not a proper method. In the context of EA, I consider issues to be more interrelated, and the appropriate approach is systems theory, specifically systems thinking and system dynamics.

EA implementation methodologies practices, especially in modeling, management, and maintenance, need more consideration for non-functional requirements in existing EA methodologies. There is no appropriate consideration of requirement analysis in most existing EA implementation methodologies. (Rouhani et al., 2015.)

The architectural concepts in most frameworks are highly abstract, adding to their complexity. TOGAF standard is primarily valued for its comprehensive process, Architectural Development Methodology (ADM), interoperability, flexibility in usage, availability of architectural knowledge, vendor-neutrality, and alignment with industry standards. In Table 1, the TOGAF addresses expressed attributes and characteristics more extensively than other frameworks, which contributes to its wide adoption in the EA industry. (Cameron & McMillan, 2013.)

Table 1. Comparative Analysis of EA Frameworks (Cameron & McMillan, 2013, p. 69).

Attributes/Criteria	Zachman	TOGAF	DoDAF	FEA	Gartner
Business alignment with information technology / business focus	1	3	1	1	4
Taxonomy guide	4	2	2	3	1
Reference model	1	3	2	4	1
Completeness of process	1	4	1	2	3
Rating of maturity	1	2	2	3	3
Governance support	1	2	3	3	3
Interoperability / flexibility	2	4	3	3	2
Knowledge repository / information availability	2	4	2	2	1
Standards (architecture, industry, government)	2	4	3	3	1
Best of breed / Best fit	2	4	2	3	1
Integration / Connectivity between layers	3	4	2	3	2
1 – very dissatisfied; 2 – dissatisfied; 3 – satisfied; 4 – very satisfied					

According to Kotusev (2018, p. 342), the enterprise architecture (EA) practice within the organization, although based on TOGAF, did not align with its core principles. The organization found that most of TOGAF's recommendations were not beneficial. Additionally, the few useful concepts from TOGAF were considered conventional rather than specific to TOGAF, and the organization independently developed the most critical aspects of its EA practice.

In this contradictory perspective, TOGAF in EA formation creates the need to observe its role in EA endeavor outcomes.

Organizations that implement EA can reap many benefits. EA can provide a significant competitive advantage by streamlining processes and enhancing communication and collaboration. By leveraging EA, organizations can ensure that their resources are optimally utilized, enabling them to make sound strategic decisions. Implementing EA can result in a substantial increase in organizational competence. In short, using EA is assumed to result in value for organizations. (Niemi & Pekkola, 2016; Tamm, Seddon, Shanks & Reynolds, 2011)

1.1 Enterprise Architecture Background

Henderson and Venkatraman (1993) argued that information technology (IT) had gained a more strategic role but still lacked its utilization as a business competence factor. Henderson and Venkatraman (ibid.) argued that the reasons are the inability to realize value from IT investments and the lack of alignment between the business strategy and IT strategies. In Figure 1 organizational design and information systems design activities describe dependencies and activities in an organizational design and information system design. They stress alignments between business and information technology strategies between organizational information systems infrastructures.

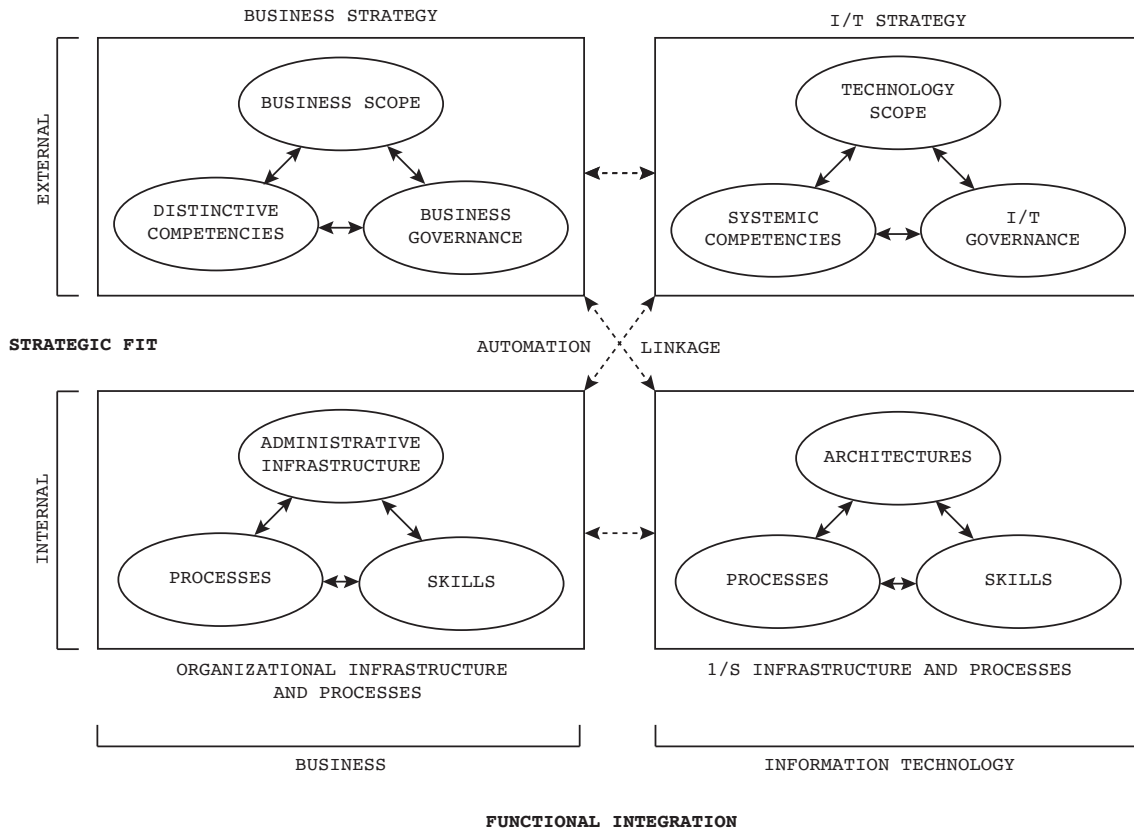


Figure 1. Organizational Design and Information Systems Design Activities (Henderson & Venkatraman, 1993, p. 476).

Since IT has developed and prices have become cheaper, progressively more complex information systems utilization has become more trivial for individuals, society, and organizations. In the business environment, the dominant trend is digitalization, which is used to develop new services and improve competence. Implementing more IT systems has made them complex to govern and use. Different systems and applications demand constant effort to adapt. Fragmented development has generated a tangled IS system, which generates ineffectiveness and is a root cause of many fundamental problems. Numerous different applications and systems are costly and timely maintenance and are not rational investments. Overlapping systems generate granularity and redundant data. Legacy systems enterprise architecture maintenance can become complex when legacy systems or technical debt are not adequately addressed. Legacy systems may require specific expertise or be difficult to integrate with modern architecture components, leading to increased complexity and maintenance

efforts. A tangled IS system is hard to alter, and it is timely, expensive, or infeasible when modification is needed. From a tangled IS system, it is hard to get the best of it and take advantage of its potential benefits.

“Paradoxically, digitizing core business processes makes the individual processes less flexible while making a company more agile” (Ross, Weill & Robertson 2006:4).

Due to emergent challenges in the IS field of organizations, EA has become a more common practice and has gained attention from practitioners and academics in the IS and business management (BM) fields.

There is no universally accepted definition of EA ([Doucet et al., 2009; Chen, Doumeingts & Vernadat, 2008; Lapalme, 2012; Quang, 2012] as cited in Vallerand, Lapalme & Moïse 2017, p. 859) present. However, Shekkerman (2004, p. 21) introduces well-known definitions:

“Enterprise Architecture is about understanding all of the different elements that go to make up the enterprise and how those elements inter-relate.” (The Open Group)

“Enterprise Architecture is a strategic information asset base, which defines the business mission, the information necessary to perform the mission, the technologies necessary to perform the mission, and the transitional processes for implementing new technologies in response to the changing mission needs.” (USA Federal CIO Council)

“Enterprise Architecture is the holistic expression of an organization’s key business, information, application and technology strategies and their impact on business functions and processes. The approach looks at business processes, the structure of the organization and what type of technology is used to conduct these business processes.” (Meta Group, Inc.)

Bernard (2012, p. 33) compressed the definition into one equation: *“Enterprise Architecture = Strategy + Business + Technology”*.

“The continuous practice of describing the essential elements of a socio-technical organization, their relationships to each other, and to the environment, in order to understand complexity and manage change”. (EARF 2010, cited in Bean, 2010;8.)

“Enterprise architecture (EA) is a discipline for proactively and holistically leading enterprise responses to disruptive forces by identifying and analyzing the execution of change toward desired business vision and outcomes. EA delivers value by presenting business and IT leaders with signature-ready recommendations for adjusting policies and projects to achieve targeted business outcomes that capitalize on relevant business disruptions.” (Gartner, 2022)

“The organizing logic for business process and IT capabilities reflecting the integration and standardization requirements of the firm’s operating model.” (MIT CISR, *Classic Topics Enterprise Architecture*, 2022)

Kotusev (2021, p. 40) describes it as a collection of documents.

“Enterprise architecture (EA) can be defined as a collection of special documents (artifacts) describing various aspects of an organization from an integrated business and IT perspective intended to bridge the communication gap between business and IT stakeholders, facilitate information systems planning and thereby improve business and IT alignment (importantly, this definition may be inconsistent with the definitions of enterprise architecture provided by other sources”.

EA has moved forward from an enterprise-wide IT perspective to a multidimensional perspective. Even though EA has extended its focus on business architecture, there are still EA practitioners who take it as a descriptive tool for better IT usage. However, there

are also EA architects who keep it as strategic design to improve efficiency, effectiveness, or innovation (Bean, 2010, p. 7).

Shekkerman (2004) describes enterprise architecture as a holistic expression of the enterprise master plan, which “acts as a collaboration force” between aspects of *business planning* such as goals, visions, strategies, and governance principles; aspects of business operations such as business terms, organization structures, processes and data *automation* such as information systems and databases *technological infrastructure* such as computers, operating systems, and networks.

According to Simon, Fischbach, and Schoder (2013), there has been no common definition for EA since Shekkerman's (2004) collection. Years later, there is no common definition either. According to Nurmi, Pulkkinen, Seppänen, and Penttinen (2019), many authors pointed to the need for a common definition for EA, and even if there is an ever-growing number of valid studies, there is no such captured. From this perspective, EA is still progressing and worth exploring.

Saint-Louis, Morency, and Lapalme (2019, p. 15) studied 102 journal articles and the definitions of EA, and 160 definitions were extracted. The results of this investigation show that some of the definitions found in the EA literature are implicit, incomplete, complex, and incoherent. This suggests that the discipline is not yet fully developed.

Different contexts and perspectives can exist in the field of EA practice and research, making a single description impossible and causing confusion about EA's meaning (see Korhonen et al., 2016; Lapalme, 2012). The lack of a common definition or, more accurately, a plethora of assumptions about the definition of EA means various expectations of it. That is one of the fundamental problems with present-day EA work.

“EA provides value in planning, change governance, and purposeful benefits realization”
(Open Group Guide 2016, p. 49).

1.2 Objective of the research, extent, and demarcation

This study focuses on non-functional requirements, that is, organizational readiness and execution aspects connected to people and capabilities, and proposes adding HR architecture to TOGAF Architectural Development Methodology (ADM).

Based on previous studies, it would be necessary to classify EA into three different sections. In this study, EA is classified as 1) EA as Capability, 2) EA as a Process, and 3) EA as a Product. EA Product is the result of EA development, implementation, and (strategic) initiative's work packages.

EA Capability is here divided into EA Capability of people and EA Capability of Process, including EA Capability to produce the required information.

EA Capability is the part of EA that maintains the EA Process and secures the EA Product. It is an overall resource and ability for EA.

“EA Capability is the ability to develop, use, and sustain the architecture of a particular Enterprise, and use the architecture to govern change.” (The Open Group, 2016, p. 13)

The study focuses on the approach and process of EA endeavors with the TOGAF ADM Framework and organizations' human capabilities for EA work. This study aims to generate a holistic, big picture of the dependencies between different disciplines and underlying aspects in the EA context in an organizational environment. It brings out the inexorable dependencies between organizational capabilities, key practices, and theories regarding EA linkage business competence.

This study's target is to develop a model for EA work that secures value formation for its stakeholders with the TOGAF framework.

1.2.1 Problem Identification

TOGAF addresses expressed attributes and characteristics more extensively than other frameworks, which contributes to its wide adoption in the EA industry (Cameron & McMillan, 2013). TOGAF is the most used framework for EA today (e.g., Dedic, 2020; Kotusev, 2018). However, Kotusev (2018, p. 342) criticizes TOGF and argues that TOGAF is popular only because there are no better sources on EA. According to Kotusev (ibid.) EA practice in the organization did not follow even the more general five-step logic (document the current state, describe the future state, analyze the gaps, develop a transition plan, and implement it)

Over 40% of the GEA programs will be terminated by 2012 due to poor execution. Common barriers identified in the study of the 27 GEA programs in US federal agencies include cultural resistance, organizational parochialism, lack of understanding by top management, and insufficient human capital and funds (Ojo, Janowski & Estevez, 2012, p. 4260).

Only a few enterprises reported finding the value of EA (e.g., Hope, Chew & Sharma 2017; Potts, 2010; Ross, Weill & Robertson, 2006; Shekkerman, 2005; Kaisler, Armour & Valivullah, 2005).

Research questions:

1. Why is the EA value not given, even if it uses the most popular and highest-rated EA framework?
2. How to improve EA value formation?

1.2.2 Demarcation

According to the Parson/Thompson model of organization levels, this research focuses on the institutional and managerial levels, excluding the technical level (Table 2). (Bernard 2012, p. 54).

Table 2. Parson/Thompson model of organization levels (Bernard 2012, p. 54).

Organizational Level	Structure Parson's Purpose of each Level	Function Thompson's Activities of the Level
<i>Institutional</i>	<i>Where the organization establishes rules and relates to the larger society as it derives legitimization, meaning, and higher-level support, thus making possible the implementation of organizational goals.</i>	<i>The organization is very open to the environment in order to determine its domain, establish boundaries, and secure legitimacy.</i>
<i>Managerial</i>	<i>Where mediation between the organization and the immediate task environment occurs, where the organization's internal affairs are administered, and where the organization's products are consumed and resources supplied.</i>	<i>A dynamic of mediation occurs where less formalized and more political activities occur.</i>
<i>Technical</i>	<i>Where the actual "product" of an organization is processed.</i>	<i>The organization is "rational" as it carries on production (input/output) functions and tries to seal off those functions from the outside to protect them from external uncertainties as much as possible.</i>

The technological dimension of EA is demarcated outside, and the research is concerned with its social dimensions. Focus disciplines outside of information systems are strategic management and organizational behavior. This research is outlined to the EA TOGAF Framework and its human aspects without taking a stand on technological matters.

The EA Process is all that is worked to produce an EA Product. An example of the process is the TOGAF Architecture Development Method (ADM) (Figure 1).

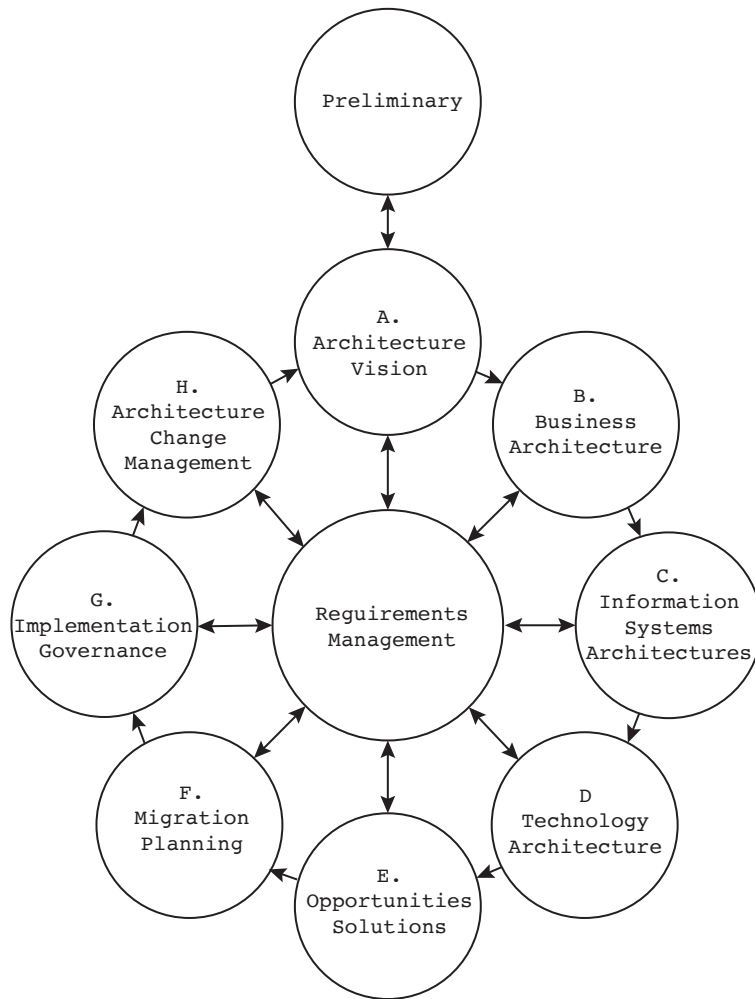


Figure 2. TOGAF Architecture Development Method (ADM).

This research focuses on TOGAF ADM's "Preliminary," "A," and "F—G" phases and how these consider EA readiness.

1.2.3 Structure of the Work

The structure follows the Design Science Research Publication Schema presented by Gregor and Hevner (2013, p. 350) (Table 3).

Table 3. DSRM Study structure – Study actions from this study.

DSRM phase		Study action
Identify problem	Literature review	Research related to EA frameworks Research related to critical success factors (in EA context) Research related to Strategic alignment Research related to Dynamic capabilities Research related to Maturity models (Research related to DSRM)
Define objectives of a solution		Develop a model which prevent strategic initiative implement inertia. (or at least is substantial improvement).
Design and development	Conceptual investigation (Empirical investigation)	1. Identification of inertia and failure factors 2. identification capabilities which eliminate inertia
	Artifact creation	3. Design EA framework model for dynamic capabilities
Demonstration	Empirical investigation	Testable hypothesis about the artifact
Evaluation		Follow the instructions of the DSR guidelines
Communication – Publication	Thesis publication	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.

Table 4 shows the work's structure, with chapters and a short summary of the key subjects.

Table 4. Structure of the Work with Key Subjects.

Chapter	Key subjects
Introduction	<ul style="list-style-type: none"> - Background, motive and stimulus - limitation and goal - Implementation of the study - Research methods - Research structure
Literature Review	<ul style="list-style-type: none"> - Highlights prior research of EA-related subjects - Introduce EA-related problems and challenges - Associates related subjects - Examine problem dimensions - Forming the scope of the problem - Evaluate research methods and approaches - Identifies research gaps
Method	<ul style="list-style-type: none"> - Introduces Design Science Research Methods background - Introduces different approaches and processes within DSR - Introduces DSR ontological perspective and DS theory - Introduces differences between design-theory camp vs. pragmatic-design camp and knowledge - Introduces differences between types Ω vs. Λ - Selection of research methods and explain in this study used Design Science Research approach - Explain used reasoning (Abduction-Deduction) - Explain used data collection and kernel theory and tools
Problem Space	<ul style="list-style-type: none"> - Literature review of EA-related problems - Evaluation of prior research results - Evaluation and examination of the problems - Evaluation and examination of the problems of mutual dependence - Grouping related problems and dividing them according to related subject
Solution Space	<ul style="list-style-type: none"> - Literature review of EA related critical success factors - Evaluation of prior research results
Artifact Description	<ul style="list-style-type: none"> - EA problem environment analysis - Introduction of related essential aspects that suggested artifact cope - EA system contribution artifact formation - EA Preflight and HR Architecture artifacts
Evaluation	<ul style="list-style-type: none"> - Artifact evaluation
Discussion & Conclusion	<ul style="list-style-type: none"> - Reflection (study objects and prior research) - The benefits manifested in the implementation of the research the evaluation and contribution to the success of the research - Problems and limitations of the research - Further research proposal
	<ul style="list-style-type: none"> - Results of the study - Artefact

2 Literature Review

Keywords for #1 search: "Enterprise Architecture/EA benefits," "Enterprise Architecture/EA value," "impact of Enterprise Architecture/EA," " Enterprise Architecture/EA organizational performance," and "EA strategic/strategy."

Keywords for #2 Enterprise Architecture, EA, Critical Problems, Problems, Issues, Failure, Critical Questions, Critical Success Factor, CSF, Systems, System thinking, Systems Dynamics, Framework, Models, TOGAF, ADM, Maturity, Maturity Models, Capability, Strategy, Strategic.

The search was executed as a Boolean search with AND, OR, and NOT.

In search #1, all headings were read if they included EA (OR) Enterprise Architecture AND some of the keywords AND criteria for the year 2010; if a peer review was conducted, if so, the abstract was read. If the abstract includes an approach that touches on this research topic, the article's conclusion sections were read, and if it includes results that touch on this research, the article was read.

In search #2, various Boolean combinations were used with more than 3 keywords AND criteria for the year 2000; if a peer review was conducted, all headings were read; if so, the abstract was read. If the abstract includes an approach that touches on this research topic, the article's conclusion sections were read, and if it includes results that touch on this research, the article was read.

In search #3, references from the articles.

Several electronic databases are used: UWASA Tritonia library search (includes various electronic databases of journals as well as E-books, IEEE Xplore - IEEE Electronic Library,

JSTOR Arts & Sciences, Academic Search Elite (EBSCO), ProQuest 5000,), and Google Scholar.

Hiekkanen, Korhonen, Collin, Patricio, Helenius and Mykkänen, (2013) study EA practitioners state that the adoption and application of EA are still relatively immature, and EA is focused on the efficiency and effectiveness of IS/IT operations and systems. This observation is supported by Kotusev (2018), and according to him, the organization did not follow even the more general five-step logic (document the current state, describe the future state, analyze the gaps, develop a transition plan, and implement it).

Lucke, Krell and Lechner (2010), identifies several shortcomings of EA frameworks. According to them, EA frameworks often do not adequately address organizational concerns (Janssen & Hjort-Madsen, 2007; Niemi, 2009; Seppanen et al., 2009; Shah & Kourdi, 2007; Wilton, 2008). *“The existing frameworks and methodologies for EA practice are generally very oriented towards the internals of EA content and processes and make it very difficult for business people to grasp how an EA approach will benefit them or their organization”* (Bean, 2010, p. 8). Moreover, few EA frameworks have a methodology (Kaisler & Armour, 2017). Bean notes that the Zachman framework has a clear, logical structure that is easily understood in theory, but very few organizations have successfully realized the expected benefits of creating and utilizing Zachman-compliant models in practice. Unlike many other frameworks, TOGAF includes a method for building an EA (Kaisler & Armour, 2017). The TOGAF ADM is a method for EA work. However, whereas Zachman’s framework is commonly grasped, TOGAF ADM makes more logical sense to an IT person and can be mapped to IT planning and development lifecycles, but it is more difficult to link into the normal processes of enterprise, meaning that the practitioners in a typical EA team often struggle to demonstrate the value of their efforts (Bean, 2010, p. 8). The current frameworks and methodologies for EA practice primarily focus on the internal aspects of EA content and processes (Kaisler & Armour, 2017; Bean, 2010).

As there is no common definition of EA, definitions that are more business-oriented are suggested e.g. EA be *“the continuous practice of describing the essential elements of socio-technical organization relationships to each other, and to the environment, in order to understand complexity and manage change”* (Bean, 2010 p. 8). That kind of development has extended the EA context with a greater focus on business architecture and approach to developing EA frameworks (e.g. Hope, Chew & Sharma, 2017). For example, MIT researchers Rhodes, Ross, and Nightingale’s (2009) research is within the field of engineering systems to develop constructs and methods for architecting enterprises engaged in system-of-systems (SoS) engineering. *“The complexity and nature of technological systems and their associated enterprises have evolved significantly in recent years due to such factors as net-centricity, complexity of the human-system interface, global engineering environment, and shifting geo-political forces. The field of engineering systems has emerged to address the challenges inherent in these systems, or systems-of-systems (SoS)”* (Rhodes, Ross & Nightingale, 2009, p. NA). They argued that this kind of development has brought system-of-systems engineering and complex enterprise engineering, presenting new challenges in identifying and achieving convergence in the enterprise stakeholder needs and further requires new ways of thinking about and managing systems. Bean (ibid.) encourages organizations to recognize other fields that provide relevant knowledge, particularly systems practice complexity science, which may need to be incorporated as part of an EA practice.

Von Bertalanffy (1950) recognized the application of systems across many disciplines, which he called General Systems Theory (GST). The foundational principles of systems thinking were first articulated in the early 20th century within disciplines such as organismic biology, ecology, psychology, and cybernetics (Capra, 1997). The concepts referenced above were embraced within the field of OR/MS as management cybernetics (Beer, 1967), system dynamics (Forrester, 1968), systems engineering (Hall, 1962), and generally under the umbrella of the systems approach (Churchman, 1968; Klir, 1969; Weinberg, 1975). These foundational systems concepts have remained largely

unchanged over the years, with numerous real-world applications that simply embody "the systems approach". (Mingers & White, 2010.)

This research is based on system dynamics (SD), which is one of the system approaches. The foundational concepts of system dynamics originated from the work of Jay Forrester at MIT during the 1960s. Forrester's focus lay in modeling dynamic behaviors within various systems, including city populations and industrial supply chains (Forrester, 1961, 1969,; Sterman, 2000). He posited that the behavior of these systems, regardless of scale, emerged from inherent structures involving flows, delays, information, and feedback relationships. SD relies on the assumption that particular patterns of feedback occur in many situations and generate particular patterns of observed behavior. According to Forrester (1969), there may be around 20 such generic structures, such as product launches or urban development. Senge (1990) popularized these structures as "systems archetypes," which often explain organizational issues. For example, the "fix that fails" archetype demonstrates how a short-term solution can lead to new and unforeseen problems, necessitating an even larger fix. (Mingers & White, 2010.)

Even if SD has its roots in an engineering environment, it is transplanted into various other disciplines and, for example, studied to determine how it fits with traditional social science paradigms such as positivism and interpretivism (Lane 2001). According to Lane (*ibid.*), it has aspects of both. Lane sees this as the integration of agency and structure of Giddens (i.e., Giddens' agency reflects intentional activities whereby individuals seek to satisfy their needs and goals, and Giddens' social structures do not reproduce themselves; it is always agents and their practices that reproduce structures, depending on circumstances). This relates to the debate as to whether SD should be seen as "hard", i.e., building models of external reality, or "soft", i.e, modeling peoples' subjective perceptions (mental models) (Lane, 2000). Mingers (2000, as cited in Mingers & White, 2010, p. 1151) supports this, arguing that SD exemplifies a particular philosophical perspective – critical realism – which involves both an integration of agency/structure and an epistemological balance between objectivism and subjectivism. Critical realism

is a supported philosophy by design theory, as Gregor and Jones (2007) suggest, and it is also this research's philosophical background.

Hope et al.'s (2017) research studies how critical success factors (CSF) work in EA implementation and the underlying aspects in the EA framework context. They studied how Zachman's framework is practiced and the role of sociological factors in the practice of EA within organizational contexts. Hope et al. (2017, p. 25) demonstrate that "cases show success perhaps comes less from *"what"* is done, as Zachman's framework would have us believe, than *"how"* it is done, i.e. the sociological process involved in the implementation of EA." Thus, they argue that methodology is not as important as how it is executed. Moreover, Hope et al. (2017, p. 25) suggest that *"the methodological skills of architects need to be supplemented with process (or social) skills so that architects might be able to attend to key aspects of the organizational context to assure the success of EA programmes as well as their own success, rather than be the victims of circumstances."*

Despite studies with the systems approach, like Rhodes, Ross and Nightingale (2009) presented and the EA development, the TOGAF ADM framework is still one of the most used methods. The literature does not provide research on how TOGAF ADM supports this approach (see. Nurmi et al. 2019). Kaisler and Armour (2017) identified a lack of well-developed integrative design and management methodology. Kaisler and Armour (2017, pp. 4808, 4812-4813) point out critical subproblems: assessing EA capability maturity, lack of alignment with business strategy, assessing infrastructure stress, the system's architect's value proposition, virtual enterprise, scalability, EA metrics, and best practices. Kotusev (2018) criticizes TOGAF heavily, and according to him, organizations tend not to follow it.

3 Method

3.1 Design Science Research

IS scholars have spent a lot of energy defending various research methods. There are debates about the end goal of design research. Much work has been done balancing a design artifact and a design theory within design science research in information systems (DSRIS). Different viewpoints exist about design science in information systems (IS) research and its outcomes and theory formulation (see e.g., Kuechler & Vaishnavi, 2008; Venable, 2006). Kuechler and Vaishnavi (2012, p. 397) point out three potential outputs of DSRIS project: (1) artifact, (2) information systems design theory (ISDT), and (3) design relevant explanatory/predictive theory (DREPT). Furthermore, according to Gregor and Jones (2007, p. 322), there is a lack of the ontological status of the artifacts of interest in the literature, and they recommend its clarifying upcoming works.

Therefore, it is necessary to open DSRIS and its philosophical background to explain how it formulates in this research. Also, because the design is two-fold – a set of activities and artifact(s) – a verb and noun (Walls et al., 1992, as cited in Hevner et al., 2004, p. 78), it is a well-founded reason to open how, when, and what the outputs will be during research.

DSR is a relatively new methodology, and even though it has developed guidelines (e.g., Gregor & Jones, 2007; Hevner et al., 2004; Marsh & Smith, 1995), it has struggled to gain popularity as an officially approved method in the academic world. There was not a generally accepted framework, and to contribute to the usage of DSR, Peffers, Tuunanen, Rothenberger, and Chatterjee (2008) and Gregor and Hevner (2013) established more specific methods to follow.

Herbert Simon's seminal work "The Science of the Artificial" (first published in 1969, 3rd edition 1996) conceptualizes the design process, which is an inventive or creative, real-

world problem-solving activity, as a science. Since then, design science (DS) has evolved under various names, and it has been referred to as “systemeering” (Iivari 1983), a “constructive” approach (Iivari 2007), and “systems development” or an “engineering approach” (Nunamaker et al. 1990-91) (Gregor & Hevner, 2013, p. 338).

March and Smith (1995, p. 252) described two kinds of scientific interest in IT. First, *Descriptive research*, which is a knowledge-producing activity that aims to understand the nature of IT and therefore is like natural science. Second, *Prescriptive research* is a knowledge-using activity aiming to improve IT performance and corresponds to DS. IT research deals with human creations like organizations and information systems. Natural science is concerned with answering “how (is)” and “why” and aims at understanding and explaining phenomena, while DS is concerned with developing artifacts to accomplish some end. For this reason, there are arguments against DS, and it is not seen as “science” per se. However, they argued that scientists could contribute to both within DS.

According to March and Smith (1995), the *descriptive research school of thought* and the *prescriptive school of thought* have created a dichotomy within IT research. Moreover, Gregor, and Hevner (2013, p. 338) identified that within DS emerged two different camps. Gregor and Jones (2007), Markus et al. (2002), and Walls et al. (1992, 2004) formed a *design-theory camp*, whereas Hevner et al. 2004, March and Smith 1995 and Nunamaker et al. (1990-91) formed a *pragmatic-design camp*.

As earlier noted, Gregor and Hevner (2013) identified two DS camps that emphasize design theories or artifacts as research contributions differently. *The pragmatic-design-camp* (e.g., Hevner et al., 2004; March & Smith, 1995) leaves theory building for less focus and tend to see theory as it is understood with natural sciences (see e.g., Venable, 2006). They promote design science as a research activity and require the construct, model, method, and/or instantiation as a research contribution. In comparison, *the design theory camp* (e.g., Gregor & Jones, 2007) emphasizes theory building and point

of view that considers design theory to be prescriptive knowledge and a research contribution.

Hevner et al. (2004) see that *design science research* (DSR) aims to generate *prescriptive knowledge* concerning IS artifacts, such as software, methods, models, or concepts. Acquiring such knowledge, Hevner et al. (ibid.) see behavioral science as an inseparable part of design science research. Behavioral science theories inform researchers of the interactions between people, technology, and organizations to manage while seeking an organization's information systems' effectiveness and efficiency. From Hevner et al. (2007, p. 79) point of view, IS research's real-world and problem space is at the confluence of people, organizations, and technology (Figure 3). Together these define business need – *problem* – which is the interest of design science research. For research relevance, research needs to be framed according to this “problem.” March and Smith (1995, p. 254) identified two basic processes of design science: *build* and *evaluation*. Hevner et al. (ibid.) stress the importance of truth and utility in research by combining behavioral science and design science paradigms.

Behavioral science addresses research through the *development* and *justifications* of theories that explain or predict phenomena related to the identified business need. Design science addresses research through the *building* and *evaluation* of artifacts designed to meet the identified business need. The goal of behavioral-science research is truth. The goal of design-science research is utility. (Hevner et al., 2004, pp. 79-80)

Hevner (2007) stresses DSR cycles of activities: relevance cycle, design cycle, and rigor cycle. The relevance cycle bridges the contextual environment of the research project with the DS activities. The rigor cycle connects the DS activities with the knowledge base of scientific foundations, experience, and expertise. The design cycle iterates between the core activities of building and evaluating the design artifacts and processes of the research. Hevner (2007, p. 88.)

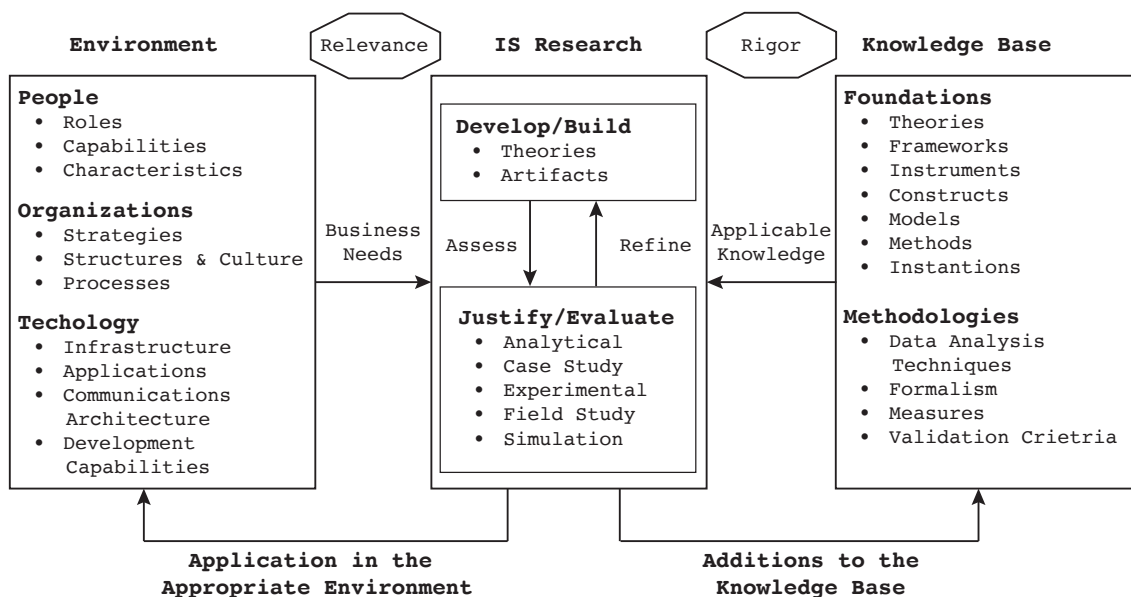


Figure 3. IS research framework (Hevner et al. 2004, p. 80).

Gregor and Jones (2007, p. 321) base their real-world and problem space on the ideas of Habermas and Popper, where realism implies that the world contains certain types of entities that exist independently of human beings and human knowledge of them. Whereas Hevner et al. (2004) consider construct, model, and method as independent design artifacts, see Gregor and Jones (ibid.) that they are all one type of thing and relate to theory or its component. According to Gregor and Jones (ibid.), phenomena of interest for design research include 1) Instantions or material artifacts. (Artifacts that have a physical existence, e.g., hardware, software, or the series of physical actions in the real world.) 2) Theories or abstract artifacts. (Artifacts without physical existence but are communicated in words, pictures, diagrams, or presentation.) 3) Human understanding of artifacts. (Usage and comprehension of abstract and material artifacts and interaction between them and actions depending on that.)

Gregor and Jones (2007, p. 322) propose that the full specification of an information systems design theory includes eight components (Table 6). The proposed design theory is parallel with Walls et al.'s (1992) information systems design theory (ISDT) (

Table 5) and Dubin's (1978) natural science-type theory but adds constructs, artifact mutability, and expository instantiation for Wall et al.'s (ibid.) ISDT, and for Dubin's (1978) natural science-type theory, it adds justificatory knowledge and principles of implementation.

Table 5. Components of an ISDT (Walls et al., 1992, p. 46).

Design Product	
1) Meta-requirements	Describes the class of goals to which the theory applies
2) Meta-design	Describes a class of artifacts hypothesized to meet the meta-requirements
3) Kernel theories	
4) Testable design product hypotheses	Used to test whether the meta-design hypotheses satisfies the meta-requirements
Design process	
1) Design method	A description of procedure(s) for artifact construction
2) Kernel theories	Theories from natural or social sciences governing design process itself
3) Testable design process hypotheses	Used to verify whether the design hypotheses method results in an artifact which is consistent with the meta-design

Table 6. Eight components of an ISDT (Gregor & Jones, 2007, p. 322).

Component	Description
Core components	
1) Purpose and scope (the <i>causa finalis</i>)	"What the system is for," the set of meta-requirements or goals that specifies the type of artifact to which the theory applies and in conjunction also defines the scope, or boundaries, of the theory.
2) Constructs (the <i>causa materialis</i>)	Representations of the entities of interest in the theory.
Principle of form and Function (The <i>causa formalis</i>)	The abstract "blueprint" or architecture that describes an IS artifact, either product or method/intervention.
4) Artifact mutability	The changes in state of the artifact anticipated in the theory, that is, what degree of artifact change is encompassed by the theory.
5) Testable propositions	Truth statements about the design theory.
6) Justificatory knowledge	The underlying knowledge or theory from the natural or social or design sciences that give a basis and explanation for the design (Kernel theories)
Additional components	
7) Principles of Implementation (the <i>causa efficiens</i>)	A description of processes for implementing the theory (either product or method) in specific contexts.
8) Expository instantiation	A physical implementation of the artifact that can assist in representing the theory both as an expository device and for purposes of testing.

Kuechler and Vaishnavi (2012, p. 397) point out three potential outputs of DSRIS project. Whereas the above-mentioned (1) artifact and (2) information systems design theory

(ISDT) are already explained, they reveal design relevant explanatory/predictive theory (DREPT) that would be a third (3) possible of DSRIS project.

Kuechler and Vaishnavi (2012, p. 398) notice that even though kernel theories are suggested components of Walls et al.'s ISDT, it is a controversial issue how the kernel theory relates to or suggests the prescribed design. However, according to Kuechler and Vaishnavi, there are equivalents of DREPT or its functionality in several papers, but not a formal definition, e.g., ISDT of Gregor and Jones (2007) includes the core component, *justificatory knowledge*, which can be considered a similar thing, but not formally defined as own mid-range theory. Merton (1968, as cited in Kuechler and Vaishnavi, 2012, p. 402) about mid-term theories; “Theories that lie between the minor but necessary working hypotheses that evolve in abundance during day-to-day research and the all-inclusive systematic efforts to develop a unified theory.” Kuechler and Vaishnavi see a more abstract type of DREPT necessary for relations between kernel theory, ISDT, and artifact. Kuechler and Vaishnavi illustrate in Figure 4 how the kernel theory relates to an artifact and how more abstract DREP helps to capture knowledge and theorizing in DSRIS.

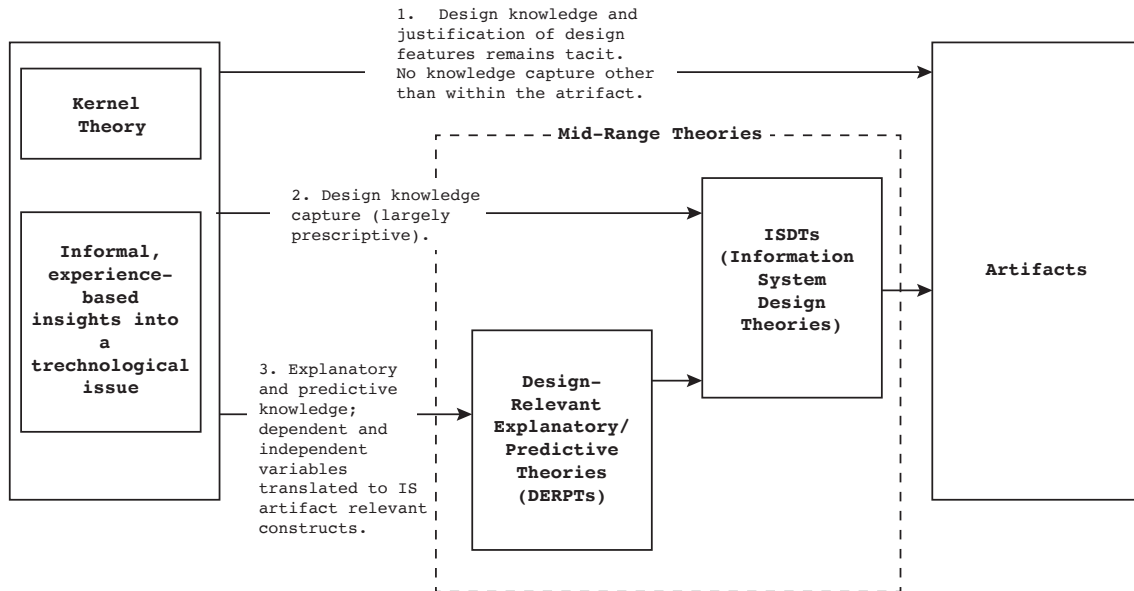


Figure 4. DREPT in DSR (Kuechler & Vaishnavi, 2012, p. 399).

DREPT is more abstract than ISDT and thus more broadly applicable. It augments the "how" information of ISDT, explaining "why" the artifact has the effects it does.

According to the literature on design science research, there are many outlines of how knowledge should be formed and utilized during research, what kind of knowledge can be used and produced, and how it relates to research. Anyhow, Gregor and Hevner (2013, p. 338) notice that many authors, reviewers, and editors struggle to present and interpret DSR work with a clear understanding of knowledge contribution. Gregor and Hevner (2013, p. 342) critique that the field has not understood what defines a clear knowledge contribution from the DSR project. Also, Drechsler and Hevner (2018) seek clearer, bolder, and more explicit design theorizing to make increasing and more substantial knowledge contributions. Moreover, vom Brocke, Winter, Hevner, and Maedche (2020, p. 521) critique the scant re-usage of the extant knowledge contributions and the limited accumulation and evolution of design knowledge (DK) in DSR.

Design Science Research should produce knowledge of a new solution to (i.e., how to) solve a class of problems when or where they occur rather than a solution to a single, situated problem (Venable, 2006, p. 10). Design knowledge (DK) concerns means-end

relationships between problem and solution spaces (Venable, 2006, as cited in vom Brocke et al., 2020, p. 520). However, there are essential criteria for the problem, and the DSR in IS addresses what is considered *Wicked Problems* (Brooks 1987, 1996; Rittel & Webber, 1984, as cited in Hevner et al., 2004, p. 81). Wicked problems in IS refer to complex and difficult-to-solve problems without a clear definition or solution. Wicked problems in IS are challenging because they require understanding the complex interplay between technology, people, and society.

Hevner et al. (ibid.) characterized wicked problems by

- Unstable requirements and constraints based upon ill-defined environmental contexts
- complex interactions among subcomponents of the problem and its solution
- inherent flexibility to change design processes as well as design artifacts (i.e., malleable processes and artifacts)
- a critical dependence upon human cognitive abilities (e.g., creativity) to produce effective solutions
- a critical dependence upon human social abilities (e.g., teamwork) to produce effective solutions.

Design scientists (Figure 3) produce and apply knowledge to create effective artifacts. Still, depending on the camp, there might be a dissenting viewpoint on developing knowledge, e.g., vom Brocke et al. (2020, p. 520) design knowledge can be presented as designed *artifacts* (Hevner et al., 2006), *design principles* (Chandea, Seidel & Gregor, 2015) or *design theories* (Gregor & Jones, 2007). Therefore, together, the *design-theory camp* and the *pragmatic-design camp* cover the design science research (DSR) *prescriptive knowledge base*. Thus, DSR contributions, e.g., the construct, model, method, instantiation, or design theory, are also abstract-level contributions to the knowledge base of Design Science. However, according to Puro (2002, as cited in Gregor & Hevner, 2013, p. 341), there are different abstraction levels depending on DSR outputs. Gregor and Hevner (2013, p. 342), in Table 7, differentiate Puro's framework of the knowledge contribution levels by adding the term *maturity level*. DK may take different forms, such as artifact, nascent design theory, and well-developed mid-range

design theory or grand theory, representing specific, limited, and less mature knowledge to more abstract, complete, and mature knowledge.

Table 7. DSR Contribution types (Gregor & Hevner, 2013, p. 342).

	Contribution types	Example Artifacts
More abstract, complete, and mature knowledge ↑↑↑↑↑↑ ↓↓	Level 3. Well-developed design theory about embedded phenomena	Design theories (mid-range and grand theories)
	Level 2. Nascent design theory – knowledge as operational principles/architecture	Constructs, methods, models, design principles, technological rules
	Level 1. Situated implementation of artifact	Instantiations (software products or implemented processes).
More specific, limited, and less mature knowledge		

Much of the DSR project's potential to contribute design knowledge base depends on its starting point, e.g., is the case a *wicked problem* or a *tame problem*? Gregor and Hevner (2013, p. 344) illustrate that in terms of *problem maturity* and *solution maturity* (Figure 5). The DSR knowledge contribution framework of Gregor and Hevner illustrates the importance of the problem's novelty. If the problem is not new, there is no case for the DSR project. Thus, the first question with the RSD project is: What do we know already?

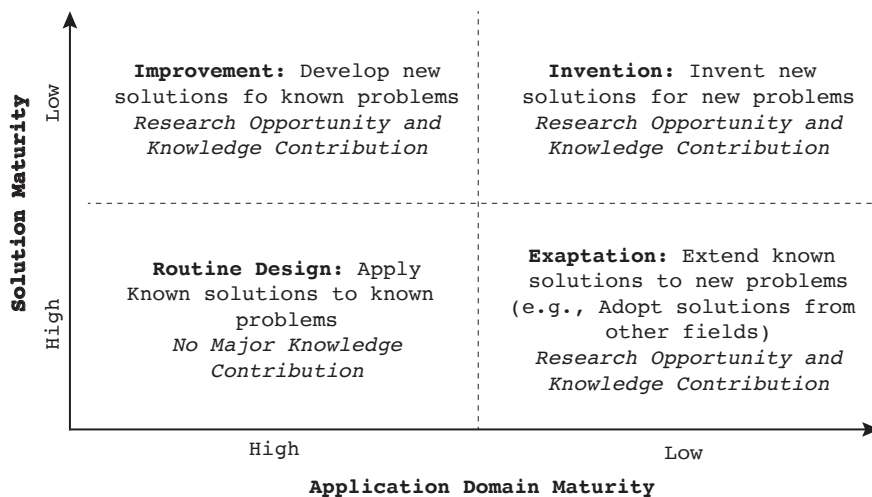


Figure 5. DSR Knowledge Contribution Framework (Gregor & Hevner, 2013, p. 345).

As indicated above, the contribution produced in a DSR project can be richly multifaceted. “*The key differentiator between professional design and DSR is the clear identification of contributions to the Ω and Λ -knowledge bases in DSR and the communication of these contributions to the stakeholder communities*” (Gregor & Hevner, 2013, p. 347). Gregor and Hevner (ibid.) present two major knowledge types: descriptive (denoted Ω , omega) and prescriptive (denoted Λ , lambda). Ω -knowledge is “*what*” knowledge about natural phenomena and laws and regularities among phenomena. Λ -knowledge is the “*how*” knowledge of human-built artifacts (Figure 6).

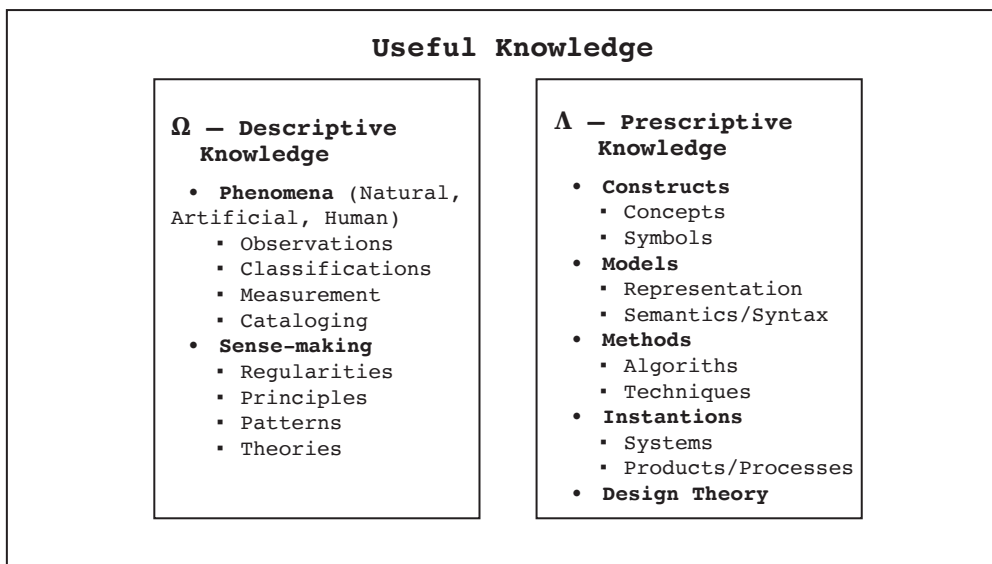


Figure 6. The DSR Knowledge Base (Gregor & Hevner, 2013).

From Ω -knowledge base, researchers draw relevant descriptive and propositional knowledge that informs research questions and may serve as *kernel theory/justificatory knowledge*. From Λ -knowledge base researcher explores prescriptive knowledge from known artifacts and design theories with similar research problems in the past. Existing knowledge gives a baseline and defines the research problem’s novelty and potential for contribution. (Gregor & Hevner, 2013, p. 343.)

Drechsler and Hevner (2018) see that there is more knowledge to use and contribute, and they expand Gregor and Hevner’s (2013) framework with *DSR project design*

knowledge. Moreover, they divide Λ -knowledge into *solution design knowledge* and *solution design entities*. From their point of view, *solution design knowledge* is more abstract and artifact independent. Drechsler and Hevner aim to illustrate that there is a wider Λ -knowledge contribution opportunity.

Solution design entities distinct abstract concepts of physical artifacts (i.e., constructs, models, and methods) to meta-artifacts that lead to other artifacts' development and constitute more abstract (nomothetic) knowledge. However, knowledge of artifact instances (i.e., systems, products, and processes) illustrates as local (idiographic) knowledge. (Drechsler & Hevner, 2018.)

Drechsler and Hevner (2018) noted that the current literature does not distinguish further between *solution design knowledge* and artifacts as an outcome of DSRIS. Drechsler and Hevner (2018) highlighted in the literature three major distinct perspectives on how solution design knowledge relates Λ -knowledge. First, a body of design propositions as design theory that should be built on kernel theories, proposed, tested, and subsequently refined (like Gregor & Jones, 2007). Second, the means-end statement of the artifact (like Hevner et al., 2004). Third, distinct, separate explanatory and predictive theories and artifacts (like DREPT of Kuechler & Vaishnavi, 2012). Drechsler and Hevner (ibid) like solving those contradictory conceptualizations using *solution design knowledge*.

Figure 7 shows knowledge utilization, production, and contribution interact in each project domain. The problem space domain uses and produces Ω -knowledge and facilitates the build and design of DSR project design theory and artifact with mid-term theory formulation, e.g., developing DREPT (Figure 4). The DSR project models and consumes Λ -knowledge. *Solution design knowledge* informs the development of a design entity, e.g., by design theories or technological rules. *Solution design entities' knowledge* informs of previously influential entities and processes to reuse for novel designs of new design entities.

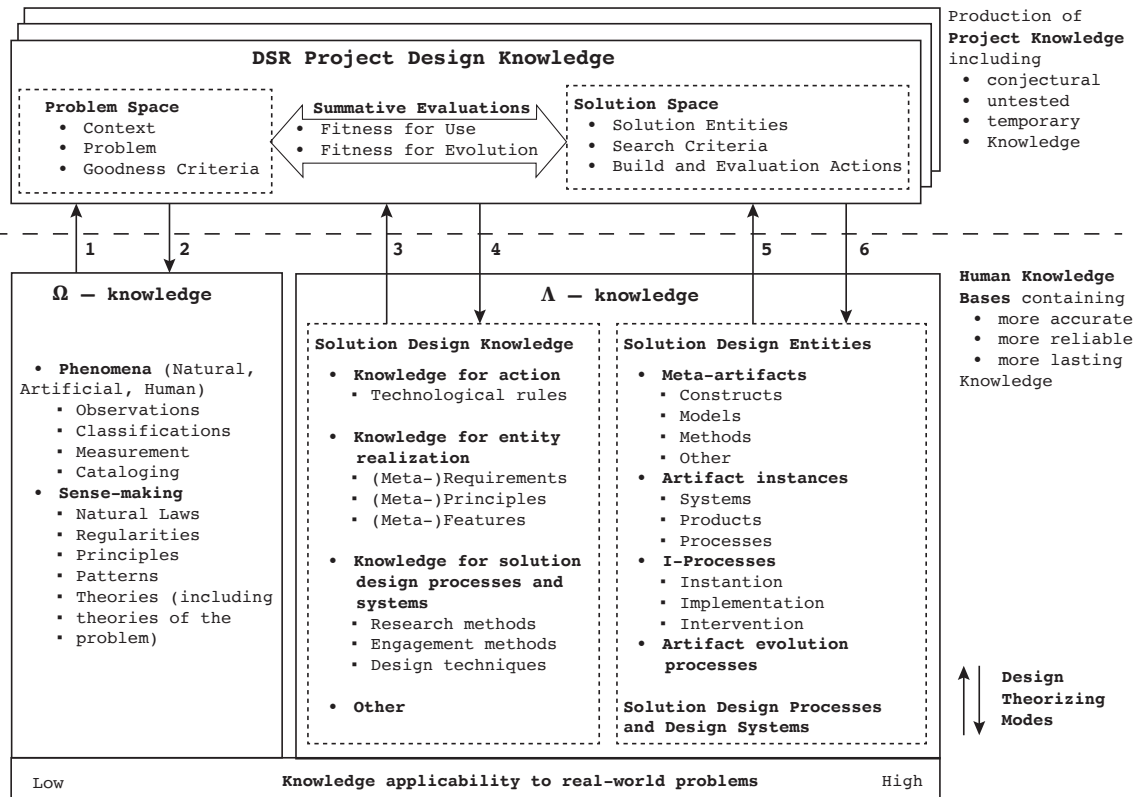


Figure 7. Unified perspective on knowledge utilization, production, and contribution in IS DSR (Drechsler & Hevner, 2018).

Traditionally DSRIS outcomes are divided into the design theory of the *design-theory camp* and construct, model, method, and/or instantiation of the *pragmatic-design camp*. Nowadays, according to Drechsler and Hevner (2018) and vom Brocke et al. (2020), both camps may contribute wider and more explicit Λ - knowledge.

Vom Brocke et al. (2020) continue from Drechsler and Hevner's (2018) work and introduce a "design knowledge map" (DK map) and a "design knowledge journeys" (DK journeys). The aim is to help position DSR project contributions with previous and future research projects. In this research, I leave DK map and DK journeys of vom Brocke et al. (ibid.) for less attention. Instead, I'd like to emphasize the necessity of a common "mental model for readers and reviewers to recognize and evaluate the results of such research" Peffers et al.'s (2007, p. 47).

Peppers et al. (2007) point out that DRS was not a part of the dominant IS research culture and lacks a commonly understood mental model, and without any, it is difficult for researchers to evaluate any DSRIS. The design science research method (DSRM) was formalized by Peppers et al. (ibid.). They compound from prior research (e.g., Hevner et al., 2004; Nunamaker et al., 1990 – 91; Walls et al., 1992) well-accepted elements to the design science research methodology (DSRM) and provide a nominal process.

The design science research method (DSRM) formalized by Peppers et al. (ibid.) focuses on the process and mental model—their synthesis of previous design research results in a process with six activities (Figure 8). Peppers et al. (2007) identified six steps of the design science research process: *problem identification and motivation, definition of the objectives for a solution, design and development, demonstration, evaluation, and communication* (Figure 8). They also pointed out that DSRM has many research entry points.

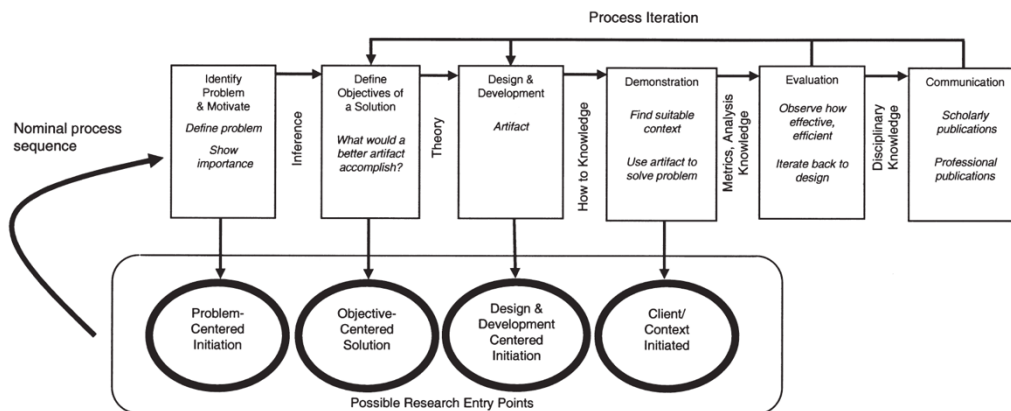


Figure 1. DSRM Process Model

Figure 8. Nominal DSR process (Peppers et al., 2007, p. 54).

3.2 Used methods and philosophical background

This study is philosophically based on critical realism (CR) and its ontology, following Gregor and Jones's (2007) view. Critical realism agrees with positivists that an observable world is independent of human consciousness but suggests that knowledge about the world is socially constructed. Philosopher Roy Bhaskar lays the foundations of critical realism in his work (*A Realist Theory of Science*, 1975). He criticized empiricism for not seeing unobservable structures that cause events as well as events if they are not actual Table 8. *"By constituting an ontology based on the category of experience, as expressed in the concept of the empirical world and mediated by the ideas of the actuality of the causal laws and ubiquity of constant conjunctions, three domains of reality are collapsed into one"* (Bhaskar, 1998, p. 41).

Table 8. Empirical realism vs. Critical realism (Bhaskar, 1998, p. 41).

	Domain of Real	Domain of Actual	Domain of Empirical
Mechanism	X		
Events	X	X	
Experiences	X	X	X

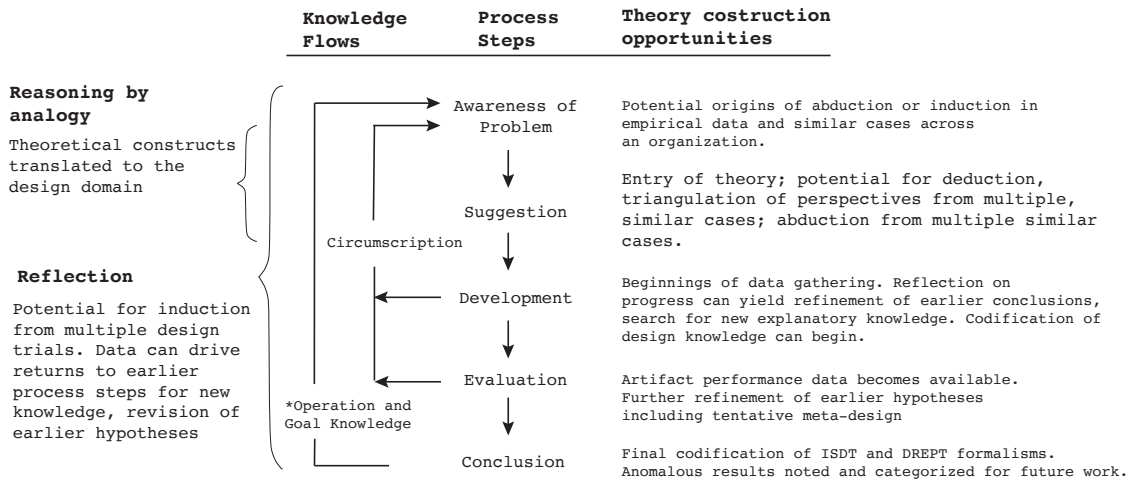
CR acknowledges that our perception of the world is always limited and influenced by our own individual perspectives and the theories we hold. It acknowledges that knowledge is always shaped by local and historical factors, but it does not believe that all viewpoints are equally valid. Therefore, it is critical in a Kantian sense (Mingers, Mutch & Willcocks, 2013, p. 795.)

In critical realism, causality is defined as the relationship between events and the underlying structures or mechanisms that give rise to them. By advocating for a layered perspective of reality and concentrating on unveiling generative mechanisms, critical realism provides a comprehensive approach to grasping causality. It goes beyond mere cause-and-effect relationships that are observable in empirical data and delves into the deeper, often imperceptible, structures that govern the behavior of systems in both the natural and social realms. This is relevant here because the EA process is developed by

people, and invisible but important human behavior, social behavior, and social relations play a major role in it.

Mingers et al. (ibid.) outline the critical realist scientific methodology, which Bhaskar refers to as retrodution. This method, also known as "abduction" by C.S. Peirce, stands in contrast to induction and deduction. Abduction entails transitioning from experiences in the empirical domain to potential structures or mechanisms in the real domain. Mingers et al. (ibid.) state that in critical realist studies, the key methodological step is to move from describing empirical events to considering potential causal mechanisms of various kinds, some of which may be nonphysical and unobservable, whereas these mechanisms if they interacted, could have potentially generated the observed events.

Above, Mingers et al. showed CR methodology, which is parallel with reasoning in the design research cycle (originated by Puroo, 2002; Dasgupta, 1996), which Kuechler and Vaishnavi expressed in Figure 9. This research demonstrates how DSR applies to this kind of problem, especially how the DREPT framework contributes to DSR work. Justificatory knowledge (Gregor & Jones, 2007) is more visible here when DREPT i.e., explanatory information (Kuechler & Vaishnavi, 2012) may borrow theoretical information from the natural, social, or design sciences, as I have done. I followed Gregor and Hevner's (2013) advice, and an outline of the selected DREPT is given in the artifact description section, where it makes more sense to show details along with the specific aspect of the design to which it refers.



*Operational knowledge (principles) can be defined as “any technique or frame of reference about a class of artifacts or its characteristics that facilitates creation, manipulation and modification of artifactual forms” (Dasgupta, 1996; Puroo, 2002).

Figure 9. Reasoning in the Design Research Cycle (Kuechler & Vaishnavi, 2012, p. 406).

This research uses abduction and deduction, as Kuechler and Vaishnavi (2012) express in Figure 9.

Research criteria for DSRIS are the problem of business relevance, i.e., whether the solution has any applied need for real life (business need), and how complex/novel the problem is.

The value problem within EA can be considered a wicked problem, which is a major criterion for DSRIS. As in the previous section, Hevner et al. (2004, p. 81) characterized wicked problems as having unstable requirements and constraints based on an ill-defined environmental context, which is the case with EA, which does not even have an established definition. Furthermore, there are complex interactions among subcomponents of the problem and its solution as is with people, organizations, and technology that are interacting when building EA. EA problems also fulfill wicked problem criteria concerning human cognitive abilities (e.g., creativity) to produce effective solutions and a critical dependence upon human social abilities (e.g., teamwork) to produce effective solutions. From this perspective, DSRIS is a valid choice for this research.

Vom Brocke et al. (2020, p. 521) critique the scant re-usage of the extant knowledge contribution in DSR. By noticing a review of vom Brocke et al., this research heavily takes advantage of previous research and the DS knowledge base. The “empirical” part is based on the design science research knowledge (DK) base, i.e., composing problem space and solution base. Also, part of DREPT is from DK, while others are from various disciplines, e.g., behavioral science, which is an inseparable part of design science research, as Hevner et al. (2004) state.

In the previous section, the DSR field introduction stated the existence of two DSR camps: the pragmatic design camp and the design theory camp. This study gravitates to the design theory camp to produce a prescriptive knowledge research contribution and follow the ontology of Gregor and Jones (2007).

The above is more detailed on how kernel theory is covered in DSR. The term was originally defined in Walls et al.’s seminal work (1992). Gregor and Hevner (2013) talk about kernel theory/justificatory knowledge, and Kuechler and Vaishnavi (2012) talk about DREPT, which are all principally the same but with some differences. In this research, the kernel theory is system thinking, and the main method is system dynamics.

A cornerstone of empirical science is the reductionist approach, which ignores feedback-loop causality. However, complex systems need to consider interactions between variables and how the system acts as a whole. System theory is for that.

The originator of the General System Theory (GST) is von Bertalanffy (1967). System thinking has evolved since, and there are many schools of system thinking (Richardson, 1990; Lane, 1994, as cited in Sterman, 2000, p. 4). However, this research follows Forrester's in the 1950s at MIT, Richardson's (1990) and Sterman's (2000) developed a school of system dynamics. *“System dynamics is a perspective and set of conceptual tools that enable us to understand the structure and dynamics of complex systems”* (Sterman, 2000, p. viii). The field of system dynamics is inherently interdisciplinary,

focusing on the behavior of complex systems. It is rooted in theoretical concepts such as nonlinear dynamics and feedback control, drawing from the fields of mathematics, physics, and engineering for its development (Stearman, 2000, p. 5). Systems theory aims to elucidate and formulate hypotheses about the traits that emerge within complex systems, traits that seem to be beyond those of any individual system within the whole. This phenomenon is known as emergent behavior. When a complex system exhibits emergent behavior, it means that it possesses characteristics that its components do not demonstrate independently. System dynamics is a practical continuation of CR and provides concrete means to study and explore the matter at hand, in this case, EA and its underlying structures.

“The fundamental goal of system dynamics diverges from conventional approaches as it seeks to achieve a profound comprehension of the underlying structural factors influencing a system’s behavior. This offers greater awareness of the roles played by each element within the system, facilitating a comprehensive assessment of how possible actions on various elements either amplify or mitigate its behavioral tendencies” (García, 2024, p. 15)

The system dynamics approach involves creating a model that closely resembles reality, allowing us to assess its utility and coherence. Additionally, it provides a means to understand the consequences of simplifying the model through simulation, enabling us to test our hypotheses. A basic tool of system dynamics is a Causal Loop Diagram (CLD), and the basic approach is to model the system problem(s). Modeling is a key tool in design science, e.g.; Herbert Simon (1990, as cited in Kaisler & Armour, 2017, p. 4811) states, *“Modeling is a principal – perhaps the primary – tool for studying the behavior of large complex systems.”*

CLDs are used to map out a system's feedback structures qualitatively. These diagrams help understand the interconnections and feedback loops without requiring numerical data. CLDs are analyzed through the lens of System Archetypes, which are common

patterns of behavior observed in various systems, such as "Fixes that Fail" or "Shifting the Burden" (Kim & Lannon, 1997). Identifying these archetypes is a qualitative exercise that provides insights into the underlying structures driving system behavior. Model Conceptualization: The initial stages of system dynamics modeling involve qualitative methods to gather insights and define the scope and boundaries of the system.

Modeling EA system problems is iterative and seeks a simple form. Applying the systems archetypes can be accomplished in four distinct ways: (1) as "lenses," (2) as structural pattern templates, (3) as dynamic scripts (or theories), and (4) as tools for predicting behavior (Kim & Lannon, 1997). When using system archetypes as lenses, we reflect the system through each archetype's behavior, which raises the right questions and thus examines the case.

The research approach is qualitative. In Tesch's (1990) classification of qualitative research, there are four main groups according to the object of interest: 1) characteristic features of language, 2) regularities of human experiences, 3) understanding the meaning of text and/or action, and 4) reflection on one's own and others' thinking and action (Järvinen & Järvinen, 2004, p. 67). Here it is 3 and 4.

4 Problem Space

Research identifies the problem in EA value creation. It is a multifaceted problem with many underlying causes. The problem is drawn from the DS knowledge base by literature review. EA professional interviews complement the literature review.

EA problem space is gathered from three comprehensive literature reviews, one dissertation with comprehensive literature reviews, an experienced enterprise architecture practitioners survey, and one study of the root causes of enterprise architecture problems in the public sector. Kaisler, Armour, and Valivullah (2005) literature review “Enterprise Architecting: Critical Problems” and its update “15 Years of Enterprise Architecting at HICSS: Revisiting the Critical Problems” (Kaisler & Armour, 2017) and Lucke, Krell, and Lechner (2010) “Critical Issues in Enterprise Architecting – A Literature Review”, Seppänen (2014) “From Problems to Critical Success Factors of Enterprise Architecture Adoption”, Dang and Pekkola (2016) “Root Causes of Enterprise Architecture Problems in the Public Sector”.

Kaisler and Armour (2017, p. 4810) find that *“well into its third decade, EA still faces a credibility challenge as many business operations managers do not see the value returned for the investment made.”* This same issue arises in an interview with a senior EA consultant. More skeptical view about EA benefits has increased among EA professionals as well as EA end users. Credibility must flow from the top down and need sponsorship from the highest level. Kaisler and Armour (ibid.) explain that few senior executives have an understanding of EA to deliver this message to lower levels.

Kaisler, Armour, and Valivullah (2005) illustrate three areas where critical problems arise in enterprise architecting: modeling, managing, and maintaining EAs. Revisiting of Kaisler and Armour (2017) show that the same three main issues are still here. Kaisler and Armour add some new or subcategory findings, i.e., design, methodology, framework, and assessment challenges.

Modeling visualizes EA, its evolution, and its impact on the existing architecture. Formal models and tools clearly and coherently describe EA to the stakeholders. Kaisler and Armour (2017, p. 4814) noted that a lack of common language challenges communication with multiple stakeholders. The lack of standard ontology to develop a formal model of EA is a challenge for stakeholders of variable business lines and disciplines. Formal models and tools analyze the EA, reveal a baseline, and help set targets. However, there are no quality attributes in EA modeling frameworks and methodology. According to Kaisler et al. (2005), selecting an appropriate framework and model was the most difficult task. In re-examination, Kaisler and Armour (2017) still see EA modeling as a challenge. According to them, many EA frameworks do not include a methodology, although the TOGAF (The Open Group Architecture Framework), DODAF (Department of Defense Architecture Framework), and TISAF (Treasury Information Systems Architecture Framework) have, these have a varied array of artifacts that constitute requirements for describing EA. Thus, it is not clear that any of these frameworks will fit, if any. Some of the major frameworks require substantial effort. They noted that EA is strategic in nature, and once a model has been chosen and developed, it will be difficult to change it in the middle of implementation.

Managing. Architecture governance is a process of managing EA design, EA development, and alignment of IT and business strategy through its life cycle. Used practices and procedures to develop EA and manage the EA team are critical issues to develop a well-defined, disciplined, managed, and mature EA process. Kaisler and Armour (ibid.) noted challenges with skill sets, agile practices, and training for team members. Kaisler and Armour (2017, p. 4812) stress that, even if EA may appear as a technical challenge, it is always a management challenge. Thus, there is a need for solid management, which is interrelated to many subproblems; e.g., Kaisler and Armour (ibid.) found a lack of sponsorship, which can be seen as a causal factor. Lack of sponsorship at the C-level foresees poor success for the EA endeavor. As EA aims to integrate multiple business systems, Kaisler and Armour (ibid.) identified a lack of well-

developed integrative design and management methodology. Kaisler and Armour (2017, pp. 4808, 4812-4813) point out critical subproblems: assessing EA capability maturity, lack of alignment with business strategy, assessing infrastructure stress, the system's architect's value proposition, virtual enterprise, scalability, EA metrics, and best practices.

Maintaining. Kaisler and Armour (2017, p. 4813) noted that even if considerable effort must devote to maintaining the running EA and its enhancement to meet requirements for the next iteration, there is very little effort devoted to these issues from an academic perspective. "*The second law of software evolution, the complexity of a software system will increase if no explicit action is taken to avoid it.*" (Lehman, 1996, as cited in Kaisler & Armour 2017, p. 4811). Kaisler and Armour (ibid.) note that complexity can lead to increased costs, possible lack of understanding of EA's functionality, and lack of agility. In today's dynamic environment, EA must focus on its agility and incorporate adaptive processes for updating. The constant evolution of SW and HW generates many update requirements, and rapid environmental change causes the need for strategic adjustment, so there may be many concurrent projects to maintain. The challenge is to synchronize and conjoin EA needs.

Frameworks. Kaisler and Armour (2017, p. 4814) accuse a lack of good theory and scientific foundation for EA development for the ability to compare EA frameworks. Kaisler and Armour (ibid.) conclude that over 90 EA frameworks are in the technical literature or described on the web. They argue that there is overlap among these frameworks, as much as 70%. From that mass, Kaisler and Armour (ibid.) highlight Zachman and TOGAF frameworks commonly used in industrial, commercial, and academic organizations. Also, DODAF is highlighted, and the U.S. Department of Defense mandates it. However, the Zachman framework needs a methodology, and DODAF is uncommon in civil use; thus, this research focuses on TOGAF.

Moreover, Burton (2009, as cited in Kotusev 2017, p. 53) argues that the strict following of EA frameworks is recognized as one of the worst EA practices. Molnar and Proper (2013, as cited in Kotusev 2017, p. 53) argue that EA frameworks are too rigid and complex to be used in some companies, even after appropriate tailoring.

Kaisler and Armour (2017, p. 4815) stress the literature review finding that organizations do not fully understand the value of enterprise architecture and enterprise architecting. They noted that Return on Investment (ROI) and Total Cost of Ownership (TCO) are discussed in a few papers, but there needs to be a formal model or metrics for valuing the contributions of EA. This raises the question of whether EA should be considered a strategic capability and seek a broader perspective for valuation than just financial benefit. Kaisler and Armour (ibid.) noted that the pace of technology innovation challenges IT managers. Thus, capable EA must adapt to changing business conditions and utilize new technologies agilely.

In Table 9, Lucke et al.'s (2010) findings are similar to those of Kaisler et al. (2005) and Kaisler and Armour (2017). They involve issues of management, semantic problems, insufficient resources, complexity, and representation. The highest level of the critical issues category consists of “understanding and management of EA” and “modeling of complex systems.”

Table 9. Categorization of emergent problem issues (Lucke et al. 2010, p. 9).

Highest level issues	Main issues	Emergent issues
Understanding and management of EA	Management	Management commitment
		EA governance
		Stakeholder & Coordination
	Semantic problems	Understanding requirements
		Shared understanding
Modeling of complex systems	Insufficient resources	Lack of experienced architects
	Complexity	Complexity
		Rapidly changing conditions
		Scoping of architectural descriptions (ADs)
		EA frameworks
	Presentation	Knowledge management
		Insufficient tool support

Lucke et al. (2010) stress that lack of management support influences the EA process in many ways. The obvious implication of lack of management commitment is an adverse factor for EA governance as well as recourse allocation. Also, the lack of guidelines for all involved people makes EA process goal hard to realize.

Lucke et al. (ibid) semantic problems refer to the lack of appreciation or ignorance of other domains accompanied by difficulties in linguistically overcoming diverse perspectives of different stakeholders. Semantic problems refer to the lack of a common language and to the need for more appreciation or ignorance of other domains, accompanied by difficulties overcoming the diverse perspectives of different stakeholders.

Insufficient resources appear as their own concept but also have an impact on the other four concepts.

Complexity refers to the nature of EA, where it needs to operate with large-scale, complex open systems, which are technologically enabled and have extensive social implications (Rhodes et al., 2009, as cited in Lucke et al., 2010, p. 7). *“The dynamics of cognitive and social processes do not obey static representations and rules of architecture”* (Meilich, 2006; Rhodes et al., 2009, as cited in Lucke et al., 2010, p. 7).

Representation refers to challenges in the complication of architectural descriptions and other deliverables and evaluation, utilization, and appropriate communication of these materials. (Lucke et al., 2010, p. 9.)

Although Dang and Pekkola (2016) focus on the EA problems in the public sector, there are the same findings as those faced in other research concerning industrial and commercial fields. Moreover, Dang and Pekkola (2016) conducted a case study, which in this case, gave insight into the relevance of the literature findings. Dang and Pekkola (2016) identified four groups of problems (the organization, EA project teams, EA users, and the EA itself) for root causes (Table 10).

Organizational-related problems were organizational structures that prevented the use of common EA frameworks and forced them to develop their own framework. The public sector usually has a complex organizational structure with multiple services, which is usually problematic (Isomäki & Liimatainen, 2008; Jan & Christine, 2014, as cited in Dang & Pekkola, 2016). EA objective that was missed or unclear. Politics influences how much support is possible to get, and sponsors strongly influence the products, plans, and approaches to building EA. Cooperating between agencies was one of the greatest challenges due to the inability to collaborate because of different points of foci, experiences, models, and activities. (Dang & Pekkola, 2016.)

EA programs’ team-related problems appear when the team has been composed incorrectly and is not led by a senior manager or agencies that have appropriate credibility. The EA teams and their skills and abilities notably affect EA results.

Overemphasized IT perspective focus on HW and SW. Thus, a lack of business perspective induces poor EA planning, with a lack of inter-organizational coordination causing poor EA outcomes. (Dang & Pekkola, 2016.)

User-related problems appear when users do not see the benefits of EA products or lack the skills needed to use EA products. This causes the new EA product not to be used at all or wrongly and will need training. Also, willingness to use EA products depends on how it is seen to affect users' roles and "benefits." (Dang & Pekkola, 2016.)

EA itself as a problem. There is a lack of shared understanding among stakeholders about EA. Also, the study interviews revealed that if there had been no efficient tools and methods for controlling the quality of EA programs, the results would have been limited. The agencies then interpreted EA in their own ways without a common taxonomy or methodology. TOGAF has been seen as too large and needs a business focus; the FEA approach requires high EA skills and capabilities in each sub-unit. For that reason, organizations develop their approach. (Dang & Pekkola, 2016.)

Table 10. Root causes of EA programs in the public sector (Dang & Pekkola, 2016).

Group	Root causes	Consequences
Organization	Organization structure	EA products, EA planning
	Legal rule and/or regulation	EA objectives, EA planning
	Politics and/or sponsors	EA planning, EA objectives, Inactive implementing EA
EA team	Forming EA team	Overemphasized IT perspective, EA
	Ability and capability of EA team	EA planning, EA products
EA users	User's capabilities and skills	Willingness to use EA
	Conflicting benefits	Willingness to use EA
EA itself	EA fundamental	Shared understanding of EA, EA planning, EA products

Rouvari and Pekkola (2023) present a more up-to-date list of EA problems. According to them, the main obstacles of EA have not changed. Table 11 is a modified list of Banaeianjahromi (2018) by Rouvari and Pekkola (2023, pp. 182-183).

Table 11. EA obstacles (Banaeianjahromi (2018), as cited in Rouvari and Pekkola 2023, p. 182-183).

<i>Obstacle</i>	<i>Description of obstacle</i>
Lack of communication and collaboration	Lack of collaboration between other personnel and architects, between members of a team and between organizations
Lack of management support	Lack of management support to prioritize the EA development and to assign enough budget and resources
Lack of knowledge among management	Lack of knowledge about the EA method, the importance or role of EA, using EA, or how to manage and steer EA work
Lack of motivation among personnel	The personnel are not motivated to put efforts and use resources to EA work
Lack of knowledge among personnel	Lack of knowledge about the EA method, the importance or role of EA, using EA, or the objectives of EA
Resistance to change	Personnel resist the change i.e., they do not adapt to the changes that the EA would introduce due to several reasons: lack of knowledge, lack of trust, or fear of losing jobs
EA consultant-related issues	Internal or external consultants lack skills like EA competence, guiding and mentoring competence, motivating competence, or communication competence
Government-related political issues	Inappropriate definition of operations, lack of long-term goals, and political and governmental changes
Influence of institutional pressure on organizations work life	Institutional pressures make EA to a part of the organization's work life, influencing EA's outcomes. (Brosius et al. 2018)
EA Governance framework	An EA governance framework is a critical tool to ensure that the EA can be used appropriately and in long-term. (Aziz et al. 2005)
Enterprise Architecture Management	Enterprise architecture management concerns the establishment and continuous development of EA. This includes the tasks of planning and controlling business change. (Aier et al. 2011, 645)

Table 12. List of identified EA problems from literature by researchers.

No:	Issue	Research paper	Authors
F1	Insufficient alignment between business and IT strategies.	Enterprise Architecting: Critical Problems	Kaisler, Armour, and Valivullah (2005)
F2	Lack of clarity in defining enterprise architecture goals and objectives.		
F3	Inadequate communication and collaboration between stakeholders.		
F4	Difficulty in managing and integrating diverse IT systems and applications.		
F5	Inadequate governance and decision-making processes.		
F6	Insufficient involvement of business stakeholders in enterprise architecture decision-making.	15 Years of Enterprise Architecting at HICSS: Revisiting the Critical Problems	Kaisler and Armour (2017)
F7	Inadequate consideration of organizational culture and change management.		
F8	Lack of sponsorship at C-level		
F9	Challenges in adapting to emerging technologies and evolving business requirements.		
F10	Difficulties in assessing and managing risks associated with enterprise architecture.		
F11	Limited integration of enterprise architecture with strategic planning and execution.		
F12	Difficulty in measuring the value and impact of enterprise architecture initiatives.		
F13	Lack of integration between business processes, data, and IT systems.	Critical Issues in Enterprise Architecting – A Literature Review	Lucke, Krell, and Lechner (2010)
F14	Insufficient involvement of business stakeholders in enterprise architecture decision-making.		
F15	Insufficient documentation and knowledge management practices.		
F16	Challenges in managing complexity and maintaining architectural coherence.		
F17	Difficulties in assessing and managing risks associated with enterprise architecture.		
F18	Limited understanding of enterprise architecture concepts and benefits among stakeholders.	Root Causes of Enterprise Architecture Problems in the Public Sector	Dang and Pekkola (2016)
F19	Lack of organizational support and commitment to enterprise architecture initiatives.		
F20	Insufficient resources and capabilities for effective enterprise architecture implementation.		
F21	Inadequate collaboration and coordination between different government agencies.		
F22	Lack of communication and collaboration.	Contextuality and Temporality of Enterprise Architecture Problems: A Comparative Case Study	Rouvari and Pekkola (2023)
F23	Lack of management support.		
F24	Lack of knowledge among management.		
F25	Lack of motivation among personnel.		
F26	Resistance to change.		
F27	EA consultant-related issues.		
F28	Government-related political issues.		
F29	Influence of institutional pressure on organizations work life.		

No:	Issue	Research paper	Authors
F30	EA Governance framework.		
F31	Enterprise Architecture Management.		
F32	Lack of communication and collaboration leads to an EA project failure.		
F33	The EA development project does not have enough support from the management.	Exploring Causal Factors Influencing Enterprise Architecture Failure	Gong and Janssen (2020)
F34	Lack of motivation among personnel hinders EA development projects.		
F35	High-level managers do not understand the benefits of EA.		
F36	EA initiatives set up processes for managing the EA life cycle parallel to the established IT processes, resulting in coordination problems.		
F37	EA approach is highly complex, preventing it from achieving its objectives.		
F38	Requiring too high effort regarding the initial EA documentation hampers the willingness to further maintain the EA artifacts.		
F39	Existing EA artifacts remain unused in daily work and decision-making due to the poor quality.		
F40	Lack of accurate and smart modeling tools makes the EA development inefficient.		
F41	Lack of clear methodologies for EA implementation projects makes the EA development inefficient.		

It is not surprising that the findings in Seppänen's (2014) literature review in his dissertation follow the findings of Kaisler et al. (2005), Kaisler and Armour (2017), and Lucke et al. (2010) and thus leave here as above has already illustrated. He noted that many problems in the literature review are interrelated and connected by causal relations, i.e., if managers and decision-makers lack the understanding of EA, there will be varied problems. However, Seppänen (ibid.) also has his own experienced enterprise architecture practitioners survey about the problems of EA adoption. Approximately 50% of the respondents represented government organizations or municipalities, 25% of the respondents are actively involved in enterprise architecture development in the field of higher education, and the other 25% come from private IT companies experienced in consulting the public sector enterprise architecture development. Survey results are displayed in tables 11 – 19.

Table 13. Scouting: Have you encountered this issue? How challenging is this issue? (Seppänen, 2014, p. 145-146).

Issue	Yes %	No %	NC %	FC %	HC %	FH %
The organization responds reluctantly to new ways of working and the changes they necessitate.	88,1	11,9	9,5	66,7	23,8	90,5
The understanding about the purpose and goals of enterprise architecting is lacking in the organization.	92,9	7,1	4,8	69,0	26,2	95,2
Enterprise architecture has an image problem due to, for example, troublesome implementation and technical representation.	76,7	23,3	18,6	65,1	16,3	81,4
There has been an excess of different management and organizational development methods. Enterprise architecture gets lost among these or may not be compatible with them.	69,0	31,0	35,0	50,0	15,0	65,0
The organization lacks the practical skills required in enterprise architecture development.	83,7	16,4	14,0	55,8	30,2	86,0
Mean	82,1	17,9	61,3	61,3	22,3	83,6
NC = "Not Challenging"; FC = "Fairly Challenging"; HC = "Highly Challenging"; FH = "Fairly + Highly challenging"						

The scouting stage concerns organizations' readiness to undertake and complete an EA project. The results of the first issue, "The organization responds reluctantly to new ways of working and the changes..." is a common reaction to change in any organization and needs to deal with how any major change must deal. "The understanding about the purpose and goals of enterprise architecting is lacking in the organization" issue has a high appearance and is considered a very challenging problem. Also, the lack of practical skills required for EA development has a high appearance and is a very challenging problem.

Table 14. Entry: Have you encountered this issue? How challenging is this issue? (Seppänen, 2014, p. 148-149).

Issue	Yes %	No %	NC %	FC %	HC %	FH %
The managers are not adequately engaged in the development of enterprise architecture.	73,8	26,2	14,6	39,0	46,3	85,4
The employees cannot participate in the development of enterprise architecture due to lack of time or other resources.	87,8	12,2	15,0	40,0	45,0	85,0
The employees are unwilling to participate in the development of enterprise architecture due to other reasons.	56,1	43,9	42,5	52,5	5,0	57,5

Appointing the accountable leadership and ownership statuses for the enterprise architecture project appears problematic.	70,7	29,3	35,7	38,1	26,2	64,3
The project group that executes the enterprise architecture adoption project is primarily staffed by the employees of IT department and the influence of other organizational functions to the work is lacking.	66,7	33,3	33,33	35,7	31,0	66,7
Mean	71,0	29,0	28,2	41,1	30,7	71,8
NC = "Not Challenging"; FC = "Fairly Challenging"; HC = "Highly Challenging"; FH = "Fairly + Highly challenging"						

The entry stage deals with the launch of the project, structuring a project group that presents different organizational stakeholders, and establishing the sponsorship and ownership statuses for the enterprise architecture function.

Table 15. Diagnosis: Have you encountered this issue? How challenging is this issue? (Seppänen, 2014, p. 149-150).

Issue	Yes %	No %	NC %	FC %	HC %	FH %
The goals that are set for the enterprise architecture are difficult to understand and poorly reasoned.	65,9	34,1	39,0	46,3	14,6	60,9
The entire organization cannot commit itself to the goals that are set for the enterprise architecture.	70,0	30,0	26,1	58,7	15,2	73,9
The goals that are set for the enterprise architecture are too ambitious to be achieved with the allocated resources.	80,5	19,5	27,0	48,7	24,3	73,0
The goals that are set for the enterprise architecture do not solve real problems and therefore cannot yield any real benefits for the organization.	57,5	42,5	45,0	32,5	22,5	55,0
The informing and communications related to the enterprise architecture are dysfunctional and/or do not reach the right audience.	78,0	22,0	29,2	53,7	17,1	70,8
Mean	70,4	29,6	33,3	48,0	18,7	66,7
NC = "Not Challenging"; FC = "Fairly Challenging"; HC = "Highly Challenging"; FH = "Fairly + Highly challenging"						

The diagnosis table shows how the goals of enterprise architecture appear.

Table 16. Planning: Have you encountered this issue? How challenging is this issue? (Seppänen, 2014, p. 151-152).

Issue	Yes %	No %	NC %	FC %	HC %	FH %
There are difficulties in transforming the goals set for the enterprise architecting into the practical tasks.	73,7	26,3	31,6	55,2	13,2	68,4
There are difficulties in delegating the enterprise architecture development related decision-making rights and responsibilities.	81,6	18,4	21,1	52,6	26,3	78,9

Due to a narrow mandate, the enterprise architecture cannot have a true influence on activities of organizational development.	68,4	31,6	27,0	37,8	35,2	73,0
There are difficulties in integrating the enterprise architecture governance model with the present practices of the organization.	68,4	31,6	26,3	42,1	31,6	73,7
Mean	73,0	27,0	26,5	47,0	26,5	73,5
NC = "Not Challenging"; FC = "Fairly Challenging"; HC = "Highly Challenging"; FH = "Fairly + Highly challenging"						

The planning table characterizes problems that relate to the operationalization of the EA management and governance.

Table 17. Action: Have you encountered this issue? How challenging is this issue? (Seppänen, 2014, p. 153-154).

Issue	Yes %	No %	NC %	FC %	HC %	FH %
The enterprise architecture method that is being used is inflexible and is not fully suited in modeling the organization's architecture.	23,7	76,3	69,7	27,3	3,0	30,3
The enterprise architecture method and modeling techniques focus too much on information systems and technologies, and therefore do not provide proper tools for modeling other functions.	50,0	50,0	45,9	37,9	16,2	54,1
The enterprise architecture models and deliverables do not produce real benefits for the organization.	52,6	47,4	39,5	42,1	18,4	60,5
The skills related to modeling the enterprise architecture are lacking.	81,6	18,4	34,2	47,4	18,4	65,8
The information that is needed to define the target state for the enterprise architecture is difficult to obtain or is not available at all.	64,1	35,9	44,7	36,9	18,4	55,3
Mean	54,4	45,6	41,1	41,0	17,9	58,9
NC = "Not Challenging"; FC = "Fairly Challenging"; HC = "Highly Challenging"; FH = "Fairly + Highly challenging"						

The action table considers the previously illustrated problem during EA project.

Table 18. Evaluation and Termination: Have you encountered this issue? How challenging is this issue? (Seppänen, 2014, p. 156-157).

Issue	Yes %	No %	NC %	FC %	HC %	FH %
There are difficulties in evaluating the benefits of enterprise architecting, for example, by using concrete measures.	78,9	21,1	16,2	43,3	40,5	83,8

There is a continuous struggle to justify the expenses of enterprise architecture function, which is challenging due to the difficult verification of the benefits.	70,3	29,7	18,9	59,5	21,6	81,1
The enterprise architecture is being developed in short-termed projects and it is difficult to establish the enterprise architecting as a continuous process.	57,9	42,1	28,6	45,7	25,7	71,4
The organization as a whole has problems in developing its operations in long-termed and planned manners.	78,4	21,6	22,2	33,3	44,5	77,8
Mean	71,4	21,6	21,5	45,4	33,1	78,5
NC = "Not Challenging"; FC = "Fairly Challenging"; HC = "Highly Challenging"; FH = "Fairly + Highly challenging"						

The evaluation and termination table deals with an organization's ability to establish the enterprise architecture as a continuing process after the adoption stage is completed.

Table 19. The most commonly encountered issues (Seppänen, 2014, p. 158).

Issue	Respondents
The understanding about the purpose and goals of enterprise architecting is lacking in the organization.	92,3 %
The organization responds reluctantly to new ways of working and the changes they necessitate.	88,1 %
Employees cannot participate in the development of enterprise architecture due to lack of time or other resources.	87,8 %

Table 20. The issues most commonly considered as highly challenging (Seppänen, 2014, p. 159).

Issue	Respondents
Managers are not adequately engaged in the development of enterprise architecture.	46,3 %
Employees cannot participate in the development of enterprise architecture due to lack of time or other resources.	45,0 %
The organization as a whole has problems in developing its operations in long-termed and planned manners.	44,4 %

Table 21. The issues most commonly considered either as fairly challenging or highly challenging (Seppänen, 2014, p. 159).

Issue	Respondents
The understanding about the purpose and goals of enterprise architecting is lacking in the organization.	95,2 %
The organization responds reluctantly to new ways of working and the changes they necessitate.	90,5 %
The organization lacks the practical skills required in enterprise architecture development.	86,0 %

Gong and Janssen (2020) have evaluated EA problems as failure factors and took a deeper look at each importance. They also conduct influence analysis and derive factors for both causal and effective factors and categorize them in four group (Table 22).

Table 22. EA failure factors from literature (Gong & Janssen 2020, p. 343).

<i>EA failure factor</i>	<i>Category</i>
Lack of communication and collaboration leads to an EA project failure	People
The EA development project does not have enough support from the management	
Lack of motivation among personnel hinders EA development projects	
High-level managers do not understand the benefits of EA	
EA initiatives set up processes for managing the EA life cycle parallel to the established IT processes,	Process
EA approach is highly complex, preventing it from achieving its objectives	
Requiring too high effort regarding the initial EA documentation hampers the willingness to further maintain the EA artifacts	Product
Existing EA artifacts remain unused in daily work and decision-making due to the poor quality	
Lack of accurate and smart modeling tools makes the EA development inefficient	Technology
Lack of clear methodologies for EA implementation projects makes the EA development inefficient	

The literature does not highlight strategy as part of the EA problems. However, it is illustrated as an underlying factor. Gong and Janssen (2020, p. 349) put it bluntly: *“The CXOs need a more solid, convincing, and strategy-oriented knowledge about EA.”* From the papers of Kaisler and Armour (2017) and Lucke et al. (2010), we can see that both highlight poor sponsorship and participation in EA endeavors at C-level (CXO). That and the lack of guidelines imply that EA is not always considered a strategic endeavor. There is no strategic goal to attain, which implies that EA is often seen as just an IT project. More apparent evidence for that is the lack of alignment with business goals (Kaisler et al. (2017, p. 4813).

Ross et al. (2006) book *“Enterprise Architecture as Strategy”* summarizes MIT research projects exploring EA in more than 200 companies and 256 other companies concerning

IT governance from 1995 to 2005. The book focuses on the execution of EA and its underlying foundations and management.

Ross et al. (2006, p. 5) note that effectiveness depends on alignment between business objectives and IT capabilities. They recognize the warning signs of a company that doesn't have a foundation that supports its strategy.

1. Different parts of a company give different answers to the same customer question.
2. New regulatory or reporting requirement is a major effort.
3. No agility in business, and every new initiative starts from scratch.
4. IT is consistently a bottleneck.
5. Different business processes complete the same activity across the company, each with a different system.
6. Information needed to make key product/customer decisions is not available.
7. People's job is to take data from one set of systems, manipulate it, and enter it into other systems.
8. Senior management dreads discussing IT agenda items.
9. No knowing of IT value.

However, there are also problems with the strategy. According to Ross et al. (ibid.), that goes wrong in at least three ways. *First*, the strategy is not clear enough to act upon. *Second*, even if the strategy is clear enough to act upon, the company implements it piecemeal. That generates a separate IT solution for each strategic initiative. *Third*, IT is always a bottleneck because it is always reacting to the latest strategic initiatives. IT never becomes an asset shaping future strategic opportunities. However, Kotusev (2017) claims that a business strategy has long been widely recognized as a poor basis for information systems planning (Baets, 1992; Chan & Reich, 2007; Kotusev, Singh, & Storey, 2016; Lederer & Mendelow, 1986, 1987, 1988, 1989; Ross, 2005; Ross et al., 2006; Segars & Grover, 1996; Shpilberg, Berez, Puryear, & Shah, 2007; Vitale, Ives, & Beath, 1986; Weill & Ross, 2008 as cited in Kotusev 2017, p. 54). Ross et al. (2006, p. 25-

26) propose that defining an operating model is the best way to support a company's strategy. According to them, the operation model describes how a company wants to thrive and grow. They see the operating model as a more stable and actionable view of the company than strategy. However, I see this as an EA-scope question. As a narrow scope of strategy, the operating model is unchanging.

The EA comprises three phases with shared and unique challenges. Below are issues from the literature regarding EA planning, implementation, and maintenance after the first installation (see Table 23, Table 24, Table 25).

Table 23. The issues with EA planning.

Lack of Alignment	One of the significant challenges in enterprise architecture is the lack of alignment between business goals and IT strategies. If there is a disconnect between the enterprise architecture plan and the organization's overall objectives, it can lead to inefficiencies and wasted resources.	F1
Lack of Stakeholder Involvement	Planning enterprise architecture without involving key stakeholders from different business units can lead to a lack of understanding of their requirements. This can result in an architecture that doesn't fully address their needs or fails to gain their support, leading to resistance during implementation.	F6, F8, F14
Insufficient Requirements Gathering	Inadequate or incomplete requirements gathering can lead to a flawed architecture design. If the planning phase doesn't comprehensively identify and analyze the organization's needs, it may result in an architecture that lacks necessary functionalities or fails to meet user expectations.	F2
Poor Communication	Effective communication is crucial during the planning phase to ensure that all stakeholders have a common understanding of the enterprise architecture goals, scope, and outcomes. Lack of clear communication can lead to misunderstandings, conflicting expectations, and ultimately a misaligned architecture plan.	F3, F22
Unrealistic Timeframes and Expectations	Setting unrealistic timeframes or having overly ambitious expectations during the planning phase can lead to poor decision-making and rushed architecture designs. It's crucial to have a realistic understanding of the time, resources, and effort required to develop a comprehensive and effective enterprise architecture.	F9, F24, F35
Lack of Expertise and Experience	Planning enterprise architecture requires a deep understanding of both business and technology domains. Insufficient expertise and experience in enterprise architecture can lead to suboptimal planning decisions, incorrect assumptions, and an architecture that fails to meet the organization's long-term needs.	F18

By addressing these problems during the planning phase, organizations can lay a solid foundation for successfully implementing and maintaining their enterprise architecture.

Table 24. The issues with EA implementation.

Insufficient Change Management	Implementation of enterprise architecture often requires significant changes in processes, systems, and organizational structure. Without a robust change management strategy, including clear communication, training, and stakeholder engagement, there can be resistance to change, lack of adoption, and potential disruptions to business operations.	F1
Inadequate Resource Allocation	Implementing enterprise architecture requires appropriate allocation of resources, including budget, skilled personnel, and technology infrastructure. A lack of resources or insufficient investment can lead to delays, compromised quality, and an inability to realize the full benefits of the architecture.	F6, F8, F14, F19, F20, F35
Poor Project Management	Ineffective project management during implementation can lead to missed deadlines, cost overruns, and scope creep. Lack of proper planning, coordination, and monitoring can result in a chaotic implementation process that undermines the success of the enterprise architecture.	F2, F10, F17, F36
Incomplete or Flawed Design Execution	If the architecture design is not properly translated into actionable implementation steps, it can result in an incomplete or flawed implementation. Inadequate attention to detail, overlooking dependencies, or misalignment between design and execution can lead to inconsistencies, integration issues, and suboptimal outcomes.	F3
Lack of Integration and Interoperability	Enterprise architecture aims to ensure integration and interoperability across systems and processes. If there is a failure to effectively integrate different components or align with existing systems, it can lead to data inconsistencies, duplication of efforts, and inefficiencies in the implementation.	F3, F9, F13
Resistance from Stakeholders	During implementation, stakeholders may resist changes associated with the enterprise architecture. This resistance can stem from a lack of understanding, fear of job loss, or concerns about the impact on existing processes. Managing and addressing stakeholder resistance is essential for a smooth implementation.	F18
Insufficient Training and User Adoption	If end-users are not adequately trained on the new systems, processes, and tools introduced through enterprise architecture, it can lead to low user adoption rates and a lack of realization of the intended benefits. Training and change management efforts should focus on helping users understand the value and functionality of the new architecture.	F1
Lack of Monitoring and Evaluation	Without proper monitoring and evaluation mechanisms in place, assessing the effectiveness and impact of the implemented enterprise architecture becomes challenging. Continuous monitoring and evaluation help identify areas for improvement, address emerging issues, and ensure the architecture remains aligned with evolving business needs.	F6, F14

Addressing these implementation challenges requires a comprehensive approach that includes strong project management, effective change management, adequate resource allocation, thorough testing, and continuous monitoring. By addressing these problems, organizations can increase the chances of successfully implementing their enterprise architecture and realizing the desired outcomes.

Table 25. The issues with EA maintenance.

Lack of Change Management	Without proper change management practices in place, maintenance activities can become ad hoc and uncontrolled. Changes to the architecture may be made without proper evaluation, impact analysis, or documentation, resulting in inconsistencies, errors, and reduced overall stability.	F7, F26
Lack of Alignment with Business Needs	Business needs may evolve over time, and the enterprise architecture must align with these changes. If there is a lack of regular assessment and alignment with evolving business requirements, the architecture may become outdated, unable to support new initiatives and hinder organizational growth.	F1
Ineffective Performance Monitoring	Monitoring the performance of the enterprise architecture is crucial to identify bottlenecks, performance degradation, or capacity issues. Without effective monitoring practices and tools in place, it becomes challenging to proactively identify and address performance-related problems, leading to degraded system performance and user dissatisfaction.	F12
Inefficient Issue Resolution	When issues arise in the enterprise architecture, inefficient and slow issue resolution can impact the performance and stability of systems and processes. Inadequate support mechanisms, poor communication channels, or a lack of skilled personnel can prolong issue resolution and disrupt business operations.	F5
Inadequate Governance and Ownership	Maintenance of enterprise architecture requires clear ownership and governance. If there is a lack of designated owners and governance processes, it can lead to confusion, lack of accountability, and inconsistent decision-making regarding updates, enhancements, and retirement of architecture components.	F5, F36
Inadequate Knowledge Transfer	When personnel with deep knowledge of the enterprise architecture leave the organization, critical knowledge can be lost. Inadequate knowledge transfer practices can hinder maintenance efforts, making it challenging to troubleshoot, update, and enhance the architecture effectively.	F15
Inadequate Training and Skill Development	To effectively maintain enterprise architecture, personnel need to stay updated with the latest technologies, methodologies, and best practices. Insufficient training and skill development opportunities can result in a lack of expertise and knowledge gaps, making it difficult to effectively maintain and enhance the architecture.	F18

Organizations can ensure their enterprise architecture's long-term viability and effectiveness by addressing these maintenance challenges through effective governance, change management, performance monitoring, security measures, and ongoing training.

In Table 22 Gong and Janssen 2020 categorized EA failures in people, processes, products, and technology. This work follows the categorization of Gong and Janssen (2020), but the process is seen to include within the organization. Organization defines its way to work, e.g., management, processes, and functions. Also, the product and

technology are in this work under the concept of EA. EA in this work includes everything from the software and hardware of EA to the models and frameworks of EA. This work divides failures and problems into people, organizations, and EA. Doing so makes it possible to illustrate the system where all are included. EA and people are subsystems of an organization and its environment.

After reviewing the literature, I identified three key agents that address EA concerns: Organization, People, and EA. I have compiled these factors into separate tables that display each agent's specific issues. These tables are numbered as Table 26, Table 27, and Table 28.

Table 26. The issues with EA itself.

EA1	Lack of Flexibility and Adaptability	Enterprise architecture should be designed to accommodate changes and evolving business needs. If the architecture is rigid and lacks flexibility, it can become outdated quickly and struggle to meet the organization's changing requirements.	F9, F16
EA2	Inconsistent Standards and Frameworks	Inconsistent use of standards, frameworks, and methodologies within the enterprise architecture can result in inconsistencies, duplication of efforts, and difficulties in integration. Establishing and enforcing consistent standards is important to ensure cohesion and interoperability.	F37, F41
EA3	Lack of Collaboration and Communication	Enterprise architecture involves multiple stakeholders and teams across the organization. A lack of collaboration and effective communication among these stakeholders can lead to misunderstandings, conflicting decisions, and a misalignment between business needs and architecture implementation.	F3, F40, F41
EA4	Inadequate Performance and Scalability	Enterprise architecture should be designed to handle the organization's current and future needs in terms of performance and scalability. If the architecture does not consider performance requirements or scalability needs, it may lead to system bottlenecks, poor user experience, and difficulties in accommodating increased workloads.	F4, F35, F36, F37, F40, F41
EA5	Inefficient Use of Technology	Enterprise architecture should leverage appropriate technologies to meet business requirements. If the architecture does not make optimal use of available technologies or fails to adopt new technologies, it may result in inefficiencies, increased costs, and missed opportunities for innovation and competitive advantage.	F30, F40, F41

Addressing these problems within the enterprise architecture requires a comprehensive review, analysis, and improvement process. It involves aligning architecture components, flexibility, enforcing standards, improving integration, and fostering effective collaboration among stakeholders.

Table 27. The issues with EA and the organization.

O1	Misalignment with Business Strategy	Enterprise architecture should be closely aligned with the organization's overall business strategy and objectives. If there is a disconnect between the architecture and the strategic goals of the organization, it can result in a lack of support, limited adoption, and an architecture that does not effectively address the organization's needs.	F1, F2, F8, F11, F35
O2	Lack of Business – IT Alignment	Enterprise architecture should bridge the gap between business and IT, ensuring that technology investments align with business needs. If there is a lack of alignment between the business and IT departments, it can result in misalignment of priorities, limited understanding of business requirements, and suboptimal technology decisions.	F1, F2, F8, F11, F13, F35
O3	Insufficient Communication and Awareness	Effective communication and awareness about the enterprise architecture are vital for its success. If there is a lack of communication channels, training programs, or awareness initiatives, it can result in a lack of understanding, resistance to change, and limited support for the architecture from stakeholders across the organization.	F3, F14, F27, F32
O4	Inadequate Change Management	Implementing enterprise architecture often requires significant changes to processes, systems, and roles within the organization. If change management is not effectively handled, it can result in resistance, employee dissatisfaction, and project delays, hampering the successful adoption and implementation of the architecture.	F7, F8, F26, F39
O5	Insufficient Flexibility	Organizations operate in dynamic environments that require agility and adaptability. If the enterprise architecture is rigid and lacks flexibility, it can hinder the organization's ability to respond to changes, embrace new technologies, and seize emerging opportunities.	F9, F16
O6	Ineffective Governance and Management	Effective governance is crucial for managing and evolving enterprise architecture. If there is a lack of proper governance mechanisms, including decision-making processes, accountability, and oversight, it can lead to poor management, inconsistent implementations, architectural drift, and difficulties in enforcing standards and policies.	F5, F10, F14, F15, F28, F30, F31
O7	Lack of Integration	Enterprise architecture aims to promote integration and interoperability across systems, processes, and departments within the organization. If the architecture does not facilitate seamless integration, it can result in data silos, fragmented processes, and inefficient communication and collaboration.	F4, F13, F22, 27
O8	Lack of management support	Without a clear appreciation of how EA can contribute to achieving business goals, it is less likely to be prioritized. Lack of management support to prioritize the EA development and to assign enough budget and resources.	F8, F12, F19, F23, F31, F33, F35
O9	Lack of EA Work Resources	It's crucial for organizational leaders and decision-makers to understand the benefits and strategic importance of enterprise architecture in order to allocate adequate resources to it.	F8, F15, F20, F33, F35

Addressing these problems requires a holistic approach that includes aligning the architecture with the organization's strategy, ensuring business-IT alignment, promoting flexibility, implementing effective governance processes, managing change effectively, and fostering organizational communication and awareness.

Table 28. The problems enterprise architecture encountered with people.

P1	Lack of Awareness and Understanding	Enterprise architecture may be complex and technical in nature, making it difficult for individuals to grasp its purpose and benefits. If people within the organization lack awareness and understanding of the architecture, it can result in resistance, skepticism, and a lack of support for its implementation.	F10, F18, F35
P2	Resistance to Change	People within the organization may resist the changes associated with implementing enterprise architecture. This resistance can stem from fear of job loss, concerns about changes to established processes, or a lack of understanding of how the architecture will benefit them. Resistance to change can hinder the successful adoption and implementation of the architecture.	F18, F26, F28, F29, F38, F39
P3	Limited Involvement and Engagement	Effective enterprise architecture requires active involvement and engagement from people across different levels and functions of the organization. If people are not adequately involved or engaged in the development and implementation process, it can lead to a lack of ownership, insufficient feedback, and a disconnection between the architecture and the organization's needs.	F6, F8, F14, F15, F25, F34, F35
P4	Skill and Knowledge Gaps	Enterprise architecture often requires specialized skills and knowledge in areas such as technology, business processes, and data management. If people within the organization lack the necessary skills and knowledge, it can impede their ability to effectively contribute to the architecture's development, implementation, and maintenance.	F15, F16, F17, F18
P5	Silo Thinking and Lack of Collaboration	Enterprise architecture aims to promote integration and collaboration across different departments and functions. However, people within the organization may have a silo mindset, focusing only on their specific areas of responsibility. This can hinder effective communication, cooperation, and alignment with the architecture's goals.	F22, F32
P6	Lack of Continuous Improvement Mindset	Enterprise architecture should be viewed as a continuously evolving discipline that requires ongoing improvements and adaptations. If people within the organization have a mindset that resists change or sees the architecture as a one-time project, it can hinder the organization's ability to adapt and optimize the architecture over time.	F5, F6, F9, F14
P7	Inadequate Training and Education	People within the organization need to be equipped with the necessary knowledge and skills to work with and leverage the enterprise architecture. If there is a lack of adequate training and education programs, it can hinder their ability to effectively understand, adopt, and utilize the architecture to its full potential.	F18, F37

Addressing these problems with people and enterprise architecture requires effective change management strategies, clear communication, stakeholder engagement,

training programs, skills development initiatives, and fostering a culture of collaboration and continuous improvement.

The issues illustrated in the tables of this chapter are interrelated and connected by causal relationships. They overlap with each other, and all point to a lack of understanding. In fact, this particular issue explains most of the other issues.

If senior management does not understand EA and its purpose, there will not be strategy and alignment with IT and any other commitment to the EA project. Therefore, there will be insufficient support and resources. Overall, EA project will see as an independent IT project. Thus, there will not be proper interaction between different levels and departments. However, there is a second angle for poor support and insufficient resources. If senior management does not see EA as a strategic initiative, which may cause insufficient resources and support, it will forecast poor value from EA. Also, a lack of understanding undervalues the need for training, education, and change management. Strategy is the fundamental part of IS design activities; if it does not exist, there is nothing to design. In this respect, it is especially pertinent for EA development.

At the individual level, a lack of understanding of EA's purpose and benefits leads to change-resistant behavior and limited involvement and engagement in developing and using EA features.

5 Solution Space

Bullen and Rockart (1981, as cited in Seppänen 2014, p. 191) defined critical success factors (CSF) as “the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department or organization. Critical success factors are the few key areas where ‘things must go right’ for the business to flourish and for the manager’s goals to be attained.”

EA has three main phases: planning, implementation, and maintenance. Analyzing problem space, I have extracted issues concerning these phases. These EA issues are gathered in Table 23, Table 24, and Table 25.

Table 29. Critical Success Factors (Ylimäki, 2008).

CSF for EA	Description
Assessment and Evaluation	The extent to which the architecture and architecture processes are evaluated and improved, and how established the evaluation processes are. Deals with issues such as definition of EA evaluation targets, evaluation purposes and audience, evaluation process and criteria (metrics), as well as data gathering and analysis techniques.
Business Driven Approach	The extent to which the business strategies, business objectives and requirements are taken into account in the architecture development.
Commitment	The extent to which both the top-management and the employees of the organization are committed to and involved in the EA effort.
Communication and Common Language	The extent to which the organization has established architecture related terminology (the common vocabulary) and effective means to conduct architecture related communication.
Development Methodology and Tool Support	The extent to which the organization has an established architecture framework and development process, and the extent to which different tools are exploited in architecture development and management.
EA Models and Artifacts	Deals with issues such as developing a documentation plan, collecting and analyzing the requirements, ensuring that all necessary views are modeled in order to provide a coherent and concise picture of the enterprise (current and future models), and developing a transition plan.
Governance	Relates to issues such as governance (architecture guidance) structures, roles, responsibilities, processes and activities, change management processes (both organizational and architectural changes) and risk management processes.

IT Investment and Acquisition Strategies	Deals with the relationship (and dependency) between architecture development and governance processes and the IT investment and acquisition processes and decisions.
Organizational Culture	Deals with issues such as the organization's readiness to develop and utilize EA, attitudes towards the architecture approach, attitudes towards changes in general, and the organizational changes the architecture development may lead to.
Project and Program Management	Deals with issues such as the coordination between various (architecture) projects, utilization of project milestones and checkpoints for architectural evaluation or guidance, taking advantage of lessons learned and best practices, as well as being on budget and schedule.
Scoping and Purpose	Deals with issues such as the definition of EA in the organization, the key stakeholder groups, the mission, goals and direction of EA, the purpose of EA, and how wide organizationally, how deep and detailed and how fast the EA should be developed in the organization.
Skilled Team, Training and Education	The extent to which the architecture team is organized and established as well as the extent to which required skills are available or acquired.

Hope et al. (2017) illustrate that all critical success factors do not guarantee desired results in EA implementation. They analyzed the top six key CSFs of the literature (see Table 30) Thinking Area: Strategy for the Development of Architecture (T1), Use of Formal Architectural Methodology (T7), and Architecture Tools (T9). The other three are from the Integration Area: Monitoring and Compliance (I6), Commitment and Motivation (I7), and Consultation and Communication (I9). Terms "Thinking Area" and "Integration Area" Hope et al. (ibid) employed from van den Berg and van Steenberg's (2006) book "Building an Enterprise Architecture Practice." In the book, the concepts of "Level of Architectural Thinking" and "Integration in the Organization" are divided into 18 key areas of architectural maturity. "Level of Architectural Thinking" means the level of shared architectural vision and appreciation of architectural practices' importance. "Integration in the Organization" is the degree of integration within the organization that reveals the extent to which architectural thinking is embodied in the organization's daily processes.

Table 30. The Top Six Key CSF (Hope et al., 2017, p. 23).

Label	Critical Success Factor	% Sources citing CSF
T1	Strategy for the Development of Architecture	33
T7	Use of Formal Methodology	63
T9	Use of Architecture Tools	25
I6	Monitoring and Compliance	30
I7	Commitment to the Use of Architecture	42
I9	Consultation and Communication	51

Table 31. Differences in Extent to which Key CSFs were Presented between Successful and Unsuccessful Cases (Hope et al., 2017, p. 25).

CSF	Case Scores		Mean Score		Delta Mean Score
	Successful cases	Unsuccessful cases	Successful cases	Unsuccessful case	
T1	2,3,4,4	2,4,5,5	3,25	3,75	-0,5
T7	2,2,3,4	1,2,3,4	2,75	2,50	+0,25
T9	0,0,1,1	0,0,0,3	0,5	0,75	-0,25
I6	4,4,5,5	0,1,1,1	4,50	0,75	+3,75
I7	4,5,5,5	0,1,1,2	4,75	1,00	+3,75
I9	4,5,5,5	0,0,1,1	4,75	0,25	+4,50

0 = "Not present at all"; 1 = "Present to a minimal degree"; 2 = "Present inconsistently";
3 = "Present consistently but weak"; 4 = "Present to a high degree"; 5 = "Present to a very high degree"

According to Hope et al. (ibid.), the delta scores of the three Thinking Key CSFs were nearly zero. This implies that these factors were equally present in both successful and unsuccessful cases; therefore, they do not differentiate between them. However, the three Integration Key CSFs delta scores imply that the presence/absence of these is associated with the success/failure of EA programs.

Even though Hope et al. (2017) analyzed only the top six success factors, it highlights integration in the organization. How well the organization and people are working together regarding EA. Also, how well essential new manners to do things are adopted.

According to Hope et al. (2017), the pattern of validated and unvalidated CSFs reveals that unvalidated “Thinking” CSFs represent the technical sophistication of EA tools, and validated “Integration” CSFs represent the sociological processes of EA implementation. They reveal that, e.g., Zachman’s framework focuses on tools and techniques for the creation of EA artifacts. However, it ignores how EA is practiced and the role of sociological factors in the practice of EA within organizational contexts. They stress that it is particularly important because success perhaps comes less from “what” is done, as, e.g., Zachman’s framework would have us believe, than from “how” it is done, i.e., the sociological process involved in the implementation of EA.

Ross et al. (2006) stresses the good foundation for successful execution. According to them, there are three key disciplines for a good foundation:

- *Operational model*, which is a necessary level of business process integration and standardization for delivering goods and services to customers. Integrations force a common understanding of data across diverse business units.
- *Enterprise architecture*. The enterprise architecture provides a long-term view of a company’s processes, systems, and technologies to build capabilities.
- *IT engagement model*. The IT engagement model is the system of governance mechanisms that ensure business and IT projects achieve both local and companywide objectives.

6 Artifact Description

The following subsections are the development parts of the artifacts and explain the necessity of the final artifacts.

Policy resistant: The complexity of the systems in which we are embedded overwhelms our ability to understand them. The result: Many seemingly obvious solutions fail or actually worsen the problem (Sterman, 2000, p. 22).

Where the world is dynamic, evolving, and interconnected, we tend to make decisions using mental models that are static, narrow, and reductionist. Among the elements of dynamic complexity people find most problematic are feedback, time delays, and stocks and flows. The heuristics we use to make causal attributions frequently fail to overcome these problems and instead often reinforce erroneous beliefs. (Sterman, 2000, p. 27)

The above text is a reminder to face the problem at hand.

6.1 EA School of Thought

There is a lack of consensus on enterprise architecture (EA) definitions, which allows for divergent assumptions. Also, different terms with similar meanings are often used in enterprise architecture literature. For instance, "enterprise architecting," "enterprise engineering," and "organization design" all appear to describe activities with similar concerns and potential outcomes. This makes the EA subject susceptible to divergent interpretations and makes it hard to establish a shared vision about the EA work and targets.

Lapalme (2012) studied the underlying assumptions of EA and revealed three schools of thought with distinct scopes and assumptions regarding EA: enterprise IT architecture

(EITA), enterprise integration (EI), and enterprise ecological adaptation (EEA). Each of them is grounded in its own belief system. Consequently, each school has a particular definition of enterprise architecture, specific concerns, and assumptions about enterprise architecture (Table 32).

Table 32. Lapalme's taxonomy on EA School of Thought (Lapalme, 2012, p.39).

Belief	Enterprise IT Architecting (EITA)	Enterprise Integrating (EI)	Enterprise Ecological Adaptation (EEA)
Motto	Enterprise architecture is the glue between business and IT	Enterprise architecture is the link between strategy and execution	Enterprise architecture is the means for organizational innovation and sustainability
Objectives & Concerns	<ul style="list-style-type: none"> - Effectively enable the enterprise strategy - Support IT planning and reduce costs - Enable business 	<ul style="list-style-type: none"> - Effectively implement the enterprise strategy - Support organizational coherence 	<ul style="list-style-type: none"> - Innovate and adapt - Support organizational coherence - Encourage system-in-environment coevolution
Principles and Assumptions	<ul style="list-style-type: none"> - Apply a reductionist (mechanistic) stance - Don't question business strategies - Design organizational dimensions independently - Don't worry about non-IT dimensions; they're not your concerns 	<ul style="list-style-type: none"> - Apply a holist (systemic) stance - Don't question business strategies and objectives - Manage the environment - Jointly design all organizational dimensions 	<ul style="list-style-type: none"> - Apply a holist (systemic) stance - System-in-environment coevolution - Environment can be changed - Jointly design all organizational dimensions
Skills	<ul style="list-style-type: none"> - Have technical competence and engineering knowledge 	<ul style="list-style-type: none"> - Facilitate small-group collaboration - Apply systems thinking 	<ul style="list-style-type: none"> - Foster dialogue - Apply system and system-in-environment thinking - Facilitate larger-group collaboration
Challenges	<ul style="list-style-type: none"> - Convince the organization to accept the designed plans 	<ul style="list-style-type: none"> - Understand organizational systemic dynamics - Collaborate across the organization - Encourage systems thinking and paradigm shifts 	<ul style="list-style-type: none"> - Foster sensemaking - Encourage systems thinking and system-in-environment paradigm shifts - Collaborate across the organization
Insights	<ul style="list-style-type: none"> - Permits the design of robust and complex technological solutions - Fosters the creation of high-quality models and planning scenarios 	<ul style="list-style-type: none"> - Permits the design of comprehensive solutions - Enables significant organizational efficiency by eliminating unnecessary contradictions and paradoxes 	<ul style="list-style-type: none"> - Fosters system-in-environment coevolution and enterprise coherency - Fosters organizational innovation and sustainability
Limitations	<ul style="list-style-type: none"> - Can produce inadequate or unfeasible solutions for the larger organizational context - Susceptible to "perfect" designs that support unsustainable strategies 	<ul style="list-style-type: none"> - Susceptible to "perfect" designs that support unsustainable strategies - Requires a paradigm shift from reductionism to holism 	<ul style="list-style-type: none"> - Requires many organizational preconditions for management and strategy creation

The EITA school of thought has the most limited view and focuses on IT planning and costs. It can be seen as a tool to support business strategy and is an engineering approach. The EI has a wider, holistic view but does not question business strategies and objectives. It lies in the middle of the EA school of thought continuum extremes. EEA

has the most holistic view and is a strategic part of organizational sustainability. Here, we must note that the EA school of thought continuum is pluralistic, and it can be divided into considering the EA environment's scope and EA's relation to strategy, i.e., is EA support for strategy, or is it seen as a strategic and part of strategy formation? Still, we can present the scope order of EAs between Lapalme's EA schools of thought, which can be expressed as EITA < EI < EEA.

Du Preez, van der Merwe, and Matthee's (2014) study reaffirms the existence of three of Lapalme's EA schools of thought and expands the taxonomy by four new ones (Table 33). The noteworthy thing is that two of them use reductionism

Table 33. EA School of Thought (Du Preez, van der Merwe & Matthee's 2014, p. 10).

Belief	Enterprise Power Authority (EPA)	Enterprise Configuration (EC)	Enterprise IT Planning (EITP)	Enterprise IT Design (EITD)
Motto	EA as a tool for power and negotiation	EA as a decision transformation methodology	EA as an analysis approach to IT strategy execution	EA as a change agent considering external IT environment
Objectives & Concerns	<ul style="list-style-type: none"> - Influence enterprise strategy direction - Organizational power 	<ul style="list-style-type: none"> - System-in-environment coevolution - Organizational coherence - Effective enterprise strategy transformation 	<ul style="list-style-type: none"> - Effective enterprise IT strategy analysis and business strategy execution - IT Planning & Cost reduction - Organizational coherence 	<ul style="list-style-type: none"> - Enterprise IT strategy execution matching external environment - Innovation & adaption
Principles and Assumptions	<ul style="list-style-type: none"> - Realism - Business strategies and objectives are provided by the business and are open to negotiation - Environment can be changed - Joint design of all organizational dimensions 	<ul style="list-style-type: none"> - Holism - System-in-environment coevolution - Environment as something to transform - Joint design of all organizational dimensions 	<ul style="list-style-type: none"> - Reductionism - IT strategy validates the business strategy through effective analysis - IT environment as something to manage - Impact of IT on organizational dimensions 	<ul style="list-style-type: none"> - Reductionism - Design of IT organizational dimensions on external environment - IT strategies and objectives are influenced by the external environment
Skills	<ul style="list-style-type: none"> - Small group facilitation - Systems thinking 	<ul style="list-style-type: none"> - System & System - in - environment thinking - Larger group facilitation 	<ul style="list-style-type: none"> - Technical competence - Engineering knowledge - Small group facilitation 	<ul style="list-style-type: none"> - Engineering knowledge - Technical competence - Larger group facilitation
Belief Concepts	<ul style="list-style-type: none"> - Realism - Closed System - Indeterminism - Authority 	<ul style="list-style-type: none"> - Holism - Open System - Determinism - Contextualism 	<ul style="list-style-type: none"> - Reductionism - Closed System - Determinism - Mechanism 	<ul style="list-style-type: none"> - Reductionism - Closed System - Environmental determinism - Contextualism
Challenges	<ul style="list-style-type: none"> - Understanding of organizational systemic dynamics - Organizational collaboration - Organizational coherence 	<ul style="list-style-type: none"> - Organizational collaboration - System-in-environment paradigm shift 	<ul style="list-style-type: none"> - Organizational understanding and acceptance of designed plans - Organizational collaboration 	<ul style="list-style-type: none"> - Organizational understanding and acceptance of external IT environment influence - Fostering sense-making
Insights	<ul style="list-style-type: none"> - Permits the design of comprehensive solutions - Ignores organizational efficiency by eliminating alternative scenarios 	<ul style="list-style-type: none"> - Permits the design of transformational solutions - Fosters enterprise-in environment coevolution and enterprise coherency 	<ul style="list-style-type: none"> - Fosters the creation of highly analytical models and planning scenarios - Permits the design of complex analytical solutions 	<ul style="list-style-type: none"> - Permits the design of external influenced technological solutions - Influence IT strategy innovation by studying external environment

Belief	Enterprise Power Authority (EPA)	Enterprise Configuration (EC)	Enterprise IT Planning (EITP)	Enterprise IT Design (EITD)
Limitations	<ul style="list-style-type: none"> - Susceptible to "political" motivated designs for unsustainable strategies syndrome - Requires many organizational pre-conditions with regards to power structure and strategy creation 	<ul style="list-style-type: none"> - Susceptible to continual design changes and unrealized strategy - Requires environments that may be influenced 	<ul style="list-style-type: none"> - Susceptible to considerable solution acceptance and implementation barriers - Susceptible to "perfect" designs for unsustainable strategies syndrome - Requires a paradigm shift from reductionism to holism 	<ul style="list-style-type: none"> - Susceptible to considerable solution acceptance and implementation barriers - Susceptible to "perfect" designs for unsustainable strategies syndrome - Fosters IT organizational innovation and sustainability

Du Preez's et al. (ibid.) schools of thought settle between the EA school of thought continuum, which Lapalme (2012) describes (Figure 10). EEA has the widest overall scope, and EITA is the narrowest.

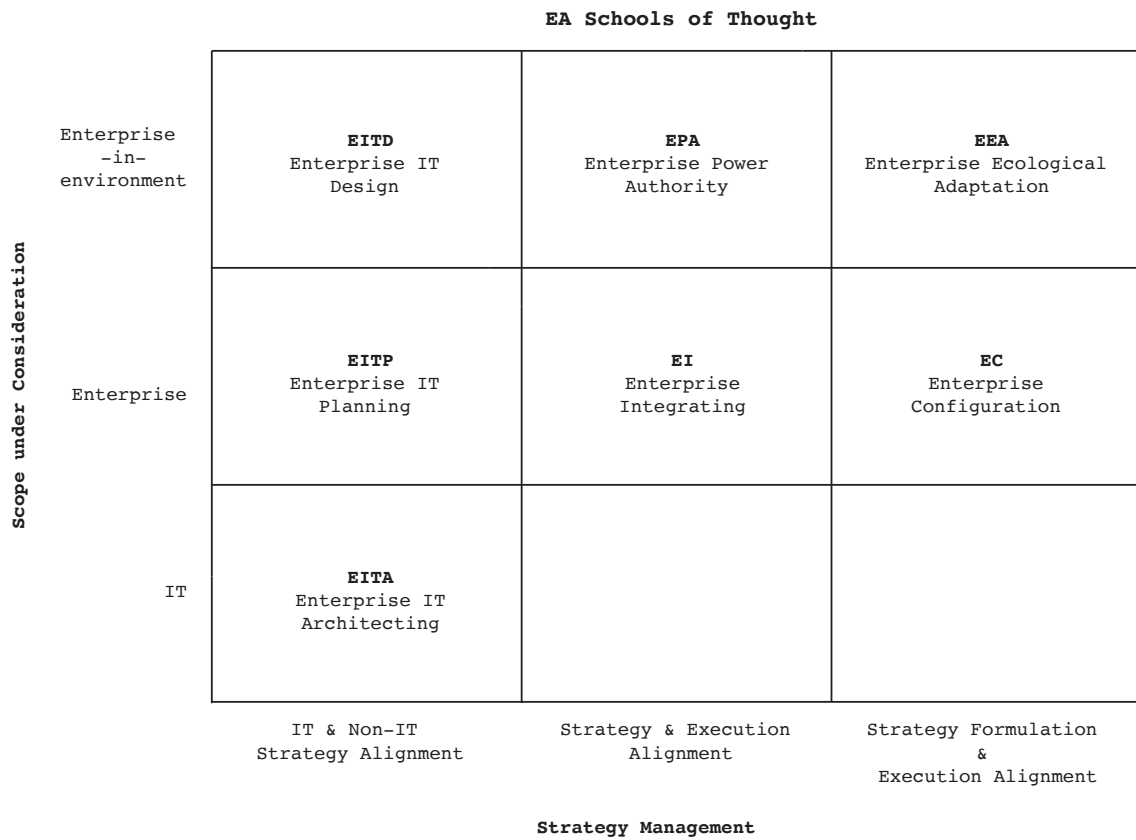


Figure 10. Existing and Emergent EA Schools of Thought (du Preez et al., 2014, p. 9).

Figure 10 shows that Lapalme's three schools of thought are in the continuum line. EITA is at the narrowest extreme, and EEA is at the widest extreme. I rank du Preez et al.'s

and Lapalme's schools from narrow to wide as follows: EITA < EITP < EI < EITD < EC < EPA < EEA.

Thus, based on them, further observations of schools of thought are formed without du Preez et al.'s (ibid.) determined four new EA schools of thought.

Korhonen, Lapalme, McDavid, and Gill (2016) continue from Lapalme's three schools of thought exploration and the adaptive enterprise architecture for the future. They compare how different EA schools of thought fit for organizations' environmental complexity. Korhonen et al. (2016, p. 274) bases their view of adaptability on Emery and Trist's (1965) seminal concept, "*The Causal Texture of Organizational Environments*," which examines the dynamic interplay between organizations and their environments, emphasizing how different environmental conditions impact organizational behavior and structure. They have identified four "*lawful connections*" related to the organization and its environment: 1) the organization's internal interdependencies, 2&3) transactional interdependencies between the organization and the environment (from either direction), and 4) processes through which parts of the environment become related to each other. Emery and Trist also identified four types of *causal textures* in organizational environments, each with distinct characteristics and implications for an organization: 1) Placid, Randomized Environment; 2) Placid, Clustered Environment; 3) Disturbed-Reactive Environment; and 4) *Turbulent Field*. According to Emery and Trist, the present state of environmental complexity is at a minimum type 4), i.e., *turbulent field* (Korhonen et al., 2016, p. 274).

Emery and Trist's framework highlights the importance of understanding an organization's environment and its relation to organizational behavior and viable organizational actions. In type 4, the environment is itself in motion, and thus, complexity exceeds an individual organization's capacities for predicting and controlling, and they cannot adapt to the turbulent environment through their direct interactions but must rely on commonly held values as the control mechanism in the field. This is a connection to the EA schools of thought. The same beliefs and worldviews in

organizations increase flexibility and adaptability when turbulent fields make unpredictable and rapid changes in the environment, “lawful connections” are forced under transformation, and structures and procedures may become obsolete. Shared values foster a common purpose among employees and help to align individual actions with the organization's goals. Strategies and tactics may need to change frequently, but shared core values remain constant. When all stakeholders understand and align with the organization's values, it becomes easier to navigate the complexities and uncertainties of the external environment.

In turbulent environments, organizations need to be more flexible, innovative, and responsive as environments become more complex and uncertain to survive and thrive. This concept underscores the dynamic relationship between an organization and its external environment, emphasizing that effective management requires continuous adaptation to changing conditions. In this case, According to Korhonen et al. (2016), only an adaptive enterprise can make choices to reduce environmental turbulence. According to Emery and Trist, maladaptations happen when trying to reduce anxiety by artificial attempts in a situation when it has become too difficult and too anxiety-laden (Korhonen et al. 2016), i.e., action has not emerged from core values.

Figure 11 juxtaposes three schools of thought, EITA, EI, and EEA, with a tripartite approach to EA, i.e., *Technical Architecture*, *Socio-Technical Architecture*, and *Ecosystemic Architecture*. These architectures illustrate the accountability level, following the Parson/Thompson model of organization levels (see Ch. 1.2.2, p. 19).

Each of these architectures would be self-contained and self-regulated, with its paradigmatic function, methods, and tools, and can shortly be described as follows: *Ecosystemic Architecture* – “*Business follows IT,*” focus on resilience and innovation, it pertains to the value system domain; *Socio-Technical Architecture* – “*IT enables business,*” focus on validity and engineering future, it pertains the innovation domain;

Technical Architecture – “IT follows business,” focus on reliability and present-day value realization, it pertains the added-value domain (Korhonen & Molnar, 2014).

ADAPTIVE AND MALADAPTIVE EA			
Ecosystemic Architecture	"Analysis paralysis." Lock-in in the as-is.	Inadequate renewal. Failure to sense and seize opportunities. Indifference to the wider context. Adapting to but not creating change.	EA that fosters innovation and sustainability. System-in-environment co-evolution. Environment can be changed.
Socio-Technical Architecture	Clinging to "best practices" Limited view of the scope and potential of architecture. Disconnect with the strategy.	EA is the link between strategy and execution. Holistic, systemic view of the enterprise. Choosing tactics. Changing the business. Changing the business.	Adaptive enterprise. Business modularity.
Technical Architecture	Architectural descriptions. EA is the glue between business and IT.	EA aimed at business outcomes. Solution architecture.	Optimized core of digitized data and processes.
	Enterprise IT Architecting (EITA)	Enterprise Integrating (EI)	Enterprise Ecological Adaptation (EEA)

Figure 11. Adaptive and Maladaptive EA (Korhonen et al., 2016, p. 276).

Figure 11 shows, by dotted line, the school of thought limits of assumptions regarding the level of architecture (Korhonen et al., 2016). The limit of EITA is in Technical Architecture, which is adequate when environmental complexity is low. The assumptions of EI fall short of Ecosystem Architecture, but in Socio-Technical Architecture, its assumptions are adequate. Socio-technical Architecture would be needed in a disturbed-reactive environment, and the EI school of thought gives a shared understanding that focuses on a more holistic view and not only follows strategic direction. Only the EEA school of thought has assumptions and worldviews that are required in Ecosystemic Architecture, which can meet the turbulent field of environment.

6.2 Systems

Harold Leavitt has stated that organizations are complex systems with four mutually interacting independent variables: organizational objectives, company structure, technology, and people (Figure 12). Harold Leavitt asserted that any change in these four components will undeniably impact the others, emphasizing that the interaction of these components is the key to achieving organizational success. All of these are affected by the organization's environment. (Buchanan & Huczynski, 2004, p. 463). Leavitt's model suggests that organizational change is a complex process involving all four interrelated components. Changes in technology require adjustments in the other components, and the effectiveness of the technology implementation is contingent upon the alignment of all four components.

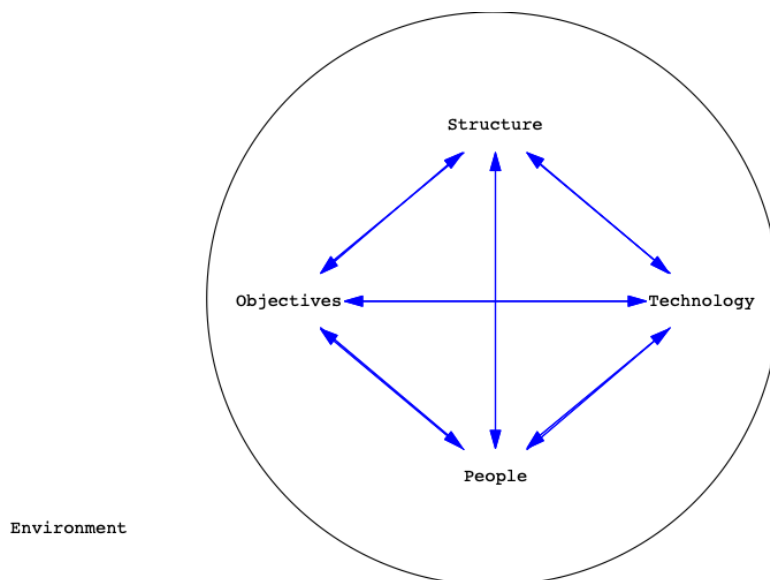


Figure 12. Leavitt diamond.

Figure 13 illustrates a general system of organization causal loop that follows the Leavitt diamond principle. It has the main system (organization) and subsystems, e.g., people and EA. The organization exists in an environment that impacts it and vice versa.

use system thinking as a holistic approach and system dynamics tools to analyze current EA problems in the field.

Chapter 4, *Problem Space*, lists EA issues in the literature. The problems in the list (Table 12) are recurring and overlapping, and further partitioning may be conjoined diversely. However, Figure 14 insightfully covers the causalities of critical EA problems from Table 9.

Lucke et al. (2010, p. 9), in Table 9. point out the main root problems, which have causalities to the group of inherent issues that will ultimately result in poor utility and difficulties in identifying value. Still, this kind of examination lacks a feedback loop, making it a more reductionist approach to the problem, where x causes y. This kind of linear approach is not as fruitful for complex systems like EA. People, organizations, and technology form systems and subsystems that are causally connected, forming complex systems in which reductive problem-solving can produce unintended results.

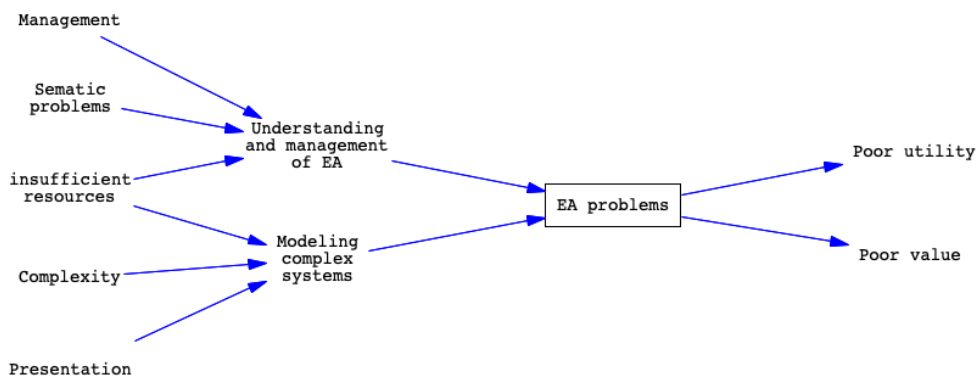


Figure 14. Reductionist Causes tree in open loop system adapted from Lucke et al. (2010).

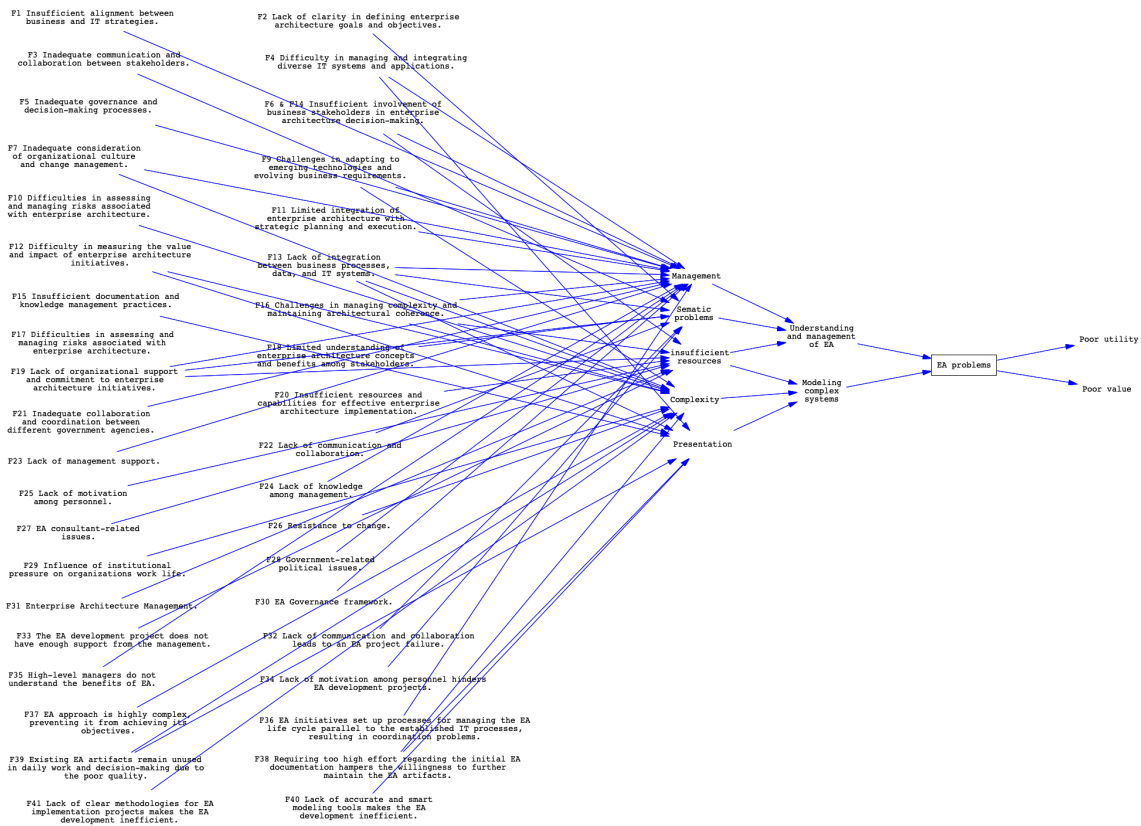


Figure 15. The Expanded Reductionist Causes Tree in an Open System.

Sterman (2000, p. 84) highlights Forrester's statements in *Industrial Dynamics*: "The solution to small problems yield small rewards... The goal should be to find management practices and organizational structures that lead to greater success." It is the essence of working on issues and problems where solutions yield lasting benefits relevant to the organization. The reductionist approach sees events and structures but lacks systemic structures that show interactions between events and patterns. In that case, the solution may lack the proper leverage. Because systems are not directly observable, a feedback loop is necessary to reveal systemic structures and find leverage points. Finding leverage points allows us to take small actions that lead to significant changes in behavior.

In Chapter 4, *Problem Space*, I divided the EA work into EA design, EA implementation, and EA maintenance. Figure 16 shows how the earlier EA work phase reinforces the next

phase and forms a reinforcing causal loop. I extracted issues that could be abducted from the literature for each EA work phase. These EA phases and related issues are presented in Tables Table 24 and Table 25. However, each phase is more or less connected to the same issues, and each phase directly affects the others; thus, treating them as one unit and in terms of EA work is more relevant, as in Figure 18.

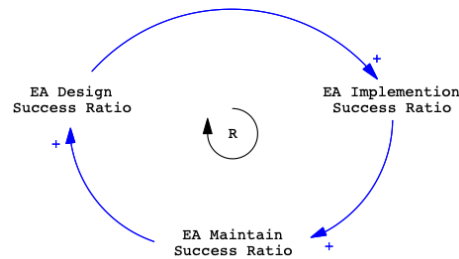


Figure 16. Reinforcing cycle of EA design, implementation, and maintenance phases.

Tavistock researcher Eric Trist established that an organization can be considered as an open socio-technical system in which the goal is to find the best fit between social and technical components (Buchanan & Huczynski, 2004, p. 90). EA work operates between organizations, people, and technology and should be considered a socio-technical system. To find the best fit between social and technical subsystems to achieve joint optimization through minimal critical specifications, I have extracted three interacting systems: organization, people, and EA (technology). Each system is presented with related EA issues from the literature (Table 26, Table 27, and Table 28).

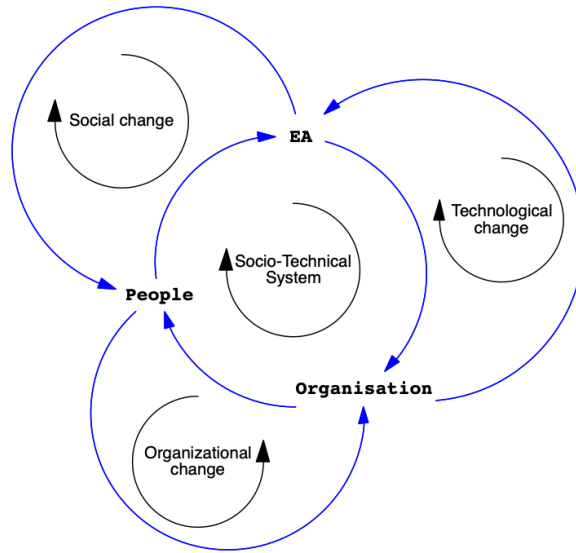


Figure 17. Social Change, Organizational Change, and Technological Change in Socio-technical system.

6.2.1 EA System Model

EA issues from the literature are divided into systems; the status of the realm of enterprise architecture can be modeled, as shown in Figure 17. Each system has its separate color in Figure 18 (EA—orange, Organization—purple, and People—red), and issues are numbered as they are in Table 26, Table 27, and Table 28. Issues are variables that are connected by causality and form loops.

A Causal Loop Diagram (CLD) is a Systems Thinking tool that usefully presents dynamic system interactions. Figure 18 links crucial issues (events) with arrows, and the color indicates if the causal relationship is in the same or opposite direction, i.e., depending on whether the previous variable increases (blue arrow) or decreases (red arrow), the latter variable. By stringing these together, loops are formed, and we can create a coherent picture of the systemic structures and see why the problems emerge. Inside the loops is a clockwise or counterclockwise circle arrow. The letter R (reinforcing) or B (balancing) indicates how the whole loop affects the variable, and a number is used to identify it. For example, $\overset{\text{R}}{\curvearrowright}$, a clockwise reinforcing loop is indicated by number 9. If the

loop has only blue arrows, it is a reinforcing (R) loop as well if it has an even number of red arrows. If the loop has an odd number of red arrows, it is a balancing loop (B). Reinforcing and balancing loops are building blocks of dynamic systems.

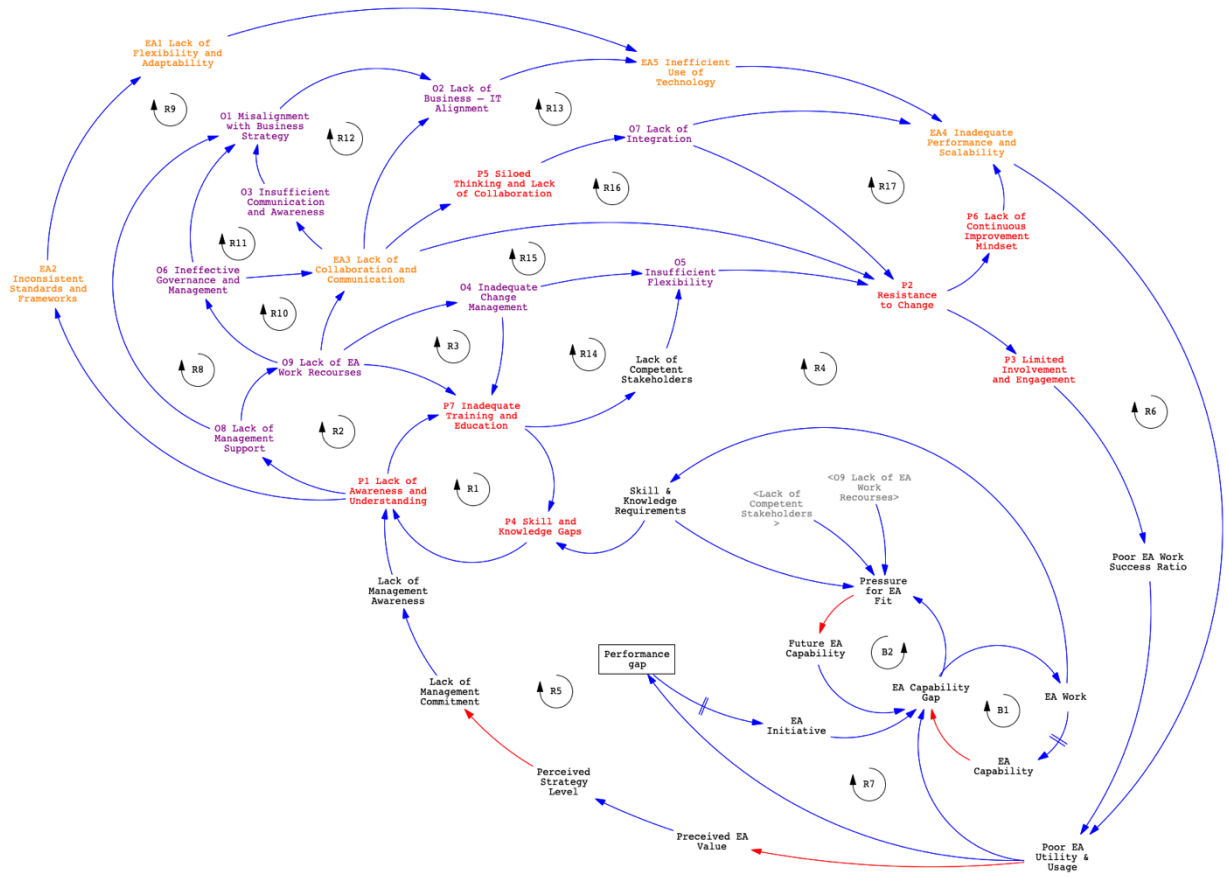


Figure 18. EA System Problems as a Causal Loop Diagram (CLD).

Here, as in Figure 18, the EA Initiative is launched to improve organizational performance, a new capability for EA. It initiates the EA Work sequence to increase EA Capability to meet the initiative’s new goal.

Figure 18 reveals two balancing loops and many reinforcing loops. Here, balancing loop B1 illustrates how the EA Capability Gap will be balanced by EA Work, which eventually increases EA Capability, which decreases the EA Capability Gap. However, EA Work also affects skill and knowledge requirements, revealing (many) reinforcing loops that

eventually oppose the B1 loops effort and will increase the EA Capability Gap or invalidate the EA Work. Skill and knowledge requirements interact with reinforcing loop R1, which many feedback loops accelerate the reinforcing effect, generate more reinforcing loops against the balancing loop B1, and increase the Capability Gap (Figure 19).

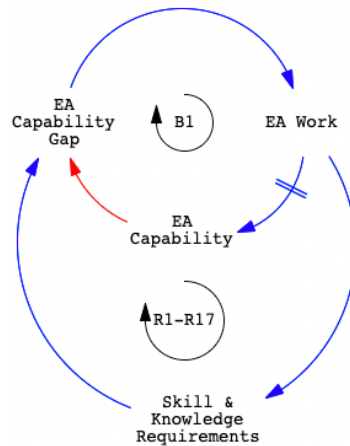


Figure 19. EA as "Fixes That Fail".

This is the first recognizable archetype from the CLD of EA System problems – “Fixes That Fail” (Figure 20). The balancing loop B is a general fix for an obvious problem, but with unintended consequences; eventually, the problem symptoms return to their previous level or become worse. (Kim & Lannon, 1997.)

“Fixes That Fail” have a characteristic behavior over time (BOT) where unintended consequences and problem symptoms increase. Problem symptoms oscillate depending on the delay from fix to consequence (Figure 19). (Kim, 2000.) The time horizon must follow the problem to see the dynamics play out. It should be able to go far back in history to illustrate the problem's origins and symptoms and anticipate potential delayed and indirect impacts (in the future). Therefore, behavior over time (BOT) charts are essential tools for systems thinking with CLD.

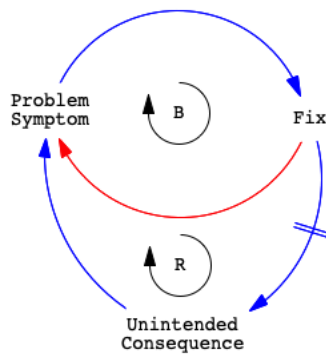


Figure 20. Systems Archetype “Fixes That Fail” (Kim & Lannon, 1997).

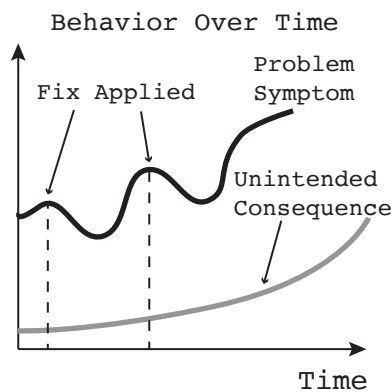


Figure 21. BOT of “Fixes That Fail” Systems Archetype (Kim & Lannon, 1997).

From EA system problems CLD, we can spot the second systems archetype, “Drifting Goals” (Figure 22). Balancing loops B1 and B2 create a situation where the gap between desired performance and current reality can be resolved by taking corrective action to achieve or lower the goal. It has a characteristic behavior over time (BOT) (Figure 23). Drifting performance figures often indicate that the “Drifting Goals” archetype is at work and that actual corrective actions are not being taken. Over time, the performance level also drifts downward. This drift may happen so gradually, even without deliberate action, that the organization is not even aware of its impact (Kim, 2000).

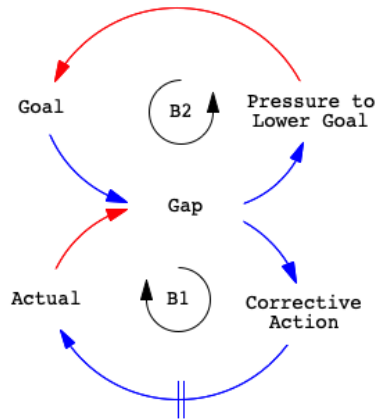


Figure 22. Systems Archetype “Drifting Goals” (Kim & Lannon, 1997).

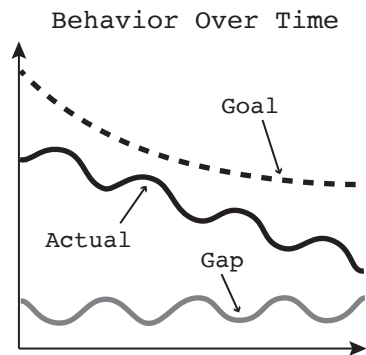


Figure 23. BOT of “Drifting Goals” Systems Archetype (Kim & Lannon, 1997).

In Figure 24, the EA initiative has set a new goal: Future EA Capability. Balancing loop B1 as the "EA work phase" should fulfill the requirements set by the new goal. The organization should be prepared to cope with new EA tasks. If there is no such readiness, it creates pressure for EA fit, lowering the goal, i.e., Future EA Capability, as loop B2 shows.

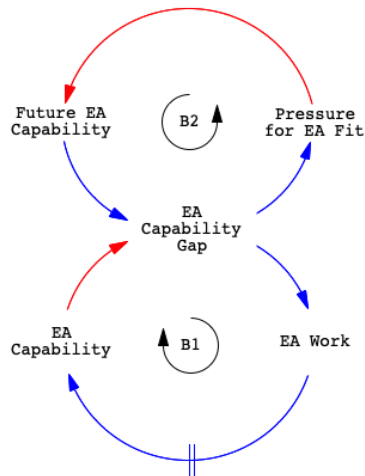
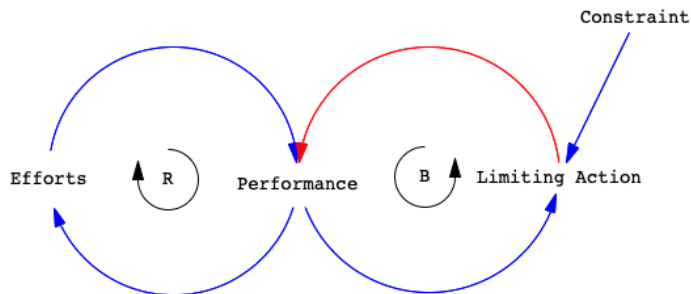


Figure 24. EA as “Drifting Goals.”

The systems archetypes “Fixes That Fail” and “Drifting Goals” above indicate the possibility of constraints in the system. From this point of view, there is a third type of systems archetype: “Limits to Success” (.Figure 25). Here, constraints cause limiting action, and performance growth folds even as efforts continue to rise.



.Figure 25. Systems Archetype “Limits to Success” (Kim & Lannon, 1997).

“Limits to Success” has a characteristic BOT (Figure 26). Here, constraints eventually kick in and start to affect performance. In the IS context, this could be a scenario where digitalization improves overall organizational performance until it becomes scattered, when here and there are different hardware, software, and various versions of them. These are overly complex to maintain, and the usage of various software and platforms has started to limit performance. This is seen in BOT of “Limits to Success”. That is usually when organizations start looking for solutions from EA.

A follow-up scenario is when an organization decides to seek organization-wide IT, eventually EA, but no groundwork is done for that. An organization's performance may experience growth, but when EA begins to outstrip the organization's ability to maintain the EA capability process, overall performance starts to decline. This indicates management's lack of awareness of future requirements.

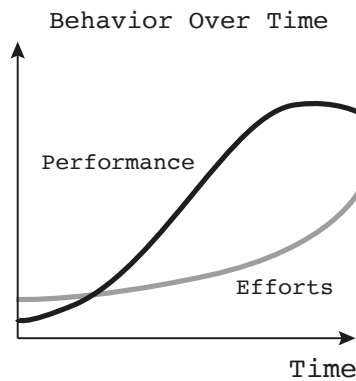


Figure 26. BOT of “Limits to Success” Systems Archetype (Kim & Lannon, 1997).

“Growth and Underinvestment” is a special case of the “Limits to Success” systems archetype. Looking more closely at Figure 18, we can find the fourth type of systems archetype — “Growth and Underinvestment.” (Figure 27).

In this archetype, a reinforcing loop creates pressure in the system, which is relieved by one or more balancing loops that slow growth. Growth approaches a limit that can be eliminated or pushed into the future if capacity investments are made. But here, performance standards are lowered to justify underinvestment, leading to lower performance, which further justifies underinvestment. “Growth and Underinvestment” has a characteristic BOT (Figure 28). At first, efforts for performance lead to rapid growth but soon plateau, impacting perceived needs to invest and performance standards. (Kim, 2000.)

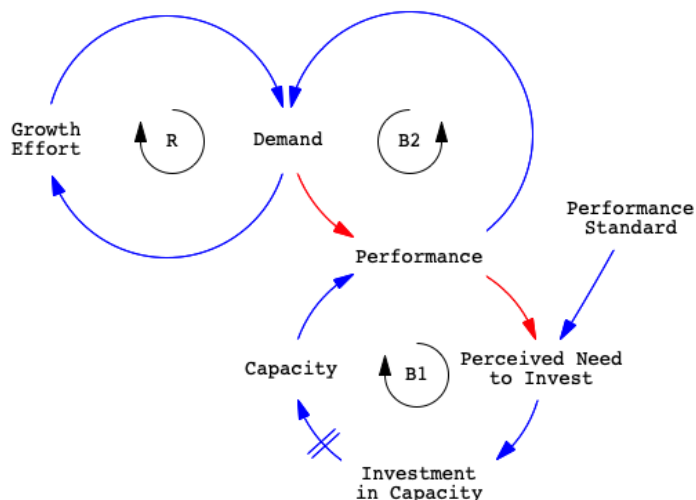


Figure 27. Systems Archetype "Growth and Underinvestment" (Kim & Lannon, 1997).

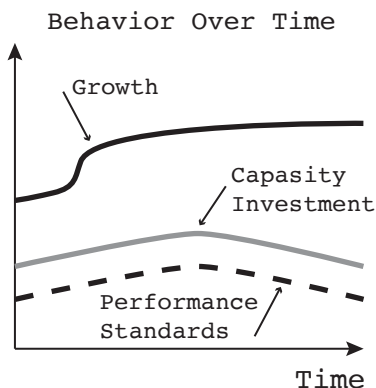


Figure 28. BOT of "Growth and Underinvestment" Systems Archetype (Kim & Lannon, 1997).

Figure 29 is like "Growth and Underinvestment" and formed by reinforcing loop R1 and balancing loops B1 and B2. In principle, it encapsulates the whole problem domain of the EA System presented in Figure 18.

EA strategy level, which affects the need to invest in EA and how to allocate resources. Thus, if the EA impact is not what management has expected, future investments start to decrease, and with poor EA utility, overall performance will decrease.

In conclusion, the EA systems problem and the found systems archetype imply that, as in Figure 30, symptomatic and fundamental solutions interact. This kind of interaction is identifiable as the “Shifting the Burden” of the systems archetype. In "Shifting the Burden," a problem is addressed by implementing a temporary solution (B1) that diverts attention from underlying, more fundamental solutions (B2) (Kim & Lannon, 1997).

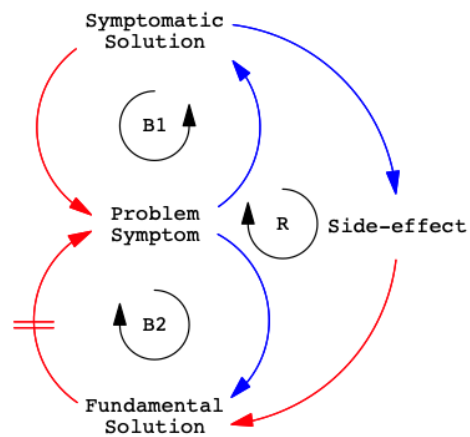


Figure 30. Systems Archetype “Shifting the Burden” (Kim & Lannon, 1997).

“Shifting the Burden” has a characteristic BOT (Figure 31). Here, the problem symptoms continuously increase and oscillate due to the delay of the fundamental solution, which decreases as the symptomatic solution has side effects to the fundamental solution, which enforces the problem symptoms.

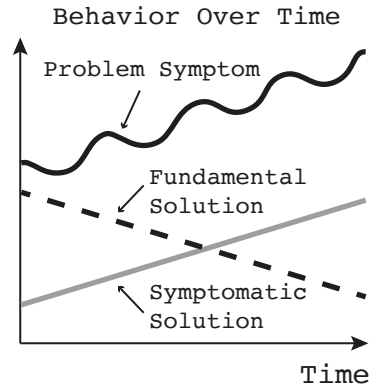


Figure 31. BOT of "Shifting the Burden" Systems Archetype (Kim & Lannon, 1997).

In the EA systems problem CLD (Figure 18), we can see a symptomatic solution (B1) in which "EA Work" aims to fix the "Problem Symptom," i.e., the "EA Capability Gap." This action has side effects, i.e., reinforcing loops R1-R17. However, there is no "Fundamental Solution," but it is obviously needed and here be expressed as "Readiness" (Figure 32).

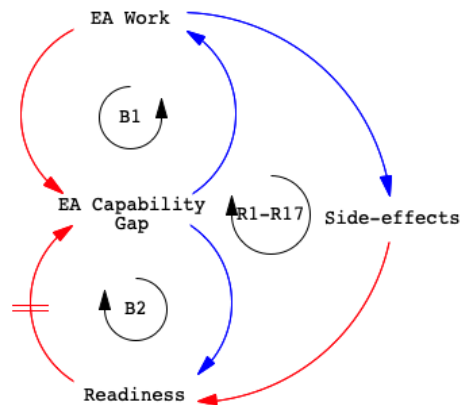


Figure 32. EA Systems Problem as "Shifting the Burden" systems archetype.

"Shifting the Burden" has an "Addiction" structure and degrades into an addictive pattern in which the side-effect gets so entrenched that it overwhelms the original problem symptom (Kim & Lannon, 1997.) This is a phenomenon in the EA realm where we can finally see leverage points for corrective actions.

6.2.2 EA System – Extended Dynamic Theory

We can design high-leverage interventions by diagnosing systemic issues in the EA system problems using CLD. By finding variables that break vicious circles, we can expect greater success in EA work and, ultimately, a better EA value. Variables that balance negative side effects remove vicious cycles.

Notably, the unintended consequences and side effects revealed are not technical but are related to people in EA work and use. As mentioned in the Problem Space chapter (Ch. 4), even if EA may appear as a technical challenge, it is always a management challenge, whether it considers resources or motivation, skills, and knowledge management. EA work stakeholders are considered to be organization employees. However, human resource management (HRM) does not occur as an active actor in EA literature (problem nor CSF field) or TOGAF. The general approach to EA does not explicitly assume or require HR's participation in the EA project.

This way, human resource management (HRM) becomes the focus of attention in the fundamental solution model development. Watson defined HRM as follows: *“HRM is the managerial utilisation of the efforts, knowledge, capabilities and committed behaviours which people contribute to an authoritatively coordinated human enterprise as part of an employment exchange (or more temporary contractual arrangement) to carry out work tasks in a way which enables the enterprise to continue into the future”* (Armstrong & Taylor, 2014 p. 5).

The goals of HRM are to:

1. Support the organization in achieving its objectives by developing and implementing human resource (HR) strategies that are integrated with the business strategy (Strategic HRM).
2. Contribute to the development of a high-performance culture.

3. Ensure that the organization has the talented, skilled, and engaged people it needs.
4. Create a positive employment relationship between management and employees and a climate of mutual trust.
5. Encourage the application of an ethical approach to people management. (ibid.)

Strategic HRM is an overarching approach to developing necessary variables for balancing actions against vicious loops. Increasing overall awareness and understanding of EA and its requirements can break the vicious circle of the EA system problems model (Figure 18). The time horizon to fulfil requirements depends on how top management perceives EA's role in the organization. It will get resources, time, and strategic HRM support to reach the goal if it is perceived as strategic.

To answer the research question, an extended dynamic theory (Figure 33) was developed based on the dynamic theory of the EA system problems.

EA System with Strategic HRM Model hypothesis that variables, "Strategic HRM model," "Training/hiring," "Opportunity Gain Skills & Knowledge," "Maturity management," "Organizational Learning," and "Corporate Culture" create "EA Readiness," which is a fundamental solution for EA.

The variables "Motivation," "Stakeholders Commitment," "Maturity Level," and "Shared Mental Model" are crucial, but they are considered outcomes of previous variables and are here merely for explanatory purposes.

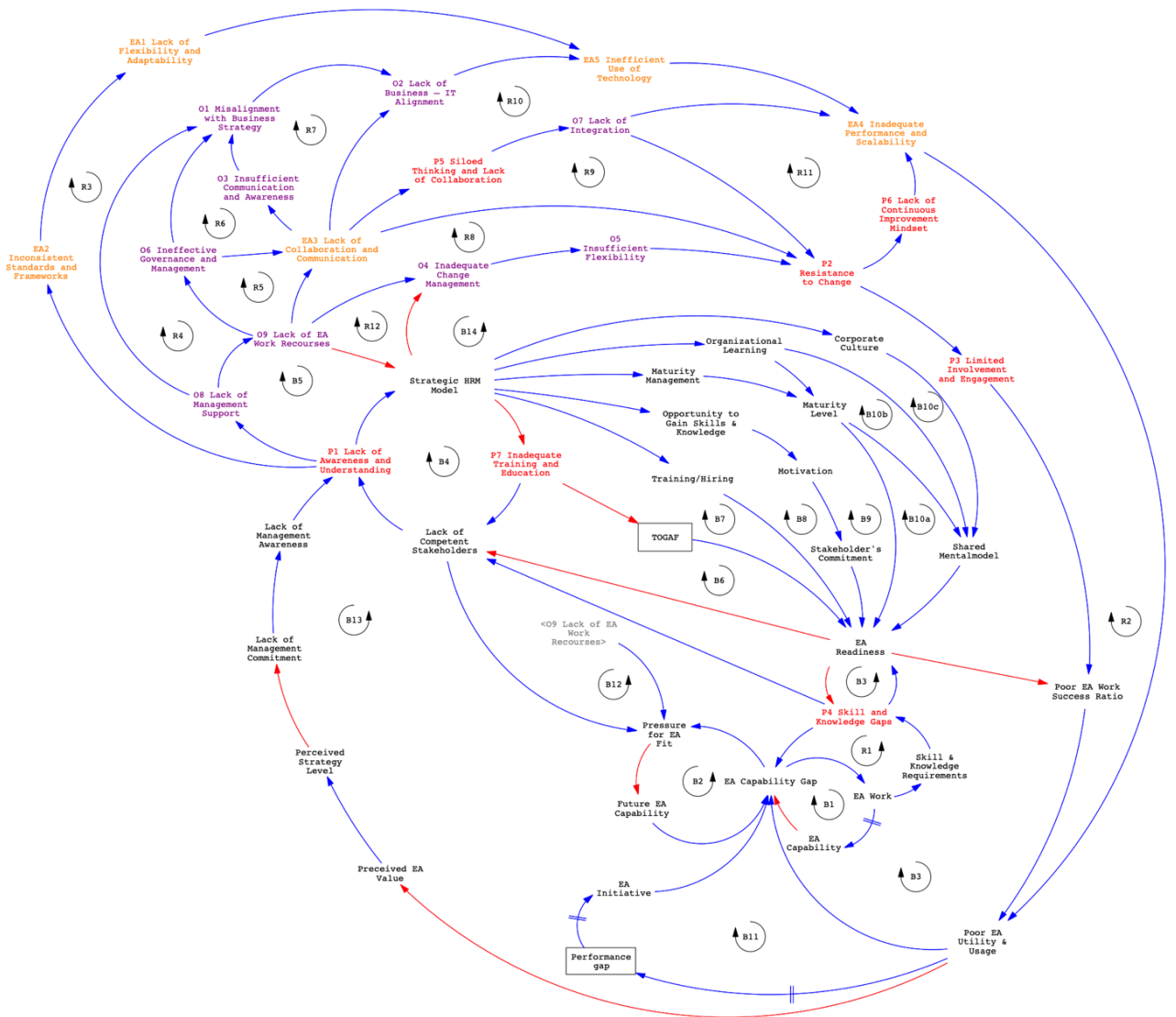


Figure 33. EA System with Strategic HRM Model as Extended Dynamic Theory.

The EA framework is an issue in the literature, but its relevance as a CSF is also challenged (e.g., Hope et al., 2017; Molnar & Proper, 2013 in Kotusev, 2017). According to Kaisler and Armour (2017, p. 4814), no framework has been deemed superior to any others. They add that the literature contains 90 EA frameworks, and the mass overlaps as much as 70%. Anyhow, TOGAF has an EA methodology, whereas others do not (except DODAF and TISAF). TOGAF is one of the most used EA frameworks in industrial, commercial, and academic organizations (e.g., Cameron & McMillan, 2013; Kotusev, 2018). Here, TOGAF presents an EA framework in general. It was selected due to its popularity and EA methodology. One research objective is to appraise its ability to verify

EA's success. Thus, TOGAF is part of the extended dynamic theory with readiness formation.

The following chapters discuss the variables of fundamental solutions related to TOGAF: Readiness and Maturity. As a fundamental solution, EA readiness building is a wide subject, and the next chapter focuses on the concept of readiness in this context. The variables "Training/hiring," "Opportunity Gain Skills & Knowledge," "Organizational Learning," and "Corporate Culture" are included in Chapter Strategic HRM, but those are not subjects of TOGAF and, therefore, do not undergo intense scrutiny.

6.3 Readiness

The successful adoption of EA relies on the organization's readiness; thus, proper readiness is necessary to avoid EA project failure (Hussein, Mahrin, Maarop & Bakar, 2020; Desfray & Raymond, 2014). *"EA readiness refers to the assessment of how ready an organization is to adopt and establish EA practices. EA readiness helps the organization to measure their stage of readiness, to identify any gaps, and then to redesign its strategy in order to adopt EA practices"* (Fischbach & Schoder, 2014; Aziz & Salleh, 2011; Jahani, Javadein, & Jafari, 2010; Dang & Pekkola, 2016 as cited in Hussein et al. 2020, p. 157).

In enterprise architecture, readiness refers to an organization's state where it possesses the required knowledge, resources, culture, governance, processes, skills, communication, mindset, and measurement tools to implement and derive benefits from enterprise architecture effectively. It is a crucial aspect that needs to be considered before implementing EA in an organization.

Working with EA requires a wide understanding of organization and pre-information to select an appropriate target and elements for the right fit for the target and organizational ability. Although EA readiness has not been a widespread topic in the EA research literature, several studies highlight the importance of the organization's readiness for EA establishment. Ismail, Mahrin, Abdullah, Rahim, Samy, and Taib (2016) show the literature search results of mechanisms to measure readiness for an organization's ICT initiatives in Table 34. Hussein et al. (2016) divide the EA implementation factors into groups of people, processes, and technology. As a result, they highlight readiness factors that are compatible with factors also shown in CLD of the EA system model Extended Dynamic Theory (Figure 33).

Table 34. List of Mechanisms to Measure Readiness (Hussein et al., 2016, p. 3).

Mechanisms to measure readiness	Reference	Factors	Purpose	Other parties that may use the instrument
1. E-Government Readiness Assessment for Government Organizations in Developing Countries	[...]	i. Workforce Capability ii. Resources iii. Strategy iv. Culture v. Awareness vi. Change Management vii. Infrastructure	Deliver an integrated framework for assessing organizational ICT readiness of e-government	Agencies to understand Important e-government dimensions.
2. An Assessment Model for the State of Organizational Readiness in Service-Oriented architecture Implementation Based on Fuzzy Logic	[...]	i. Leadership ii. Strategy iii. Culture iv. Awareness v. Governance vi. Infrastructure	To evaluate state of readiness for successful SOA implementation.	For organizations to identify strengths and weaknesses, thus increase their readiness. Model is tested by means of a case study in an ICT organization located in a Tehran municipality.
3. A Readiness Assessment Framework for e-Government Planning - Design and Application	[...]	i. Leadership ii. Resources iii. Governance iv. Change Management v. Infrastructure	To assess readiness for electronic government planning	To collect experience from applying the framework at Maldives.
4. Mechanisms for Assessing and Enhancing Organisations' Readiness for Collaboration in Collaborative Networks	[...]	i. Competency ii. Resources	To assess readiness for collaboration assessments	–
5. Measurement of enterprise architecture readiness within organizations	[...]	i. Leadership ii. Resources iii. Strategy iv. Culture v. Governance vi. Change Management vii. Infrastructure	To measure the amount of readiness before implementing enterprise architecture	–
6. Assessing E-Government Readiness of Local Governments in China: Developing a Bottom-up Approach	[...]	i. Workforce Capability ii. Leadership iii. Resources iv. Infrastructure v. Security	To assess the E-government readiness of specific local governments with particular priorities and goals	Assessment case was carried out in China to test the assessment method.
7. Assessing Electronic Government Readiness of Public Organizations	[...]	i. Leadership ii. Competency iii. Resources iv. Strategy v. Culture vi. Change Management vii. Infrastructure	To include all internal factors affecting EGR of a public organization.	–
8. E-publishing readiness assessment in Iranian publishing companies	[...]	i. Workforce Capability ii. Leadership iii. Resources iv. Culture v. Security vi. Infrastructure	To investigate the readiness of the society and ministry	Ministry of Culture and Islamic Guidance as a legislator towards e-publishing in Iran

Table 35. Factors Related to Readiness in EA Implementation (Hussein et al., 2016, p. 4).

ICT Readiness Mechanisms	Factors										
	People					Process				Technology	
	WC	L	Cp	R	CM	Cl	G	A	S	I	Sc
1. E-Government Readiness Assessment for Government Organizations [...]	X			X	X	X		X	X	X	
2. Assessment Model for the State of Organizational Readiness in Service-Oriented architecture Implementation [...]		X				X	X	X	X	X	
3. Readiness assessment framework for electronic government planning [...]		X		X	X		X			X	
4. Mechanisms for Assessing and Enhancing Organisations' Readiness for Collaboration in Collaborative Networks [...]			X		X						
5. Measurement of enterprise architecture readiness within organizations [...]		X		X	X	X	X		X	X	
6. Assessing E-Government Readiness of Local Governments in China [...]	X	X		X						X	X
7. Assessing Electronic Government Readiness of Public Organizations [...]		X	X	X	X	X			X	X	
8. E-publishing readiness assessment in Iranian publishing companies [...]	X	X		X		X				X	X
<i>WC – Workforce Capability, L – Leadership, Cp – Competency, R – Resources, CM – Change Management, Cl – Culture, G – Governance, A – Awareness, S – Strategy, I – Infrastructure, Sc – Security</i>											
<i>Workforce capability</i>	Refers to the effectiveness of ICT training and capability of human resources.										
<i>Resources</i>	Refers to human resources, ICT resources and budget resources.										
<i>Strategy</i>	Refers to business and ICT strategy.										
<i>Culture</i>	Refers to activities in the environment of an organization.										
<i>Governance</i>	Refers to structure, procedures and routines, and communications involving business and IT.										
<i>Awareness</i>	Refers to the understanding of the concept, sharing of experience and raising the level of knowledge.										
<i>Leadership</i>	Leadership Refers to highest hierarchy in organisation or stakeholders.										
<i>Infrastructure</i>	Infrastructure Refers to technology, including software and hardware.										
<i>Security</i>	Refers to policy, information safety, and the legal and regulatory environment.										
<i>Change Management</i>	Refers to change commitment and change efficacy.										
<i>Competency</i>	Refers to skills, experience and knowledge.										

The CLD of EA System Problems model (Figure 18) demonstrates the need to understand EA's initial requirements, which vary depending on the interconnected roles of the stakeholders. From the organizational perspective, it is necessary to understand the scope of impact that the target process and technology produce and how to cope with it now and in the future. It is essential to remember that EA is not a one-time project and needs recurring updates. EA seeks to define the architecture of an organization's processes, information, and IT assets in alignment with its strategies and goals.

Because the impact of EA is so broad, awareness is one of the main factors in avoiding problems with EA work. In Chapter 4, many studies pinpoint problems with understanding EA (e.g., Dang & Pekkola, 2016; Lucke et al., 2010; and Kaisler & Armour, 2017). Awareness is the first motivation step to wider understanding. Without the right picture of EA, i.e., awareness, there is no motivation to gain understanding and knowledge for proper EA work. Senior management's lack of awareness is one of the root problems and needs to be surveyed before EA work starts. Without awareness, EA work will have difficulties getting senior management's support, which also affects the number of resources as well as aligning strategy and goal. Also, due to the lack of awareness senior management's commitment and attitudes toward EA are dismissive while thinking of EA only as an IT project. Kaisler and Armour (2017, p. 4812) stress that, even if EA may appear as a technical challenge, it is always a management challenge. Therefore, it is helpful to think about EA through some typical organizational theory to pinpoint areas that stakeholders need to understand regarding EA work and its implementation (Table 36). Also, it works as an awareness measurement tool and indicates the depth of understanding of EA. The concept of contingency as it applies to organizational readiness and technology implementation is captured in various theories and models that recognize the importance of alignment among an organization's strategy, structure, technology, and environment.

Table 36. Readiness indicator theories for EA work.

Leavitt's Diamond	This model suggests that organizational change is a complex process involving four interrelated components: tasks, people, structure, and technology. Changes in technology require adjustments in the other components, and the effectiveness of the technology implementation is contingent upon the alignment of all four components.
Organizational Readiness for Change	This concept acknowledges that the success of technology implementation is contingent upon whether an organization is ready for the change. Organizational readiness is influenced by various factors, including culture, employee attitudes, past experiences with change, and the presence of change champions.
Socio-Technical Systems Theory	This theory also reflects contingency thinking by emphasizing that the effective implementation of technology is contingent upon the simultaneous optimization of both the social and technical systems in an organization (e.g. Eric Trist & colleagues at the Tavistock institute).
Resource-Based View (RBV)	RBV is a perspective that considers a firm's resources and capabilities as key to its strategy and performance. The successful implementation of technology is seen as contingent upon whether the organization has the necessary resources and capabilities to support the technology (e.g. Prahalad & Hamel, 1990).
Technology Acceptance Model (TAM)	TAM considers how perceived usefulness and perceived ease of use influence an individual's decision to use new technology. The model implies that the fit between technology and user needs is contingent upon these perceptions. Davis, Bagozzi & Warshaw (1989).

The organizational design includes a contingency theory. It is a view that the appropriate solution in any specific case depends on the circumstances prevailing at the time. Furthermore, Joan Woodward (1965) introduced the notion of technological imperative. She discovered that a firm's organizational structure was related to its performance but through an important, additional variable – technology. According to her, the most appropriate organizational structure that gives the best performance is contingent upon the type of technology employed by that firm (Buchanan & Huczynski, 2004, p. 522).

Thus, the contingency theory emphasizes the value of ensuring the right "*fit*" among leaders, employees, and the organization as a whole rather than partial optimizing varied parts to the demands of the situation. EA work should follow the contingency approach principle. The contingency approach holds that EA's success will be secured when the EA project achieves a match between its requirements and the organization's abilities. The contingency approach operates on a cause-and-effect basis, e.g., if your technology, environment, or employee skills are like this, then your EA should be that (which fits them) and vice versa.

In organizational theory, the concept of "*fit*" typically refers to the alignment between different components of an organization, which can include its strategy, structure, processes, people, and culture. The basic idea behind "*fit*" theory is that an organization can achieve optimal performance when all these components are aligned and congruent with each other. While seeking the proper alignment of components, thinking of EA through some typical organizational fit model also helps to indicate the depth of understanding of EA.

Table 37. Readiness Indicator Fit models.

Strategic Fit	This involves aligning an organization's strategy with its external environment, ensuring consistency with environmental demands, competitive pressures, and internal resources and capabilities.
Technology-Organization Fit	The idea that technology should align with an organization's processes, culture, and strategy incorporates the concept of contingency. This fit affects how readily new technology is adopted and how effective it is in practice.
Structural Fit	Organizational structure should support the strategy and operational processes. This means that the organizational structure should be aligned with the organization's strategy to promote effective execution.
Cultural Fit	The organizational culture must be in harmony with the strategy and structure. A culture that supports the values and behaviors necessary to implement the strategy is crucial for effective functioning.
Fit with Human Resources	This refers to having the right people in the right positions. Human resource practices (recruitment, training, development, and compensation) should be designed to attract, develop, and retain talent that fits with the organization's strategic goals.
Contingency Fit	This is the idea that there is no one best way to organize a corporation or make decisions. Instead, the optimal course of action is contingent upon the internal and external situation. An organization must be adaptable and change its approach based on changing circumstances.
Fit and Performance	The theory posits that organizations with a high level of fit among their strategy, structure, culture, and processes will perform better than those with poor alignment. Misalignment can lead to inefficiencies, decreased employee morale, and a failure to achieve strategic goals.
Dynamic Fit	Organizations operate in dynamic environments, which means that fit is not a one-time achievement. Organizations must continually adapt to maintain alignment among their components in response to changing circumstances.

In an EA context, thinking readiness through the lens of *"fit"* highlights how well the different parts of an organization work together. This shows those parts that need to be compatible, coherent, and tailored to support the organization's overall strategy and objectives and the organization's readiness level for EA. In addition, they must be able to adapt to environmental changes to maintain alignment over time.

The concepts and models above show that the success of technology implementation in organizations is contingent upon various factors, including the organization's readiness, the fit between technology and other organizational components, and the alignment of technology with the organization's strategy and culture. More comprehensive methods are various maturity models that can be used to evaluate an organization's state that illustrates readiness for specified level action, as discussed in Chapter 6.3.

EA literature and the readiness lenses mentioned earlier make it possible to create a general readiness list to secure base-level awareness of the scope of EA work requirements (Table 38 and Table 39). These lists may be used as a starting point

worklist for preliminary work to ensure that all stakeholders have the right level of skill and knowledge base.

Table 38. General EA Readiness List.

Strategic Alignment	<ul style="list-style-type: none"> • Ensure that the enterprise architecture aligns with the business strategy. • Understand the organization's vision, mission, and strategic goals.
Stakeholder Buy-in	<ul style="list-style-type: none"> • Identify and engage key stakeholders from IT and business units. • Secure executive sponsorship for EA initiatives.
Governance Structure	<ul style="list-style-type: none"> • Establish a clear EA governance structure. • Define roles and responsibilities, including that of a chief architect.
Skilled Team	<ul style="list-style-type: none"> • Assemble a team with the right mix of skills, including IT, business, and communication skills. • Invest in continuous training and certification.
Frameworks and Methodologies	<ul style="list-style-type: none"> • Choose appropriate enterprise architecture frameworks (e.g., TOGAF). • Adopt standardized methodologies for consistent development and maintenance of the EA. (e.g., ADM)
Communication Plan	<ul style="list-style-type: none"> • Regularly communicate the purpose, benefits, and updates of the EA to all stakeholders. • Establish feedback loops to refine the architecture based on input.
Toolset Selection	<ul style="list-style-type: none"> • Invest in the right tools for modeling, documentation, analysis, and presentation. • Ensure compatibility and integration capabilities with other organizational tools.
Documentation and Repository	<ul style="list-style-type: none"> • Maintain an up-to-date repository of architectural artifacts, patterns, standards, and guidelines. • Ensure accessibility to relevant stakeholders.
Baseline Assessment	<ul style="list-style-type: none"> • Document the current state architecture to understand the starting point. • Identify pain points, redundancies, and opportunities for improvement.
Future-State Vision	<ul style="list-style-type: none"> • Define a clear vision for the desired future state of the enterprise architecture. • Set measurable goals and milestones to track progress.
Change Management	<ul style="list-style-type: none"> • Create a plan to effectively handle organizational changes due to initiatives driven by Enterprise Architecture. • Map stakeholders' and end-users' skill requirements. • Implement EA maturity plan. • Address potential resistance proactively.
Metrics and KPIs	<ul style="list-style-type: none"> • Define clear metrics and Key Performance Indicators (KPIs) to evaluate the success of the EA program. • Monitor and adjust based on continuous feedback.
Regular Reviews	<ul style="list-style-type: none"> • Schedule regular architecture reviews to ensure alignment with changing business needs. • Iterate and update the architecture as required.
Risk Management	<ul style="list-style-type: none"> • Identify potential risks associated with EA initiatives. • Develop mitigation strategies and backup plans.
Funding and Budgeting	<ul style="list-style-type: none"> • Secure consistent funding for EA initiatives. • Ensure alignment between EA budgeting and broader IT and business budgets.
Integration and Interoperability	<ul style="list-style-type: none"> • Focus on designing systems that can integrate and interoperate seamlessly. • Adopt open standards where possible.
Scalability	<ul style="list-style-type: none"> • Design architectures that can scale with the organization's growth and changing needs. • Consider both horizontal and vertical scaling.
Security and Compliance	<ul style="list-style-type: none"> • Integrate security considerations at every level of the architecture. • Ensure compliance with industry regulations and standards.
Continuous Improvement	<ul style="list-style-type: none"> • Adopt a mindset of continuous improvement for the EA process. • Incorporate lessons learned from past projects.
Cultural Consideration	<ul style="list-style-type: none"> • Understand the organizational culture and tailor the EA approach accordingly. • Foster a culture that values and understands the importance of enterprise architecture.

Table 39. General Organizational Level Readiness List for Successful Enterprise Architecture.

Organizational Understanding and Support	The organization must have a clear understanding of what EA is and how it can benefit the business. This includes support from top management, as they play a crucial role in driving EA initiatives.
Alignment with Business Goals	EA should be aligned with the business goals and strategies of the organization. This alignment ensures that the architecture supports the business effectively and is not just a technical exercise.
Resource Availability	Adequate resources, including skilled personnel, tools, and budget, should be allocated to EA initiatives. The right mix of skills is essential for effective architecture planning, development, and management.
Governance Framework	A governance framework should be in place to guide, control, and monitor EA activities. This includes processes for making decisions about IT investments, architecture standards, and compliance.
Maturity of Existing Processes and Systems	The existing IT infrastructure and processes within the organization can impact the readiness for EA. Organizations with an existing maturity model may find it easier to integrate EA principles.
Cultural Readiness	The organizational culture should be conducive to change and innovation. EA often requires changes in how teams work and collaborate, and a culture resistant to change can be a significant barrier.
Training and Development	Continuous training and development programs for staff to understand and implement EA practices effectively are crucial. This includes not just the IT team but also business stakeholders and end-users.
Communication and Stakeholder Engagement	Effective communication channels should be established to ensure stakeholders are kept informed and engaged throughout the EA process.
Measurement and Evaluation Mechanisms	There should be mechanisms in place to measure and evaluate the effectiveness of the EA, ensuring it delivers value to the organization.
Continuous Improvement	An attitude of continuous improvement in EA practices helps adapt to new technologies, methodologies, and business needs.

Enterprise Architect Readiness (Table 40) refers to an organization's or individual's preparedness and capability to design, implement, and manage architecture.

Table 40. Readiness of the EA Architect.

Knowledge and Skills	An enterprise architect should possess deep knowledge of the organization's business, technology, information systems, and strategic objectives. This includes understanding emerging technologies, architectural principles, and methodologies like TOGAF (The Open Group Architecture Framework)
Strategic Alignment	Readiness also involves aligning the enterprise architecture with the organization's goals and strategic direction. This ensures that the IT infrastructure and systems support the overall business objectives.
Stakeholder Engagement	Effective communication skills to engage with various stakeholders, including business leaders, IT professionals, and external partners, are crucial. This involves translating complex technical concepts into understandable business terms.
Governance and Compliance	Ensuring that the enterprise architecture adheres to relevant standards, regulations, and best practices. This includes risk management and ensuring data privacy and security.
Change Management	The readiness to manage and guide the organization through technological and architectural changes. This requires skills in project management, leadership, and the ability to anticipate and mitigate potential challenges.
Continuous Learning	Keeping up-to-date with industry trends, new technologies, and best practices is essential for an enterprise architect. This involves continuous learning and professional development.

Engaging stakeholders effectively is critical in ensuring the success of EA initiatives. In Table 41 is a general readiness list detailing the ability requirements for various stakeholders in an enterprise architecture endeavor.

Table 41. Readiness of the EA Stakeholders

<p>Executive Leadership (CEO, CIO, COO, CHRO)</p>	<p>Strategic Vision: Understand and articulate the long-term vision for the organization and its functions' abilities and capabilities.</p> <p>Awareness of EA's strategic sense: Understanding EA's strategic function and seeing it as an independent capability.</p> <p>Change Management: Understanding of contingency and technological determinism and applying fit approach. Understanding of organization-level interconnected change factors and ability to drive and manage change across the organization.</p> <p>Budgeting: Ensure appropriate budget allocation for EA initiatives.</p> <p>Prioritization: Make decisions about which EA initiatives to pursue and in what order.</p>
<p>Enterprise Architects</p>	<p>Technical Acumen: Deep understanding of various architectural domains (business, data, application, and technology).</p> <p>Communication: Ability to explain complex technical concepts in simple terms.</p> <p>Modeling: Skills in utilizing EA tools and creating architectural diagrams and blueprints.</p> <p>Stakeholder Management: Engage and manage diverse stakeholder groups.</p>
<p>Business Leaders and Managers</p>	<p>Business Strategy: Understanding of the business goals and objectives.</p> <p>Operational Insight: Knowledge of daily operations, challenges, and opportunities.</p> <p>Collaboration: Willingness to work with IT and EA teams to align business and IT strategies.</p>
<p>IT Managers and Technical Leaders</p>	<p>Technical Depth: Proficiency in specific IT domains.</p> <p>Integration: Understanding of how different IT systems and components interact.</p> <p>Innovation: Ability to propose new technological solutions to business problems.</p> <p>Project Management: Oversee EA-related projects to ensure timely delivery.</p>
<p>HR managers</p>	<p>Business Strategy: Understanding of the business goals and objectives.</p> <p>Change Management: Understanding of contingency and technological determinism and applying fit approach. Understanding of organization-level interconnected change factors and ability to drive and manage change across the organization.</p>
<p>End Users and Operational Staff</p>	<p>Feedback: Provide insights about system usability, issues, and areas for improvement.</p> <p>Adaptability: Willingness to adapt to new systems, processes, and tools.</p> <p>Training: Actively participate in training sessions and workshops.</p>
<p>External Partners and Vendors</p>	<p>Alignment: Understand the organization's EA vision and standards.</p> <p>Flexibility: Ability to adjust products or services based on the organization's architectural decisions.</p> <p>Collaboration: Work closely with enterprise architects and other stakeholders.</p>
<p>Regulatory and Compliance Officers</p>	<p>Regulatory Insight: Deep understanding of applicable laws, regulations, and standards.</p> <p>Risk Management: Ability to identify and articulate risks associated with architectural decisions.</p> <p>Communication: Notify EA teams about changing regulatory landscapes.</p>
<p>EA Governance Body</p>	<p>Oversight: Monitor the progress and adherence of EA initiatives.</p> <p>Guideline Development: Create and update EA policies, principles, and guidelines.</p> <p>Decision-making: Make decisions on architectural disputes, exceptions, and changes.</p>
<p>Change Agents and Champions</p>	<p>Advocacy: Promote the benefits and value of EA initiatives.</p> <p>Resistance Management: Identify and address resistance to architectural changes.</p> <p>Engagement: Actively engage with various stakeholder groups to gather feedback and ensure alignment.</p>

“ Enterprise Architecture implementation will require a deep knowledge and awareness of all of the business transformation factors that impact transitioning to the visionary state. With the evolution of IT, the actual technology is not the real issue any more in Enterprise Architecture, but the critical factors are most often the cultural ones. Any Implementation and Migration Plan has to take both into consideration. Neglecting these and focusing on the technical aspects will invariably result in an implementation that falls short of realizing the real promise of a visionary Enterprise Architecture.” (TOGAF 26.7 Business Transformation Readiness Assessment)

TOGAF chapter (26), Business Transformation Readiness Assessment, deals with readiness matters. It builds on the Canadian Government's Business Transformation Enablement Program (BTEP).

Enterprise Architecture is a significant initiative within an organization, often involving an innovative Architecture Vision (Phase A) and supporting Architecture Definition (Phases B to D) that will bring about substantial change. While there are various aspects to consider in this change, the human element is the most crucial. For instance, if the enterprise plans to consolidate its information holdings and transition to a new paradigm like service orientation for integrated service delivery, the implications for the workforce are substantial. When combined with a culture resistant to change and a workforce with narrow skills, even the most robust and innovative architecture may face significant obstacles. (TOGAF chapter 26)

The readiness and ability requirements vary based on the organization's EA maturity level (and size and industry). The above-presented list (Table 38) provides a foundational understanding, but it's essential to tailor it to each organization's specific needs and nuances.

The TOGAF Architecture Capability Framework (ACF) includes skills and knowledge readiness requirements. It puts organizational structures, processes, roles,

responsibilities, and skills in place to realize the capability of architecture. The TOGAF *Architecture Development Method* (ADM) can support Enterprise Architecture Capability. ADM is a generic method for architecture development, and it is important to stress that the order of the phases in ADM depends on the maturity of the architecture discipline within the enterprise. So, there is a readiness model, and ADM describes the preparation and initiation activities required to create an architecture capability, including customization of the TOGAF framework and definition of architecture principles. TOGAF *ADM Guidelines and Techniques* introduce *Gap Analysis* (e.g., people skill gaps for cross-training requirements) and TOGAF *Business Transformation Readiness Assessment*, which focus on readiness. Transformation Readiness assessment stresses that; *“understanding the readiness of the organization to accept change, identifying the issues, and then dealing with them in the Implementation and Migration Plans is key to successful architecture transformation in Phases E and F. This will be a joint effort between corporate (especially human resources) staff, lines of business, and IT planners”* (TOGAF 26.1). ADM's preliminary phase evaluates readiness and the gaps that the intended EA deals with.

However, ADM preliminary phase relies on the assumption of proper awareness of EA work and readiness that supports the information requirements in this phase. ADM preliminary phase input information can be gathered within the ADM process. Still, without senior management's active support and participation, there is no non-architectural and architectural information (Table 42), and the foundation for EA work will be weak, leading to possible failure. Therefore, senior management must provide their full commitment to ensure a proper foundation by valid outputs of ADM preliminary phase (Table 43) to ensure the success of EA implementation.

Table 42. ADM preliminary phase inputs (TOGAF 5.2.2 & 5.2.3).

<p>Non-Architectural Inputs</p>	<ul style="list-style-type: none"> ● Board strategies and board business plans, business strategy, IT strategy, business principles, business goals, and business drivers, when pre-existing ● Major frameworks operating in the business; e.g., project/portfolio management ● Governance and legal frameworks, including Architecture Governance strategy, when pre-existing ● Architecture capability ● Partnership and contract agreements
<p>Architectural Inputs</p>	<p>Pre-existing models for operating an Enterprise Architecture Capability can be used as a baseline for the Preliminary Phase. Inputs would include:</p> <ul style="list-style-type: none"> ● Organizational Model for Enterprise Architecture including: <ul style="list-style-type: none"> ○ Scope of organizations impacted ○ Maturity assessment, gaps, and resolution approach ○ Roles and responsibilities for architecture team(s) ○ Budget requirements ○ Governance and support strategy

Table 43. Outputs of ADM preliminary phase (TOGAF 5.4).

<ul style="list-style-type: none"> ○ Organizational Model for Enterprise Architecture, including: <ul style="list-style-type: none"> ○ Scope of organizations impacted ○ Maturity assessment, gaps, and resolution approach ○ Roles and responsibilities for architecture team(s) ○ Constraints on architecture work ○ Budget requirements ○ Governance and support strategy ○ Tailored Architecture Framework, including: <ul style="list-style-type: none"> ○ Tailored architecture method ○ Tailored architecture content (deliverables and artifacts) ○ Architecture Principles ○ Configured and deployed tools ○ Initial Architecture Repository, populated with framework content ○ Restatement of, or reference to, business principles, business goals, and business drivers ○ Request for Architecture Work (optional) ○ Architecture Governance Framework <p>The outputs may include some or all of the following:</p> <ul style="list-style-type: none"> ○ Catalogs: <ul style="list-style-type: none"> ○ Principles catalog
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Within the *Architecture Capability Framework (ACF)* is the *Architecture Skills Framework (ASF)* (more in Chapter 6.5), which assesses the skills required to deliver a successful enterprise architecture. However, this needs senior management participation and authorization. Thus, there is the chicken or the egg causality dilemma; therefore, we should keep readiness as an independent specific issue involved in many levels of the EA endeavor. In conclusion, the challenge is senior management's awareness and, thus,

motivation to gain the required readiness that EA work necessitates. If EA is not seen as a strategic question, it easily leaves an isolated it-project without the required joint effort between corporate (especially human resources) staff, lines of business, and IT planners, *as the* ADM Transformation Readiness assessment stresses.

6.4 Maturity

Maturity models have been proposed to aid organizations in adopting adequate EA practices and processes. However, only mature models mentioned in TOGAF are presented and evaluated for EA work in the context of EA systems problems.

TOGAF (The Open Group Architecture Framework) does include aspects of maturity planning, particularly in the context of the maturity of enterprise architecture (EA) practices within an organization (

Table 44). This is mainly addressed through the Architecture Maturity Models, which are part of TOGAF's Architecture Capability Framework. However, TOGAF does not include a maturity model, but it supports the use of some. Instead, TOGAF includes the Architecture Skills Framework, which is a closely related topic (from a people's maturity perspective) that can be used to plan the target skills and capabilities required by an organization to successfully develop and utilize Enterprise Architecture (more in the next Chapter).

Table 44. Key Points of TOGAF Maturity Planning.

Architecture Maturity Models	TOGAF provides maturity models, such as the Architecture Capability Maturity Model (ACMM), which help organizations assess and plan the maturity of their architecture functions. These models provide a structured path for developing and enhancing an organization's enterprise architecture capabilities.
Maturity Assessments	Organizations can use TOGAF's guidelines to conduct maturity assessments. These assessments help in understanding the current level of maturity in various areas of enterprise architecture and identify areas for improvement.
Continuous Improvement	Maturity planning in TOGAF is not a one-time activity but a continuous process. As organizations evolve, their architecture needs and capabilities also change, requiring regular reassessment and adjustment of their maturity plans.
Alignment with Business Goals	Maturity planning in TOGAF is closely aligned with the overall business goals and strategies of the organization. It ensures that the development of architecture capabilities is in sync with business objectives.
Roadmap Development	Part of maturity planning involves developing roadmaps for achieving higher levels of maturity. This includes setting specific goals, timelines, and identifying necessary resources and actions to enhance the EA practice.

The original Capability Maturity Model (CMM) was developed by the Software Engineering Institute (SEI) in the early 1990s. It has worked as a framework for building maturity models in various disciplines. Capability Maturity Models Integration (CMMI) evolved from CMM and was developed in the early 2000s. It is a more robust and integrated framework for a wider range of processes and disciplines.

In TOGAF, Chapter 45.3 introduces the US Department of Commerce's (DoC) developed Architecture Capability Maturity Model (ACMM), which helps conduct internal assessments. The ACMM provides a framework representing the key components of a productive enterprise architecture process. The aim is to increase the chances of success for enterprise architecture by pinpointing weak areas and providing a clear path for improving the architecture process (Table 45). As the previous chapter about readiness stated, the hardest level to pass is level 0, where awareness of EA does not exist.

Table 45. Architecture Capability Maturity Model (ACMM).

ACMM Levels	Enterprise Architecture elements (attributed at each level)
Level 0 (Incomplete): <ul style="list-style-type: none"> • Ad hoc and uncontrolled processes. 	1. Architecture process
Level 1 (Initial/Ad hoc): <ul style="list-style-type: none"> • Initial process awareness, but still reactive and uncontrolled. 	2. Architecture development
Level 2 (Under development, Managed): <ul style="list-style-type: none"> • Processes are documented and standardized. 	3. Business linkage
Level 3 (Defined): <ul style="list-style-type: none"> • Processes are integrated with the entire organization 	4. Senior management involvement
Level 4 (Quantitatively Managed): <ul style="list-style-type: none"> • Processes are measured and controlled. 	5. Operating unit participation
Level 5 (Measured): <ul style="list-style-type: none"> • Focus on process improvement through continuous feedback. 	6. Architecture communication
	7. IT security
	8. Architecture Governance
	9. IT investment and acquisition strategy

However, only ACMM's *Enterprise Architecture elements 4. and 5.* concern stakeholders (

Table 46). ACMM does not stress people's abilities and underlying factors; it only expresses status. Also, it relies on developing the capability of management participation and their feedback regarding future targets. If there is no feedback loop or if it is set wrong, it causes a lag in overall competence improvement or capability adjustment regarding strategic goals. As Chapter 6.2 Systems CLDs shows, linking relevant feedback loops and understanding underlying factors is necessary. As John D. Sterman (2002, p. 6) stated,

“Time delays in feedback channels mean the long-run response of a system to an intervention is often different from its short-run response. High leverage policies often cause worse-before-better behavior, while low leverage policies often generate transitory improvement before the problem grows worse.”

Table 46. ACMM elements 4 & 5 per maturity level.

ACMM Levels	Enterprise Architecture elements (attributes of 4 & 5)
Level 0 (Incomplete): <ul style="list-style-type: none"> • Ad hoc and uncontrolled processes. 	<ul style="list-style-type: none"> • Senior management involvement <ul style="list-style-type: none"> ○ Lack of it or random • Operating unit participation <ul style="list-style-type: none"> ○ Lack of it or random
Level 1 (Initial/Ad hoc): <ul style="list-style-type: none"> • Initial process awareness, but still reactive and uncontrolled. 	<ol style="list-style-type: none"> 4. Senior management involvement <ul style="list-style-type: none"> ○ Limited management team awareness or involvement in the architecture process. 5. Operating unit participation <ul style="list-style-type: none"> ○ Limited operating unit acceptance of the Enterprise Architecture process.
Level 2 (Under development, Managed): <ul style="list-style-type: none"> • Processes are documented and standardized. 	<ol style="list-style-type: none"> 4. Senior management involvement <ul style="list-style-type: none"> ○ Limited operating unit acceptance of the Enterprise Architecture process. 5. Operating unit participation <ul style="list-style-type: none"> ○ Responsibilities are assigned and work is underway.
Level 3 (Defined): <ul style="list-style-type: none"> • Processes are integrated with the entire organization 	<ol style="list-style-type: none"> 4. Senior management involvement <ul style="list-style-type: none"> ○ Senior management team aware of and supportive of the enterprise-wide architecture process. Management actively supports architectural standards. 5. Operating unit participation <ul style="list-style-type: none"> ○ Most elements of operating unit show acceptance of or are actively participating in the Enterprise Architecture process.
Level 4 (Quantitatively Managed): <ul style="list-style-type: none"> • Processes are measured and controlled. 	<ol style="list-style-type: none"> 4. Senior management involvement <ul style="list-style-type: none"> ○ Senior management team directly involved in the architecture review process. 5. Operating unit participation <ul style="list-style-type: none"> ○ The entire operating unit accepts and actively participates in the Enterprise Architecture process.
Level 5 (Measured): <ul style="list-style-type: none"> • Focus on process improvement through continuous feedback. 	<ol style="list-style-type: none"> 4. Senior management involvement <ul style="list-style-type: none"> ○ Senior management involvement in optimizing process improvements in architecture development and governance. 5. Operating unit participation <ul style="list-style-type: none"> ○ Feedback on architecture process from all operating unit elements is used to drive architecture process improvements.

In this study *Chapter 4. Problem Space*, and *Chapter 5. Solution Space*, it becomes more evident that the most relevant issues concerned people. E.g., Hope et al. (2017) analyzed critical success factors. They highlighted integration in the organization, i.e., how well the organization and people are working together regarding EA and how well essential new manners to do things are adopted. Hope et al. (ibid.) state that the most relevant CSF represents people and the sociological processes of EA implementation. Also, Gong and Janssen (2020) show that lack of knowledge is one of the five most influential causal factors for EA failure. Moreover, Lucke et al. (2010) show that understanding and management of EA is a high-level issue.

This study emphasizes the sociological aspects of TOGAF framework and how it addresses related issues. As mentioned, TOGAF does not have a maturity model but supports using some. TOGAF in *Chapter 45.4.1 Capability Maturity Model Integration (CMMI)*; According to SEI, CMMI models improve on previous models by enabling organizations to:

- More explicitly link management and engineering activities to business objectives.
- Expand the scope of and visibility into the product lifecycle and engineering activities to ensure that the product or service meets customer expectations.
- Incorporate lessons learned from additional areas of best practice (e.g., measurement, risk management, and supplier management).
- Implement more robust high-maturity practices.
- Address additional organizational functions critical to its products and services.
- More fully comply with relevant ISO standards.

In the same Chapter, TOGAF introduces capability models that the SEI is currently developing to provide a means of managing complexity. One of them is People CMM or P-CMM (People Capability Maturity Model). P-CMM serves as a guide for implementing workforce practices that continuously improve an organization's workforce capability (Curtis, Hefley, & Miller, 2018, p. 3).

"The philosophy implicit the People CMM can be summarized in ten principles.

1. *In mature organizations, workforce capability is directly related to business performance.*
2. *Workforce capability is a competitive issue and a source of strategic advantage.*
3. *Workforce capability must be defined in relation to the organization's strategic business objectives.*
4. *Knowledge-intense work shifts the focus from job elements to workforce competencies.*

5. *Capability can be measured and improved at multiple levels, including individuals, workgroups, workforce competencies, and the organization.*
6. *An organization should invest in improving the capability of those workforce competencies that are critical to its core competency as a business.*
7. *Operational management is responsible for the capability of the workforce.*
8. *The improvement of workforce capability can be pursued as a process composed from proven practices and procedures.*
9. *The organization is responsible for providing improvement opportunities, while individuals are responsible for taking advantage of them.*
10. *Since technologies and organizational forms evolve rapidly, organizations must continually evolve their workforce practices and develop new workforce competencies.” (Curtis et al. 2018, pp 4-5)*

P-CMM is a five-level roadmap for implementing workforce practices that continuously improve an organization’s workforce capability (Table 47). Adopting P-CMM improves workforce readiness and aligns human capital practices with business objectives.

Table 47. People CMM levels (Curtis et al. 2018).

P-CMM Levels	Maturity elements
<p>Level 1 (Initial)</p>	<p><i>The Initial Level typically exhibits four characteristics:</i></p> <ul style="list-style-type: none"> ○ <i>Inconsistency in performing practices,</i> ○ <i>Displacement of responsibility,</i> ○ <i>Ritualistic practices, and</i> ○ <i>An emotionally detached workforce.</i> <p><i>The organization's workforce practices are usually unstructured and reactive. Processes might be inconsistent and largely dependent on individual effort.</i></p>
<p>Level 2 (Managed)</p>	<p><i>Frequent problems that keep people from performing effectively in low-maturity organizations include:</i></p> <ul style="list-style-type: none"> ○ <i>Work overload</i> ○ <i>Environmental distractions</i> ○ <i>Unclear performance objectives or feedback</i> ○ <i>Lack of relevant knowledge or skill</i> ○ <i>Poor communication</i> ○ <i>Low morale</i> <p><i>Practices start to become more planned and organized. The organization establishes basic policies for managing people and begins to track workforce activities.</i></p>
<p>Level 3 (Defined)</p>	<p><i>The organization develops a set of standard processes for managing and developing its workforce. These processes are well-defined and understood across the organization.</i></p>

P-CMM Levels	Maturity elements
Level 4 (Predictable)	The organization uses quantitative analysis to predict workforce behavior and performance, enabling more effective workforce management.
Level 5 (Optimizing)	At the highest level, an organization continuously improves its workforce practices based on a quantitative understanding of its objectives and performance needs. It adapts and innovates its people management processes to address future challenges and opportunities.

P-CMM's primary goal is to improve the capability of an organization's workforce, which improves the organization's overall capability. By progressing through the levels of the P-CMM, organizations can achieve more effective and efficient workforce management, leading to better overall performance and competitiveness (Table 48). It emphasizes areas such as competency development, organizational culture, performance management, and workforce planning.

Table 48. Process Threads in the People CMM (Curtis et al. 2018, p. 43).

Maturity levels	Process Area Threads			
	Developing individual capability	Building workgroups & culture	Motivating & managing performance	Shaping the workforce
5 (Optimizing)	Continuous Capability Improvement		Organizational Performance Alignment	Continuous Workforce Innovation
4 (Predictable)	Competency Based Assets Mentoring	Competency Integration Empowered Workgroups	Quantitative Performance Management	Organizational Capability Management
3 (Defined)	Competency Development Competency Analysis	Workgroup Development Participatory Culture	Competency Based Practices Career Development	Workforce Planning
2 (Managed)	Training and Development	Communication and Coordination	Compensation Performance Management Work Environment	Staffing

TOGAF does not inherently include P-CMM, but using them in conjunction enhances an organization's overall maturity and effectiveness. Implementing P-CMM in TOGAF framework is focused on improving the management and development of an organization's human assets, while TOGAF is concerned with enterprise architecture.

In conclusion, according to the revealed issues with EA, TOGF needs (as it suggests) a maturity model. P-CMM is an excellent candidate for mitigating human-related EA issues concerning knowledge, skill, and organizational culture. P-CMM enhances the human aspect, ensuring that the workforce is capable and ready to support the goals and structures laid out in the enterprise architecture as per TOGAF.

6.5 Strategic Human Resource Management

This study has shown the causal factors of EA using its own system dynamic approach, utilizing research findings from previous studies. For example, Gong and Janssen (2020) determine that the lack of proven EA methodology, lack of EA knowledge, lack of communication, and lack of tools, in this order, are the most influential factors for failure in EA.

Previous chapters show the necessity of awareness, readiness, and knowledge to form skills and understanding to establish EA and suggest how to identify gaps and what could be done in the context of TOGAF. Even if we use TOGAF or any other framework, it cannot compensate for the absence of awareness among senior management. If the awareness cannot be initiated, nothing can be done. Senior management support is a key to proper resources and decision-making. If EA could be illustrated as a strategic initiative, it would force proper attention from senior management. *“Everything that is important is not strategic, but everything that is strategic is important - although maybe not right now!”* (Karlöf, 1996 p. 16¹) EA is strategic. EA can help organizations align their IT infrastructure, applications, data, and processes with their overall business strategy, reduce complexity, improve decision-making, and enhance agility; EA should be seen as a strategic asset.

¹ Karlöf, B. 1996. *Strategia – Suunnitelmasta toteutukseen*, Helsinki: Ekonomiliitto & WSOY

Literature implies that one fundamental reason for poor results is improper preliminary work, which should show gaps in requirements for the EA work. TOGAF ADM has a preliminary phase before EA works within its A to H phases and maps EA readiness.

The objectives of the Preliminary Phase are to:

1. Determine the Architecture Capability desired by the organization:
 - Review the organizational context for conducting Enterprise Architecture
 - Identify and scope the elements of the enterprise organizations affected by the Architecture Capability
 - Identify the established frameworks, methods, and processes that intersect with the Architecture Capability
 - Establish Capability Maturity target
2. Establish the Architecture Capability:
 - Define and establish the Organizational Model for Enterprise Architecture
 - Define and establish the detailed process and resources for Architecture Governance
 - Select and implement tools that support the Architecture Capability
 - Define the Architecture Principles

(TOGAF Chapter 5.1)

TOGAF acknowledged the organization's form and the different roles and skills required. *"For an architecture framework to be used successfully, it must be supported by the correct organization, roles, and responsibilities within the enterprise"* (TOGAF Chapter 32.2.16).

However, the only outputs of the preliminary phase that can be seen as a concern about the ability to do EA work are three points in the Organizational Model for Enterprise Architecture (TOGAF part IV, 32.2.16 *Organizational Model for Enterprise Architecture*) including:

- Scope of organizations impacted
- Maturity assessment, gaps, and resolution approach
- Roles and responsibilities for architecture team(s)

The scope of organizations impacted is an obvious task to do to identify all stakeholders. Impact Assessment assesses the current architecture requirements and specifications to identify changes that should be made and the implications of those changes

Maturity assessment in TOGAF context refers to Capability Maturity Models, which typically identify selected factors that are required to exercise a capability. An organization's ability to execute specific factors provides a measure of maturity and can be used to recommend a series of sequential steps to improve a capability. It is an assessment that gives executives an insight into pragmatically improving a capability. (TOGAF Part II, Chapter 5.5.7) Observations about Maturity and Maturity Models in TOGAF were processed in Chapter 6.4.

TOGAF uses the Skills Framework for roles, responsibilities, and competence levels required for EA work. They are relatively common for defining the skills required for a consultancy and/or project management assignment to deliver a specific project or work package. They are also widely used by recruitment and search agencies to match candidates and roles. Their value derives from their ability to provide a means of rapidly identifying skill matches and gaps. Successfully applied, they can ensure that candidates are fit for the jobs assigned to them. Their value in the context of Enterprise Architecture arises from the immaturity of the Enterprise Architecture discipline and the problems that arise from this. (TOGAF Chapter 46.1).

The tables below describe an Enterprise Architect's role, the required fundamental skills, and some possible disciplines in which an Enterprise Architect might specialize. Below are examples of the tables intended to be used for each EA team role. The TOGAF

standard delivers an enterprise architecture and, therefore, requires both business and it-trained professionals to develop the enterprise architecture. The TOGAF Architecture Skills Framework provides a view of the competency levels for specific roles within the Enterprise Architecture team. The Framework defines:

- The roles within an Enterprise Architecture work area
- The skills required by those roles
- The depth of knowledge required to fulfill each role successfully

The value is in providing a rapid means of identifying skills and gaps. Successfully applied, the Framework can be used as a measure for:

- Staff development
- Ensuring that the right person does the right job

Table 49. TOGAF Enterprise Architecture Role and Skill Categories.

Level	Achievement	Description
1	Background	Not a required skill, though should be able to define and manage skill if required.
2	Awareness	Understands the background, issues, and implications sufficiently to be able to understand how to proceed further and advise client accordingly.
3	Knowledge	Detailed knowledge of subject area and capable of providing professional advice and guidance. Ability to integrate capability into architecture design.
4	Expert	Extensive and substantial practical experience and applied knowledge on the subject.

Roles	Architecture Board Member	Architecture Sponsor	Enterprise Architecture Manager	Enterprise Architecture Technology	Enterprise Architecture Data	Enterprise Architecture Applications	Enterprise Architecture Business	Program/Project Manager	IT Designer
Generic Skills									
Leadership	4	4	4	3	3	3	3	4	1
Teamwork	3	3	4	4	4	4	4	4	2
Inter-personal	4	4	4	4	4	4	4	4	2
Oral Communications	3	3	4	4	4	4	4	4	2
Written Communications	3	3	4	4	4	4	4	3	3
Logical Analysis	2	2	4	4	4	4	4	3	3
Stakeholder Management	4	3	4	3	3	3	3	4	2
Risk Management	3	3	4	3	3	3	3	4	1

Roles	Architecture Board Member	Architecture Sponsor	Enterprise Architecture Manager	Enterprise Architecture Technology	Enterprise Architecture Data	Enterprise Architecture Applications	Enterprise Architecture Business	Program/Project Manager	IT Designer
Enterprise Architecture Skills									

Business Modeling	2	2	4	3	3	4	4	2	2
Business Process Design	1	1	4	3	3	4	4	2	2
Role Design	2	2	4	3	3	4	4	2	2
Organization Design	2	2	4	3	3	4	4	2	2
Data Design	1	1	3	3	4	3	3	2	3
Application Design	1	1	3	3	3	4	3	2	3
Systems Integration	1	1	4	4	3	3	3	2	2
IT Industry Standards	1	1	4	4	4	4	3	2	3
Services Design	2	2	4	4	3	4	3	2	2
Architecture Principles Design	2	2	4	4	4	4	4	2	2
Architecture Views Viewpoints Design	2	2	4	4	4	4	4	2	2
Building Block Design	1	1	4	4	4	4	4	2	3
Solutions Modeling	1	1	4	4	4	4	4	2	3
Benefits Analysis	2	2	4	4	4	4	4	4	2
Business Interworking	3	3	4	3	3	4	4	3	1
Systems Behavior	1	1	4	4	4	4	3	3	2
Project Management	1	1	3	3	3	3	3	4	2

The above TOGAF tables map roles and skills, but how to obtain or develop these is not explicitly defined. Another fundamental aspect is that there is no estimate of how this will affect end users' work and its requirements, nor do end users have the required skills for it. However, TOGAF Stakeholder Management (Part III, chapter 21) lists people and organizations affected by the enterprise architecture project but is not concerned about training needs.

EA maturity models have been proposed to aid organizations in adopting adequate EA practices and processes. The models promote that they offer organizational roadmaps and assessment frameworks for guiding the implementation of effective and mature practices and processes. Maturity models, especially People CMM, operate continuously, improving the development of the workforce's knowledge, skills, and motivation.

However, deeper consideration is needed when approaching maturity increase and how to progress from one maturity level to another.

Vallerand, Lapalme, and Moïse (2017) use an organizational learning perspective and the learning model (single-loop and double-loop) of Argyris and Schön (1974) to study maturity models related to EA practices. Vallerand et al. (ibid) find that EA maturity models have three maturity model design approaches:

1. Improvement approach: Exclusively, an increase in maturity requires an increase in action strategy effectiveness; hence single-loop learning is the means to greater maturity.
2. Transformation approach: Exclusively, an increase in maturity requires a critical review of governing variables and assumptions; hence double-loop learning is the means to greater maturity.
3. Dual approach: Both single-loop and double-loop learning are means to increases in maturity. (p. 874)

Vallerand et al. (2017) conclude that the EA maturity model design approaches are based on Argyris and Schön's (1974) organizational learning framework and Lapalme's (2012) three schools of thought regarding EA. Argyris and Schön (1974) state that three interrelated concepts are at the heart of an organizational learning framework: governing variables, action strategies, and consequences and relationships between these concepts can be expressed in the general form "in situation **S**, if you want to achieve consequence **C**, under assumptions $\mathbf{a}_1 \dots \mathbf{a}_n$, do **A**" (Vallerand et al., 2017, p. 864). This is an essential theory because it has assumption ($\mathbf{a}_1 \dots \mathbf{a}_n$) as a variable and is further referred to as a mental model. Mental mode is a deeply ingrained generalization of how we understand the world and how we take action (Senge 1990, p. 8). Senge (ibid.) argued that managing it is a major breakthrough for building learning organizations (p. 163).

Vallerand et al. (2017) connect the above maturity model approaches to Lapalme's (2012) three schools of thought regarding EA: enterprise IT architecture (EITA), enterprise integration (EI), and enterprise ecological adaptation (EEA). In short, maturity

models are divided regarding how they see performance improvement, relation to the environment, and problem-solving (i.e., reductionist or systemic stance) based on these schools of thought. Whereas the improvement approach is straight linear (single-loop) and keeps its mental model focusing on action strategies through all maturity levels, the transformation approach is more holistic (double-loop). It appraises assumptions, and its mental model and governing variables may shift from one school of thought to another. Dual model, whereas the dual approach may use both.

Vallerand et al. (2017) state that EA maturity models adopt only one of three possible design approaches to operationalize the concept of increasing maturity.

So, the point is to understand these underlying assumptions in maturity models and find out how the selected or built model fits your school of thought EA. The TOGAF Skills Framework approach is based on single-loop learning to fix gaps without challenging underlying performance standards, while two of Vallerand et al.'s (2017) EA maturity model design approaches do so. This inconsistency between the TOGAF Skills Framework and the two of Lapalme's (2012) EA schools of thought implies challenges in achieving desired results when either is chosen. For them, TOGAF is the EA, and little attention is given to understanding the system as a whole.

Thus, e.g., progressing from one maturity level to another involves many variables related to knowledge management, learning organizations, and corporate culture. Because the contemporary business environment is increasingly knowledge-intensive, all these will play a more central role in organizations. How one should manage knowledge in an organization is a constantly increasing concern, as is how an organization will succeed in its environment. These aspects are highlighted in the study by Korhonen et al. (2016), which is based on Emery and Trist's model of causal textures of the environment model.

Concepts of knowledge management, learning organization, and corporate culture have some overlapping and interaction.

Knowledge management concerns turning individual tacit knowledge into explicit knowledge so that it can be shared by a process that organizationally amplifies the knowledge created by individuals. Nonaka and Takeuchi (1995) argue that the ability to create knowledge and solve new problems has become a core competence for most organizations (Buchanan & Huczynski, 2004, p. 128). Nonaka and Takeuchi (1995) define tacit and explicit knowledge, and Nonaka and Konno (1998) formalized a foundation for knowledge creation in organizations. They define SECI (Socialization, Externalization, Combination, Internalization), the spiral evolution of knowledge conversion, and the self-transcending process by which knowledge is formed between individuals, groups, and organizations. In this process, however, knowledge is assumed to be valid without seeking to question it.

“Organizational learning is a process of detecting and correcting error” (Argyris, 1977).

Argyris and Schön (1974) define single-loop and double-loop learning as where single-loop learning does not challenge or rethink its values and assumptions, but double-loop learning does. Whereas knowledge management focuses on converting knowledge and turning individual knowledge into organizational knowledge, organizational learning focuses on double-loop learning and seeking new (“more valuable”) knowledge. The emphasis would be on double-loop learning, which means that underlying assumptions, norms, and objectives would be open to confrontation (Argyris, 1977). One- and double-loop learning is more than just knowledge; it is also how people are willing to share knowledge and participate in change.

Senge (1990) popularized organizational learning with his book *The Fifth Discipline*. Senge’s fifth discipline is system thinking, which is based on double-loop learning.

Table 50. Senge's five learning disciplines (Buchanan & Huczynski, 2004, p. 130).

1. Personal mastery	A discipline of aspiration, concerning what you want to achieve.
2. Mental models	A discipline of reflection and inquiry, concerning the constant refinement of thinking and development of awareness.
3. Shared vision	A collective discipline, concerning commitment to a common sense of purpose and actions to achieve that purpose
4. Team learning	A discipline of group interaction, concerning collective thinking and action to achieve common goals.
5. System thinking	A discipline which concerns understanding interdependency and complexity and the role of feedback in the system development.

Crossan, Lane, and White (1999) note that organizational learning is dynamic and creates a tension between assimilating new learning and exploiting or using what has already been learned. While new ideas and ways to do things flow from individual to group and organizational levels, at the same time, what has already been learned flows back from organization to group and individual levels, affecting how people act and think (Table 51). This is like the model of Nonaka and Takeuchi (1995). Crossan et al. (1999) described the flow from individual to group and organizational levels feed-forward and from organization to group and individual levels feedback.

Table 51. Learning/Renewal in Organizations: Four Processes Through Three Levels (Crossan et al., 1999, p. 525).

Level	Process	Inputs/Outcomes
Individual	Intuiting	Experiences Images Metaphors
	Interpreting	Language Cognitive map Conversation/dialogue
Group	Integrating	Shared understandings Mutual adjustment Interactive systems
Organization	Institutionalizing	Routines Diagnostic systems Rules and procedures

Learning organization enables individual learning to generate valuable outcomes such as efficiency, innovation, and competitive advantage. However, Weick and Westley (1996, p. 190) point out that the concepts of organization and learning are contradictory. This assumption is based on the thought that organization implies order and stability,

whereas learning implies change, variety, and disorganization. They point out that organization and learning pull in opposite directions due to an organization's underlying retention function. Weick and Westley (ibid.) notice that "if organization is conceptualized in terms of culture, it is easier to talk about organizational learning" (p. 2026). By this, organizational culture comes under observation.

Crossan et al. (1999), in a sense, support Weick and Westley's point of view of organizational learning's antibonding influence. Crossan et al. (1999, p. 535) noted that continued investment in individual and even group learning may be counterproductive if the organization does not have the capacity to absorb or utilize it. Crossnan et al. (1999) stress the need for capability for cross-level examination for the tension inherent in the feed-forward and feedback processes. They suggest linking human resource management and strategic management for that. This is important to guide and control what to learn and exploit previous learning.

Organizational learning interacts with organizational culture by creating and exploiting it. Thus, it is important to recognize how it works and how it is a part of an organization's ability to change and agility.

According to Schein (2016, p. 6.), organizational culture:

"The culture of a group can be defined as the accumulated shared learning of that group as it solves its problems of external adaptation and internal integration; which has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, feel, and behave in relation to those problems. This accumulated learning is a pattern or system of beliefs, values, and behavioral norms that come to be taken for granted as basic assumptions and eventually drop out of awareness."

Organizational culture influences organizational learning “disciplines” and especially the formation and retention of mental models, which is one of the essential aspects of EA work. A shared mental model prevents silo thinking when developing EA with different business unit stakeholders. This can be linked to Emery and Trist's argument about core values and their utility in turbulent fields (see Ch. 6.1).

The literature identifies organizational culture, communication, and common language as critical success factors (Ylimäki, 2008). If enterprise architecture stakeholders have common mental models, we can avoid silo thinking and collaborate more easily on EA capabilities for mutual targets. However, as we have seen, there are more underlying interrelated aspects with identified CSFs, which need to be understood holistically.

The above organizational learning, knowledge, and culture models will not be discussed in more depth as they are beyond the research area. The presented mechanisms tell about the scope of their dimensions, how they are part of the problem, and the solution to the problem. In order for EA to function, they need attention in these matters as well as investment, planning, coordination and management.

In the chapter EA System Model (6.2.1), the last system archetype, “Shifting the Burden,” illustrates the problem with the fundamental solution, whereas previous archetypes imply problems meeting requirements and limiting actions with constraints. Senge (2006, pp. 105 – 106) observed that the "Shifting the Burden" structure elucidates a wide array of behaviors where well-intentioned "Solutions" exacerbate matters in the long run. A straightforward solution is enticing, and the underlying problem remains unaddressed, while the side effects of the symptomatic solution make it even harder to apply the fundamental solution. Senge (ibid.) uses an example where line managers tend to bring HR experts to solve problems occurring with personnel. Using it as a symptom solution makes the problem repetitive and increases HR experts' demand for a solution, staff costs increase, and managers' development decreases over time. In connection with this, I like to point out Senge's expression of “the delusion of learning from

experience”:*“ We learn best from experience, but we never directly experience the consequences of many of our most important decisions.” The most critical decisions made in organizations have systemwide consequences that stretch over years and decades (p. 23).* EA is not a one-time project or a short-term task; EA’s evolution needs management, and a change in the organization will take a couple of years and continue with iteration (Jung & Fraunholz, 2021). This underscores the need for strategic HRM to act in the long run with supporting organizational strategy. Unlike plain personnel administration, SHRM emphasizes its continuous development and role in organizational strategic issues. In Figure 34, Truss and Gratton (1994) show a model of the SHRM process. The HR strategy and HR intervention, depending on business strategy outcomes, are adjusted by the feedback loop.

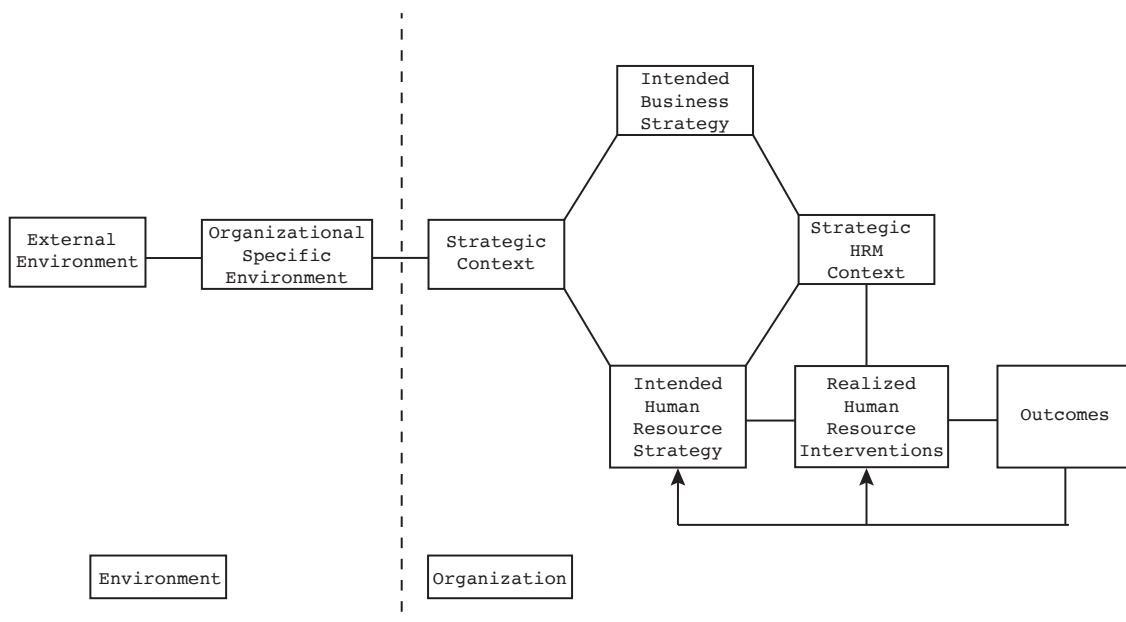


Figure 34. Strategic human resource management (Truss & Gratton 1994, p. 680).

It is good to acknowledge that the prefix strategic is here to highlight the change in personnel administration. The term human resource management (HRM) is also understood as strategic HRM (Buchanan & Huczynski, 2004, p. 679). Therefore, in this study, HRM is now understood in the same way as SHRM and vice versa, and subsequent discussion uses the abbreviation HRM. Watson (2010, p. 919, as cited in Armstrong &

Taylor, 2014, p. 5) definition: HRM is the managerial utilization of the efforts, knowledge, capabilities, and committed behaviors which people contribute to an authoritatively co-ordinated human enterprise as part of an employment exchange (or more temporary contractual arrangement) to carry out work tasks in a way which enables the enterprise to continue into the future. HRM emphasizes that training and development, organizational development, and human resource administration should no longer be separate support functions but rather an integrated part of the organization's performance assessment. HRM is a managerial perspective focused on creating a cohesive set of personnel policies to drive and uphold organizational strategy.

According to Storey (2001, as cited in Buchanan & Huczynski, 2004, p. 685), HRM consists of four elements. The *first* element is "beliefs and assumptions" concerning the significance of the way in which people are managed. The *second* is "strategy," concerning the links between HRM policies and business goals. The *third* element is the "line management role," concerning the involvement of non-specialist managers in the implementation of HRM practices such as team briefings and performance appraisals. The *fourth* element is "key levers" concerning techniques for implementing HRM.

An especially important one is "beliefs and assumptions" regarding EA work. Lapalme (2012) illustrates that there are three different EA belief systems. Vallerand et al. (2017) reveal that there are three different EA maturity model designs, each with its own underlying assumptions. Du Preez et al. (2014) extended Lapalme's taxonomy of the three schools of thought to seven. Moreover, Korhonen et al. (2016) showed how different EA schools of thought, organizations' environments, and different EA architectural levels are connected.

HRM's fundamental principle is that people make a difference in organizational performance. Many HRM models illustrate this, e.g., the Harvard model in Figure 35.

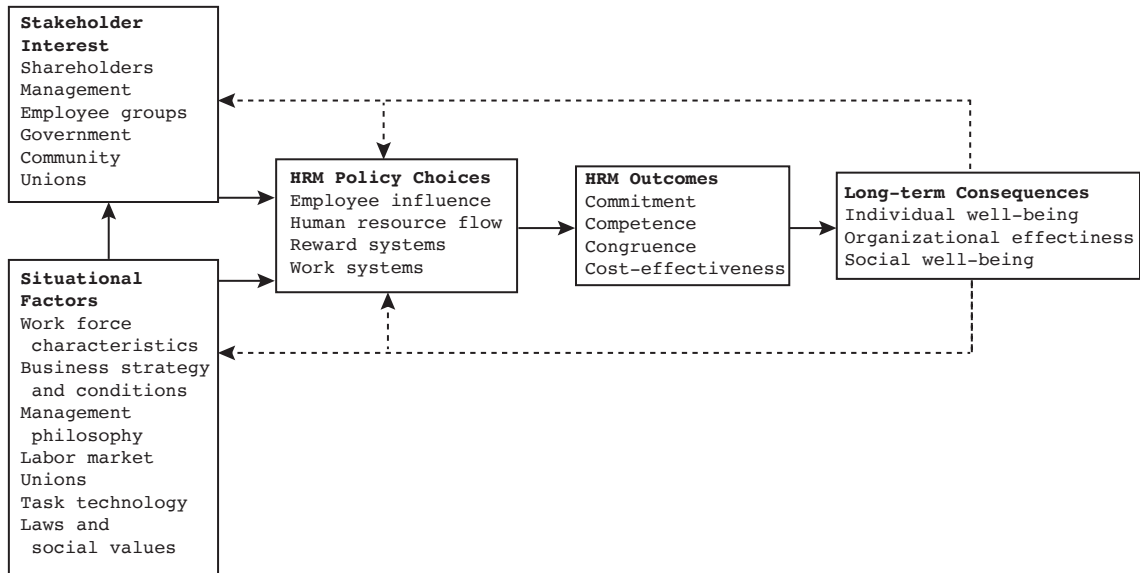


Figure 35. Map of the HRM Territory (Beer et al., 1984, p. 16).

The Harvard model shows HRM outcomes: commitment, competence, congruence, and cost-effectiveness, which are the same factors needed in EA work. According to the literature, EA work has poor commitment, silo thinking, and a lack of skills. Ulrich's (1997) HRM model shows how HRM acts in different dimensions (Figure 36). It stresses HRM's global approach.

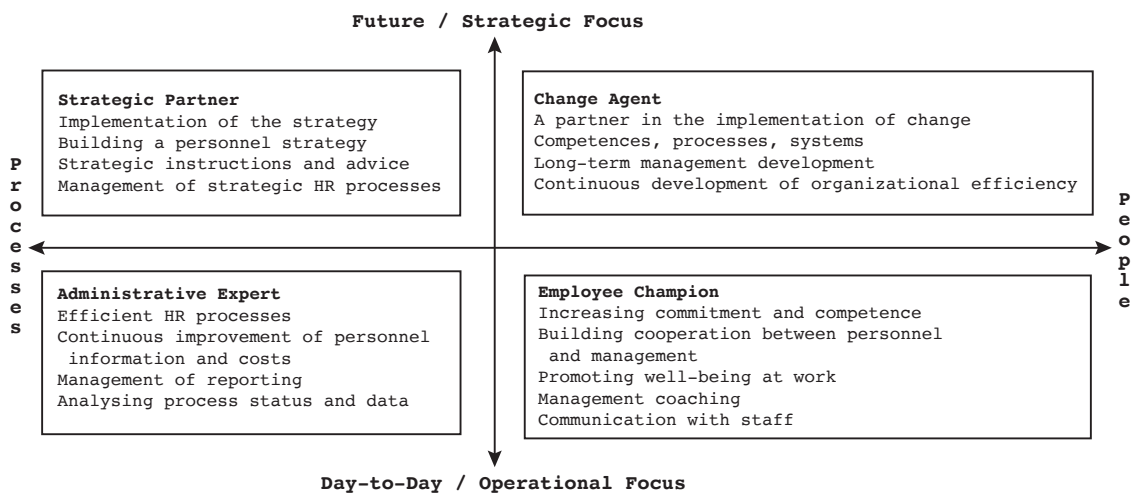


Figure 36. Ulrich HRM model (adapted from Dave Ulrich, 1997).

The point of demonstrating HRM and HRM models is to show how they are relevant to support EA work. From the artifact perspective, it is essential to acknowledge that social resources with presented methods do not behave regularly even though they are assumed to do so. Therefore, there must be an HRM that oversees and adjusts if necessary. HRM involves all variables that balance vicious circles in the EA systems model: knowledge management, organizational learning, organizational culture, maturity management, hiring, and training, as is in Figure 33. EA System with Strategic HRM Model as Extended Dynamic Theory. Even if TOGAF notes in its *Business Transformation Readiness Assessment* chapter that implementation and migration plans are essential to successful architecture transformation, a joint effort between corporate and especially human resources staff, lines of business, and IT planners, there is no more specified that process.

Therefore, developing a model and governance for that process is necessary.

6.6 EA Preflight and HR Architecture

The following tables (Tables 52, 53, and 54) show all issues examined using the system thinking approach. I identified causalities and vicious loops (reinforcing loops) and hypothesized the leverage points for balancing actions and desired methods, as shown in Figure 33.

Actions or methods are presented for all issues to mitigate the issue or its underlying factor.

Table 52. The issues with EA itself.

Manifestation Code	Manifestation	Causes and Countermeasures	Issue#
EA1	Lack of Flexibility and Adaptability	The underlying reasons are poor design and delays in the process. The poor design needs skills and understanding. Proper usage of common standards, which helps flexibility and adaptability, needs knowledge and understanding. For these underlying reasons, knowledge management, SHRM training/hiring, and other revealed methods to develop required capabilities. Eventually, proper EA school of thought with maturity model where delay from EA initiative to target EA capability is short.	F9, F16
EA2	Inconsistent Standards and Frameworks	A proper knowledge level needs awareness of EA requirements. Frameworks need understanding and skills to use and adjust. Understanding of frameworks underlying assumptions (e.g., EA school of thoughts and EA maturity model design approach) EA framework may be targeted for specified EA schools of thought perspective.	F37, F41
EA3	Lack of Collaboration and Communication	The very base of EA is communication between different participant units and stakeholders. Common language is needed, as is awareness of the EA's purpose. The use of EA frameworks and methods requires understanding and skills. SHRM maintains the opportunity to gain these skills and capabilities. Understanding the relevance of a common mental model with a proper EA school of thought is crucial.	F3, F40, F41
EA4	Inadequate Performance and Scalability	The same countermeasures are mentioned above to avoid poor design and lack of compatible standards, which cause poor performance and scalability. Poor EA outcomes may be adjusted to fit organizational readiness. Too narrow the EA school of thought prevents a proper approach to future requirements.	F4, F35, F36, F37, F40, F41
EA5	Inefficient Use of Technology	One reason is a poor design with the same countermeasures mentioned above and wrong strategy alignment due to previous reasons. The EA process time frame may cause the use of obsolete technology. Delay in awareness for EA initiative to target EA capability is long. Options are better readiness for shorter delivery or developing a proactive EA method.	F30, F40, F41

Table 53. The issues with EA and the organization.

Manifestation Code	Manifestation	Causes and Countermeasures	Issue#
O1	Misalignment with Business Strategy	Silo thinking and different EA schools of thought interpretation cause altered EA vision and expectations that need a common mental mind. Supporting functions are organizational culture, overall understanding by knowledge management, and organizational learning. A lack of strategy needs to be avoided.	F1, F2, F8, F11, F35
O2	Lack of Business – IT Alignment	Silo thinking and different EA schools of thought interpretation cause altered EA vision and goals that need the common mental mind to align. Supporting functions are organizational culture, overall understanding by knowledge management, and organizational learning.	F1, F2, F8, F11, F13, F35
O3	Insufficient Communication and Awareness	Organizational culture and a common mental mind create a common language and knowledge management through organizational learning with an overall understanding to eliminate barriers to communication and awareness.	F3, F14, F27, F32
O4	Inadequate Change Management	Proper SHRM can mitigate change resistance in many ways, and other presented functions support it and reduce the reasons for change resistance in the first place, e.g., core values formed by organizational culture and organizational learning—aligned worldview by aligned EA school of thought.	F7, F8, F26, F39
O5	Insufficient Flexibility	Improved readiness gives flexibility on the right attitude, skill, and knowledge base gained in training, organizational learning, and support by organizational culture. A proper EA school of thought gives the right approach to environmental requirements. E.g., EEA EA school of thought gives better adaptability and flexibility than EITA can.	F9, F16
O6	Ineffective Governance and Management	Common EA school of thought interpretation and other underlying contradictions are fundamental causes that can be avoided by awareness and understanding. Also, proper maturity models and management improve governance, while organizational culture and learning increase self-regulation.	F5, F10, F14, F15, F28, F30, F31
O7	Lack of Integration	Better understanding and awareness increase the overall quality of design. Silo thinking prevents a broader perspective and better integration. Different worldviews exist without organizational culture and a common mental model.	F4, F13, F22, 27
O8	Lack of management support	Awareness and understanding of top management are the foundations. The interpretation of the EA school of thought affects how the EA process is treated and how EA is seen from a strategic perspective. The inability to understand the value of EA can be mitigated by producing a functional EA and an understandable EA with scope, strategy connection, and specification, which include all architectures formed (Business, HR, Data, Technology, etc.).	F8, F12, F19, F23, F31, F33, F35

Manifestation Code	Manifestation	Causes and Countermeasures	Issue#
O9	Lack of EA Work Resources	Awareness and understanding of top management are the foundations. The interpretation of the EA school of thought affects how the EA process is treated and how EA is seen from a strategic point of view. (see previous point.)	F8, F15, F20, F33, F35

Table 54. The problems EA encountered with people.

Manifestation Code	Manifestation	Causes and Countermeasures	Issue#
P1	Lack of Awareness and Understanding	SHRM offers training possibilities, and hires required competencies. Maturity models and organizational learning support awareness and understanding.	F10, F18, F35
P2	Resistance to Change	Proper SHRM can mitigate change resistance in many ways, and other presented functions support it and reduce the reasons for change resistance in the first place, e.g., core values formed by organizational culture and organizational learning—aligned worldview by aligned EA school of thought. Better awareness and understanding decrease resistance to change.	F18, F26, F28, F29, F38, F39
P3	Limited Involvement and Engagement	SHRM creates Ability, Motivation, and Opportunity (AMO) through its practice and increases engagement. Overall awareness and understanding improve engagement. Awareness and understanding of management increase resources and give better possibilities to participate in EA work. Controlled change management increases the willingness to participate. A better understanding of EA's purpose increase involvement and engagement	F6, F8, F14, F15, F25, F34, F35
P4	Skill and Knowledge Gaps	SHRM executes hiring, training & AMO. SHRM oversees knowledge management, maturation management, and organizational learning.	F15, F16, F17, F18
P5	Silo Thinking and Lack of Collaboration	Supporting functions are organizational culture, overall understanding through knowledge management, and organizational learning. Underlying different EA schools of thought interpretation causes divergent mental models. SHRM fosters factors that form a mental model.	F22, F32
P6	Lack of Continuous Improvement Mindset	Supporting functions are organizational culture, learning organization, and maturity management. Supporting EA school of thought. A suitable maturity model depends on the EA school of thought and its view of EA's purpose.	F5, F6, F9, F14
P7	Inadequate Training and Education	SHRM manages the AMO model, supporting functions, knowledge management, and organizational learning.	F18, F37

An iterated literature review implies issues and open questions in theories suggesting behavioral and cognitive reasons for poor EA value interpretations. Poor EA success can be explained by inadequate skills, knowledge, and understanding of EA and a lack of senior management support due to a lack of awareness, strategic perspective, and different worldviews or belief systems with key EA stakeholders. EA work needs a shared

mental model concerning EA goals and processes. Different EA schools of thought with key EA participants prevent the shared mental model formation, resulting in poor EA success or total failure. Moreover, Krantz (2006, p. 134) hypothesizes that significant organizational change efforts pose great psychic challenges to their members and require distinctive conditions to adequately contain the profound anxieties evoked by such upheaval.

Achieving successful change in the organization requires skill and subtlety on a number of dimensions simultaneously. Krantz (2006, pp. 150 – 151) reminds us that good is characterized by features that are consistent with realistic, grounded, thoughtful functioning and include, e.g., a) Articulation of a plausible and compelling picture of the future that is commonly shared and understood. b) Clarity about how the change effort represents continuity as well as discontinuity – how it is linked to the past. c) Carefully planned and thoughtfully executed, with an appreciation of the human, economic, and technical factors that intermingle to produce successful outcomes.

As Krantz (2006) is more focused on the change of people and psychodynamic change efforts in an organization, his instructions are valid with all major changes in any organization. It is necessary to note that a more workable readiness function model may also be a change that needs to be evaluated on how much it is a part of the anxiety problem and resistance. Therefore, only a practical and realistic part of the readiness function model needs to be achieved.

HRM is needed to coordinate and execute the means required to operate with the selected EA strategy. It is based on a selected EA school of thought, and HRM fosters a mental model that follows the beliefs, principles, and assumptions of that EA school of thought. HRM also fosters methods to develop the skills, understanding, and knowledge required to do EA work with selected EA Frameworks and maturity models.

As an outcome of this research, I develop and suggest a preflight check for the EA endeavor and HRM Architecture to add the EA Framework.

The preflight process to verify underlying assumptions, i.e., the EA school of thought, and how they relate to the EA vision. It checks whether the EA vision is realistic and aligned with the objective and whether it is shared with crucial EA stakeholders (e.g., the EA architect and EA architect team, the sponsor, and the CEO/CTO/CIO). It also limits the selection of possible EA Frameworks, which must be aligned with the EA target and EA school of thought, and the EA maturity model, which is aligned with the previous. These must be aligned because if there is an inconsistency between one of the mentioned, the EA project will fail. If and only if those are aligned, it is possible to continue. The next stage is to check the readiness for the EA project. If readiness meets the EA's previous selections, the EA project is ready to start. If the case is immature readiness and it is otherwise ready to go, it is possible to make HRM architecture, which is a complete plan to meet the requirements at the required level for a start and required time and is the base for EA capability formation regarding people in EA work future phases.

Figure 37 shows that the preflight EA process forms the base for the HRM architecture and will be completed within the EA process.

The HRM architecture includes methods from the EA System Model, with the HRM model as the dynamic theory presented in Figure 33. EA readiness is connected to Training/Hiring, a basic HR duty, knowledge management (one- and double-loop), maturity management (people capability), corporate culture, and organizational learning. AMO model (Ability, Motivation, Opportunity) is a driver for composing HRM architecture, while other methods foster a shared mental model.

Knowledge management as a one-loop method eventually converts tacit personal knowledge into explicit knowledge and organizational knowledge. Knowledge

management as a double-loop method also concerns knowledge generation and validation. Corporate culture assists with shared mental model formation and guides the implementation of a working method. Organizational learning involves activities to develop enduring capability to change, which eventually benefits the organization not only in knowledge and agility but also; *“The process will pay back the organization with far greater levels of diversity, commitment, innovation and talent”* (Senge et al. 1999, p. 33).

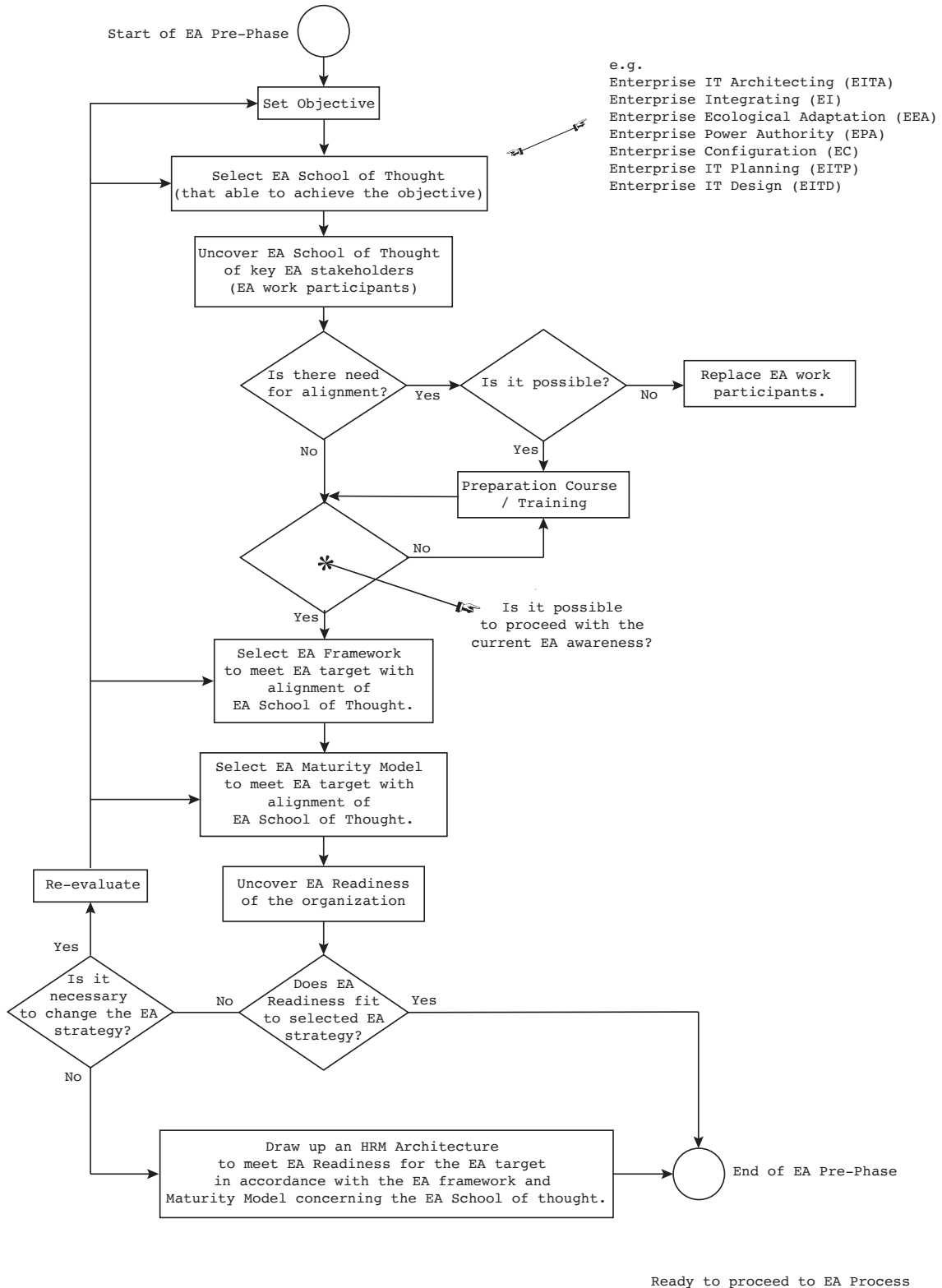


Figure 37. EA preflight model.

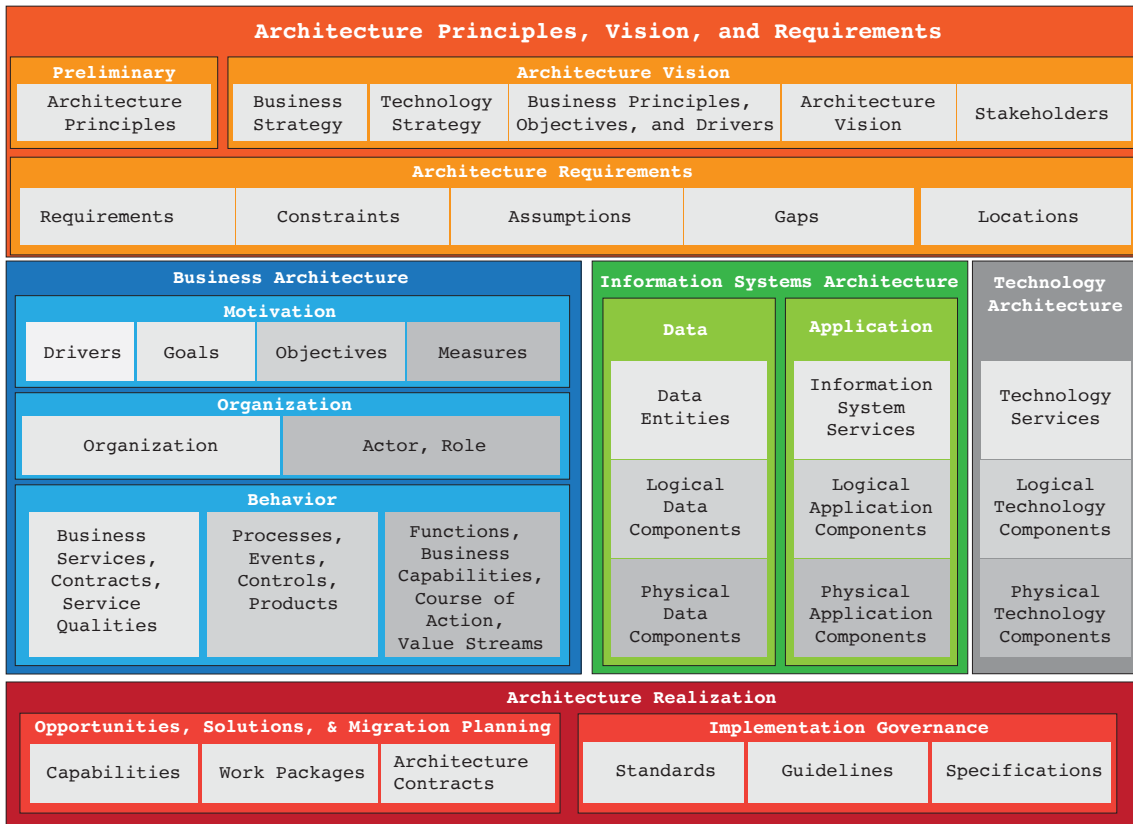


Figure 38. TOGAF Content Metamodel (TOGAF Part IV, Chapter 29.2).

TOGAF includes *business architecture, information architecture, and technology architecture*. However, it does not include *HRM architecture*, even though it mentions that the human element is the most important element in EA work (TOGAF Part III, Chapter 26). Therefore, I suggest creating an HRM architecture (Figure 39) that supports the EA process and includes all HRM strategies, required tasks, methods, and schedules. This is an essential part of EA capability because EA is a long-term investment that needs lasting and controlled constant ability development. Moreover, organizational culture, mental model, and maturity growth are slowly developing and need long-term and planned influence. As Senge expressed, “*We learn best from experience, but we never directly experience the consequences of many of our most important decisions. The most critical decisions made in organizations have systemwide consequences that stretch over years and decades (1990, p. 23).*”

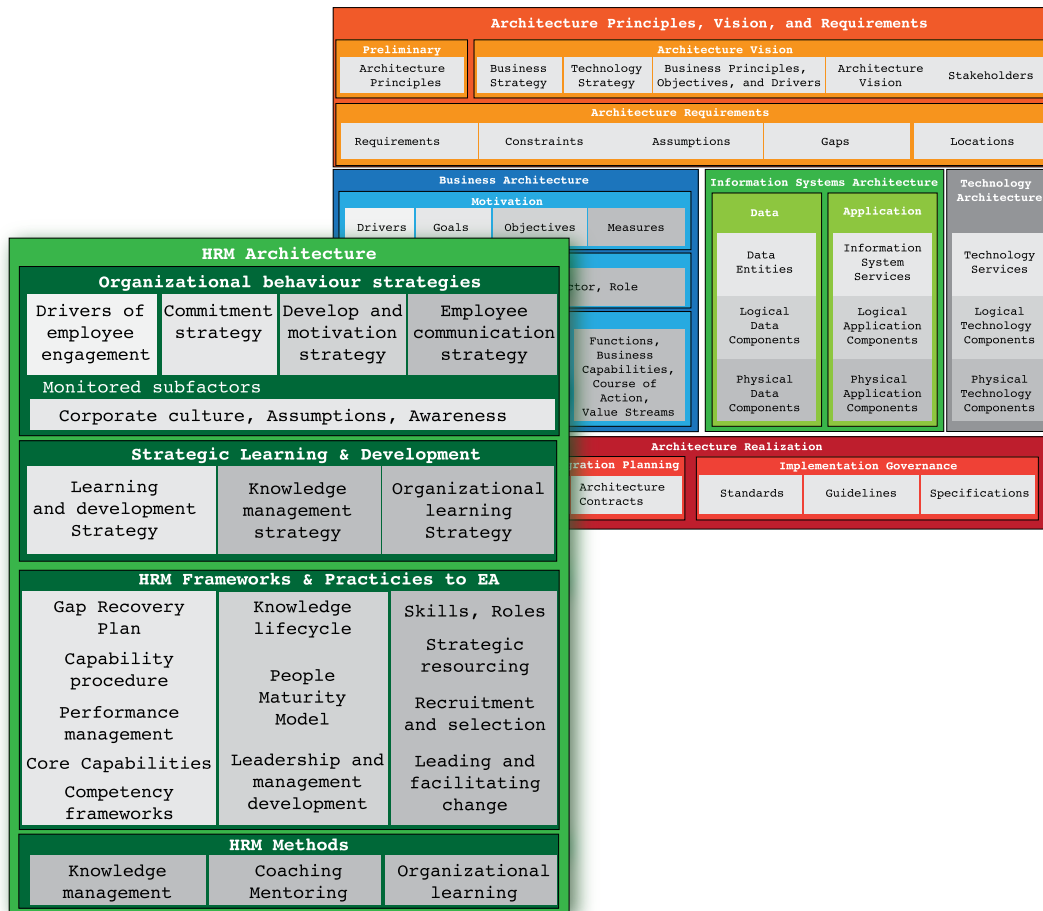


Figure 39. HR Architecture (in addition to TOGAF).

HR architecture includes as-is readiness status and to-be readiness requirements for first-loop capability building as well as future maturity level targets. HR architecture includes steps from as-is readiness to forthcoming EA evolution and organizational readiness maturity levels. HR architecture follows the chosen EA scope and the approach according to the appropriate EA school of thought and the suitable selection of means. It considers the strategy and its changes, which requires selecting means for the entire life cycle. Therefore, it can support the narrow EA view and its technical approach but includes a transformation map for the future. HR architecture utilizes the maturity model design approach that Vallerand, Lapalme, and Moïse (2017) revealed. They presented a dual approach when EA maturity models could be constructed based on their relative importance to various action strategies and governing variables.

Evolving across the maturity model would mean shifting the assumptions within the organization from one school of thought to another.

" It takes time to develop the knowledge of working as a whole. In other words, great teams are learning organizations – groups of people who, over time, enhance their capacity to create what they truly desire to create." (Senge, Kleiner, Roberts, Ross and Smith (1994, p. 18).

6.7 Summary of answers to the research questions

Research questions:

1. Why is the EA value not given, even if it uses the most popular and highest-rated EA framework – TOGAF?
2. How to improve EA value formation?

Answer to question 1:

First, working with TOGAF limits the scope of EA and may not be what EA stakeholders seek. Value is a complex concept that can be understood differently. EA has no common description. There are different expectations about the EA, its result, and the time frame when the value is obtainable. The EA outcome and its value are evaluated from a financial or strategic perspective. Therefore, contradictory perceptions emerge. There must be a shared understanding of the purpose of EA before the value can be evaluated. Second, EA execution may fail. For that are many reasons the above has expressed. As a rule, the reasons are the lack of involvement of stakeholders, the lack of involvement of managers, and the organization's lack of readiness, which consists of many causally interactive variables that imply poor skills and understanding of EA.

The word "value" originates from the Old French *valoir*: 'be worth'. It is the regard that something is held to deserve; the importance, worth, or usefulness of something. Within

the context of Business Architecture, it is important to think of value in the most general sense of usefulness, advantage, benefit, or desirability rather than the relatively narrow accounting or financial perspective that defines value as being the material or *monetary* worth of something. Value is fundamental to everything that an organization does. The primary reason that an organization exists is to provide value to one or more stakeholders. It is the foundation of a firm's business model, which describes the rationale for how a business creates, delivers, and captures value. (TOGAF G178, 2022, p. 1.)

Value streams and value stream maps are, in effect, the counterpoint to business capabilities and capability maps. Whereas business capabilities deal with what a business does, value streams focus on the actions describing (at a high level) how a business delivers value to its stakeholders – through the effective combination of those capabilities. Value streams thus have an intrinsic relationship with business capabilities. (TOGAF G178, 2022, p. 1.)

“EA provides value in planning, change governance, and purposeful benefits realization”
(Open Group Guide 2016, p. 49).

Research demarcated to develop a model for EA work that secures value formation for its stakeholders with the TOGAF framework. Thus, there is no more value interpretation and research value formation based on TOGAF description and Hope et al. (2017) notation of the generally accepted benefit of EA: *“There is reasonable consensus that doing EA well contributes to improved organizational performance through aligning business objectives with information technology infrastructure in an organization.”*

Answer to the sub-question of why TOGAF is not enough:

TOGAF is a working framework with linear and reductionist approaches when there is no need to open EA potential for wider organization development. It works when its

technical architecture, “*EA is the glue between business and IT,*” meaning it is subordinate to business and its strategy as it is, e.g., in Lapalme’s (2012) *Enterprise IT Architecting (EITA)* EA school of thought.

When an organization seeks wider organizational development with other EA schools of thought and mental models, it must adjust to meet emergent requirements, especially regarding HR and readiness.

Answer to question 2:

The whole chapter presents the answer, but the missing parts of TOGAF are summed up in the HR architecture and EA preflight.

No matter the underlying assumptions with EA, it is necessary to do “preflight” as the preflight artifact guide. If the foundation is already conflicting, it will be difficult to realize EA or benefit from it as planned.

The proposed HRM architecture is a required addition to the EA process to verify EA’s planning, implementation, and maintenance as a maturity development.

Even if TOGAF notes in its *Business Transformation Readiness Assessment* chapter that implementation and migration plans are key to successful architecture transformation, which will be a joint effort between corporate and especially human resources staff, lines of business, and IT planners, there is no more specified process.

Understanding the readiness of the organization to accept change, identifying the issues, and then dealing with them in the Implementation and Migration Plans is key to successful architecture transformation in TOGAF ADM Phases E and F. This will be a joint effort between corporate (especially human resources) staff, lines of business, and IT planners.

This study uses a system dynamics method to open the nonlinear behavior of complex systems, i.e., EA, over time and derives value formation subparts. There are obvious reasons to focus on value and the problem behind it, e.g., Rodrigues and Amaral (2010, p. 27), *“The lack of a clear understanding of the concept of value, the need to consider different views (of stakeholders) in assessing the value, the difficulty in identifying the key variables that contribute to the value and how and on what terms they should be measured and, finally, the organization’s need to quickly prove the architecture’s value are, in our opinion, the main issues contributing to the complexity and difficulty in assessing the Enterprise Architecture’s value.”* (p. 31). Gong and Janssen (2018, p. 2) emphasize that a positive perception of EA value is very important to ensure the continuous commitment of stakeholders to EA efforts.

Davis (1989) *“Perceived usefulness is a strong correlate of user acceptance and should not be ignored by those attempting to design or implement successful systems”* (p. 334).

However, from a causal perspective, Davis emphasizes that results suggest that ease of use may be an antecedent to usefulness. A significant pairwise correlation exists between ease of use and usage, which all but vanishes when usefulness is controlled for. Thus, the results are consistent with an ease of use --> usefulness --> usage chain of causality. Following the above, TOGAF and its presumption that the purpose of EA is to create or enhance capability, i.e., results in some specific utility for the organization’s competence. The perceived usefulness for stakeholders can explain the base of EA value.

This study suggests an approach in which situational and environmental information about people, places, and things is used to anticipate needs for successful EA planning, implementation, and maintenance. This context-aware EA deployment highlights the role of people in EA work. Basically, context-aware EA seeks to evaluate the readiness of the enterprise for EA work. From a strategic point of view, there are two possible dimensions: 1) proactive, where to-be EA will adjust to meet current resources, or 2)

reactive, where EA determines the resources. After analyzing the problem space and solution base, causalities were seen between the problems based on people and their skills, knowledge, and mental model of EA. Moreover, within the scope of TOGAF framework, there is no specific architectural approach for the people and maturity model.

Table 55 follows Gregory and Jones's (2007) suggestions for eight ISDT components. This research aims to meet the requirements of the ISDT components.

Table 55. Eight Components of an Information Systems Design Theory (Gregory & Jones 2007, p. 322).

<i>Component</i>	<i>Description</i>
<i>Core components</i>	
<i>1) Purpose and scope (the causa finalis)</i>	<i>The aim is to develop an approach for EA work that detects underlying non-functional aspects of EA planning, implementation, and maintenance.</i>
<i>2) Constructs (the causa materialis)</i>	<i>EA Preflight, HR architecture</i>
<i>3) Principle of form and Function (the causa formalis)</i>	<i>EA Preflight aligns intent and ability. It checks whether EA's vision is realistic based on the current stance. An addition (HR architecture) to the TOGAF framework is given to aid in identifying non-functional people-related subjects and processes to contextual issues and categorizing readiness.</i>
<i>4) Artifact mutability</i>	<i>EA preflight work in all environments. HR architecture is built to anticipate necessary changes and include e.g. maturity design approach that allow fundamental changes.</i>
<i>5) Testable propositions</i>	<i>Hypothesis is a proof of concept.</i>
<i>6) Justificatory knowledge</i>	<i>The underlying knowledge and theory are from DK and OD theories that gives a basis and explanation for the design. These are knowledge management, organizational learning, organizational culture, strategic HRM models, dual design approach of maturity models, EA school of thoughts, double-loop learning and system thinking.</i>
<i>Additional components</i>	
<i>7) Principles of implementation (the causa efficiens)</i>	<i>A description of processes for implementing the theory (either product or method) in specific contexts.</i>
<i>8) Expository instantiation</i>	<i>A physical implementation of the artifact that can assist in representing the theory both as an expository device and for purposes of testing.</i>

7 Evaluation

Gregor and Hevner (2013, p. 351) remind us that artifacts should be evaluated, and criteria can include validity, utility, quality, and efficacy. However, they also noted that: “...some degree of flexibility may be allowed in judging the degree of evaluation that is needed when new DSR contributions are made – particularly with very novel artifacts, a proof-of-concept may be sufficient” (p. 351). This may be the case with levels 2 and 3 Design Science Research Contribution Types (see Table 7).

March and Smith (1995) remind Popper’s falsificationism, where “Popper (1963) argued that scientists should try to disprove claims since a single negative instance could do so, while innumerable confirming instances could not prove a theory true.” (p. 253) Popper supports the hypothetico-deductive method, whereas created hypotheses are falsifiable but true until they are tested to be untrue.

One example of an algorithmic statement of the hypothetico-deductive method is as follows:

1. Use your experience: Consider the problem and try to make sense of it. Gather data and look for previous explanations. If this is a new problem to you, then move to step 2.
2. Form a conjecture (hypothesis): When nothing else is yet known, try to state an explanation, to someone else, or to your notebook.
3. Deduce predictions from the hypothesis: if you assume 2 is true, what consequences follow?
4. Test (or experiment): Look for evidence (observations) that conflict with these predictions in order to disprove 2. It is a logical error to seek 3 directly as proof of 2. This formal fallacy is called *affirming the consequent*.

One possible sequence in this model would be **1, 2, 3, 4**. If the outcome of **4** holds, and **3** is not yet disproven, you may continue with **3, 4, 1**, and so forth; but if the

outcome of **4** shows **3** to be false, you will have to go back to **2** and try to invent a *new* **2**, deduce a *new* **3**, look for **4**, and so forth.

Note that this method can never absolutely **verify** (prove the truth of) **2**. It can only **falsify** **2**. (https://en.wikipedia.org/wiki/Hypothetico-deductive_model)

Gregor and Hevner (2013, p. 351) imply that *“when a researcher has expended significant effort in developing an artifact in a project, often with much formative testing, the summative (final) testing should not necessarily be expected to be as full or as in-depth as evaluation in a behavioral research project where the artifact was developed by someone else.”* In that regard, the lack of an in-depth evaluation could be justified for the suggested EA theory.

I want to relate to the above reference from Gregor and Hevner (2013). This research used the framework of Kuecher and Vaishnavi (2012), and through the artifact design (research), it used design relevant explanatory/predictive theories (DREPT) to explain why the artifact has the effects it does and is expected to be the solution to the fundamental research questions, i.e., wicked problem in the EA field. In this research, DREPTs' purposes for artifacts are explained within their theory introductions to justify it and open its usage to evaluation. Also, Gregor and Jones (2007, p. 323) argue that *“specifying the six components is sufficient to give the idea of an artifact that could be constructed.”* The mentioned *“six components”* refer to system theory components that Gregor and Jones suggested [see Table 6. Eight components of an ISDT (Gregor & Jones, 2007, p. 322)]. Therefore, here presented instantiation ex post evaluation leaves for future further build instantiation.

In this work, here created hypotheses are based on other disciplines' researchers' work (*artifacts*) and have undergone their own evaluation. This is one DSR priority, and therefore DSR project consumes and contributes to the cumulative design knowledge bases of descriptive (Ω) and prescriptive (λ) knowledge. Based on these early contributions, DK may eventually become more fit e.g., by grounding solution

components in kernel theories. This work uses kernel theory and mid-theories or DREPT, as Kuechler and Vaishnavi (2012) assign them. Systems Theory (transdisciplinary systems science) as a kernel theory and organizational learning theory, SECI theory, AMO theory of OD discipline, CMM of IS discipline, and system thinking (transdisciplinary systems science) as a DREPT. Therefore, we can presume that kernel and mid-theories have already been tested and are true here. So, paragraph 2 of the hypothetico-deductive method is already verified, and the outcome of it, i.e., paragraph 3, as this work suggested, is also true. Basically, this proves the reductionist research approach to be wrong for complex systems, and thus, the systems approach fits better.

In any case, the suggested artifacts – method and theory – will be left for future evaluation.

8 Discussion & Conclusions

The primary objective was to determine why EA is not seen as bringing value, the underlying reasons, and whether it is possible to fix it. This study's demarcation leaves out EA's technical aspects and focuses on an EA framework and method with human-related aspects of EA capability, EA process, and EA work. The research assesses the feasibility of TOGAF in the context of the indicated problem area.

The research scans the literature for EA-related studies of problems and critical success factors. The findings of these studies are triangulated with each other. The findings are listed, coded, and grouped according to the systems and subsystems of the organization, people, and enterprise architecture.

The EA system's problem field was modeled using the system dynamics (Forrester, 1961, 1969, Sterman, 2000) tool CLD to expose the underlying problems and high-leverage intervention points for hypothesized fundamental solutions. CLD analysis reveals many missing variables that together emerge as improper EA readiness. For improper EA readiness, an extended dynamic theory was developed and modeled with CLD. Vicious loops that undermine EA's resources and senior management's support and, thus, EA's possibilities to succeed are connectable to perceived value. The interactions and feedback loops highlighted underlying reinforcing loops (vicious loops) that debilitate the EA process.

The suggested theory consists of Organizational Development (OD) concepts: knowledge management, organizational learning, corporate culture, maturity management, and proper training/hiring politics regarding EA knowledge requirements. Strategic HRM administers these. HRM is initially connected to the EA project, and its role is central throughout the EA life cycle.

TOGAF ADM is very comprehensive, but it is implicit regarding HR aspects. It includes various HR-related recommendations, e.g., readiness and skill requirements, but explicit methods are missing. Kotusev (2018, p. 343) criticizes, "Organizations have found only several scattered ideas from its approximately 700-page manual to be useful in practice, and even these ideas are not TOGAF specific." I recognized the same problem. TOGAF suggests, e.g., maturity models and introduces P-CMM but does not include them. Using TOGAF requires knowledge, and practitioners have to be bothered to do this work. Thus, using TOGAF includes the readiness that is needed with every EA.

Also, TOGAF is technically oriented (Korhonen et al., 2016; Korhonen & Molnar, 2014; Lapalme, 2012) and falls under the EA school of thought, which thinks EA is the glue between business and IT and classifies it as Technical Architecture in the categories of Ecosystemic Architecture, Socio-Technical Architecture, and Technical Architecture.

TOGAF is a working when EA is seen in a narrow perspective business-IT (BITA) alignment (e.g., Korhonen & Kaidalova, 2015; Korhonen et al., 2016), and EA vision is as in Enterprise IT Architecting (EITA) EA school of thought (Lapalme, 2012; du Preez et al., 2014).

This research theory hypothesizes that EA preflight and HR architecture are suitable contributions to EA TOGAF modeling. EA preflight ensures that the EA vision aligns with the EA school of thought and is shared with key stakeholders. It also verifies that the EA framework and maturity models are aligned in terms of how they can execute the vision. EA Preflight initiates HR Architecture formation if the EA vision, EA framework, and maturity models are aligned, but their knowledge and skill requirements are not met with readiness and are remediable.

Preflight can be considered a fundamental solution regarding EA's possibilities of establishing value. If EA begins on the wrong track, it is unlikely to form any value.

Of course, HR Architecture is an essential part of the fundamental solution. But it depends on EA readiness. This research points out that EA readiness is a pivotal concept that forms from corporate culture, motivation, skills, knowledge, and HRM methods to foster and build these.

HR Architecture is basically the same as other EA architectures, such as Business Architecture, Data Architecture, Application Architecture, and Technology Architecture. The remarkable change with EA formation is that HRM is strategically involved in planning and execution. How broad and deep HR Architecture will depend on 1) the chosen EA approach, i.e., is EA technical, socio-technical, or Ecosystemic (Korhonen et al., 2016; Korhonen & Molnar, 2014), 2) what is the underlying EA school of thought (Lapalme, 2012; du Preez, 2014), 3) EA readiness (Hussein et al., 2020; Hussein et al., 2016), and 4) the HRM strategy approach for HRM (e.g., Resource-Based View (RBV), core competence, hiring policy).

This research states that the perceived value of EA interacts with how EA can be established and succeed. Rodrigues and Armal (2010) notice that the main issue for value assessment was a lack of a clear definition of what is meant by value. The shared mind model addresses this, i.e., the EA school of thought (Lapalme, 2012; du Preez et al., 2014). Divergent assumptions of EA create various value expectations, which need to be acknowledged and unified. EA preflight is meant to prevent proceeding if key stakeholders have divergent EA schools of thought view. Stakeholders with the same assumptions parallelly understand what is important and valuable.

Despite the multiple perspectives on EA, Hope et al. (2017) noted that *“there is reasonable consensus that doing EA well contributes to improved organizational performance through aligning business objectives with information technology infrastructure in an organization.”* This implies that EA itself is not valueless; it just needs to be appropriately established. These puts seek reasons for EA failures in EA work and its environment. Of course, EA endeavor may be broader than just Business-IT (BITA)

alignment (e.g., Korhonen & Kaidalova, 2015; Korhonen et al., 2016), but the concept of EA is sound, and the reason for dimming value needs to be found elsewhere. To observe this area, it is possible to recognize systems such as organizations, people, and EA itself.

The research contribution and recommendation for EA practitioners is the preflight model of verifying EA's start for the visioned goal and improving EA development through HR architecture. HR architecture clarifies responsibilities and presents a roadmap on how to secure forthcoming skills and knowledge requirements fulfillment in EA's life cycle.

The research contribution to the EA research field is the demonstration of the dynamic systems approach for complex problems and the composition of the EA school of thought's interconnection to the EA process via HRM.

Further work is required to develop EA definitions. The lack of a common definition has a surprisingly wide impact on EA. If more classifications are needed depending on the purpose, they should be generally accepted. Although this field has developed extensively (Korhonen et al., 2016; Lapalme, 2012), it has not yet reached the TOGF framework practically. It is inevitable that various assumptions of EA cause divergent expectations and, therefore, conflicts and poor results for EA practitioners.

The secondary objective of the research was to demonstrate the DSR method. DSR is a still-developing methodology (e.g., vom Brocke et al., 2020; Gregor & Hevner, 2013; Peffers et al., 2007; Gregor & Jones, 2007; Gregor, 2006), and this study combined some selected theories in practice. This research uses the DREPT framework (Kuechler & Vaishnavi, 2012), which is like justificatory knowledge in ISDT (Gregor & Jones, 2007) but more formally stated and used in addition to ISDT. I have also tried to respond to the criticism of vom Brocke et al. (2020) about the scarce utilization of the DK database. Therefore, e.g., the problem and solution bases have been compiled directly from the DK database, as is the case with many artifact-building phase ideas. Moreover, the

research process and artifact building are explained as well as possible, as vom Brocke et al. (2020) have recommended.

Recommendations to researchers can suggest a systems approach that is suitable for complex problems and systems dynamics methods to study the problem field and create solutions for the right problem. With the reductionist approach, I do not recommend processing complex problems.

The research's most significant limitations were post-ex evaluation and the lack of a hypothesis test environment. The substantial limitation is the limited opportunity for the final thesis scope to review the large amount of research caused by EA's numerous trends and great interest.

Regarding validity, the DSRIS and DREPT framework reasoning cycle includes abduction as a logical formalism (see Figure 8, Kuechler & Vaishnavi, 2012). Abduction allows biases and may, therefore, decrease validity. This was primarily a problem when developing the EA problem model. *"All models are wrong, but some are useful."* Professor George E.P. Box (1979), and this is what must be remembered when developing a model. However, the CLD outcome results are reliable.

Cross-checking triangulates the trustworthiness and credibility of the data used, which is verified by the literature research criteria. Consistent methods and research philosophy verify the result's trustworthiness. The systems approach (Bean, 2010; Stearman, 2000), DSRIS (Gregor & Hevner, 2013), ISDT (Gregor & Jones, 2007), and critical realism (Mingers et al., 2013) are aligned and consistent. The result's transferability is broad and is not tied to one organization or case. This study supports previous research results, e.g., *"The EA function will only achieve maximum effectiveness when all stakeholders involved collaborate efficiently towards a shared goal"* (van Der Raadt, Schouten & van Vliet, 2008, p. 32). This is parallel with the idea of aligning the EA school of thought between key stakeholders.

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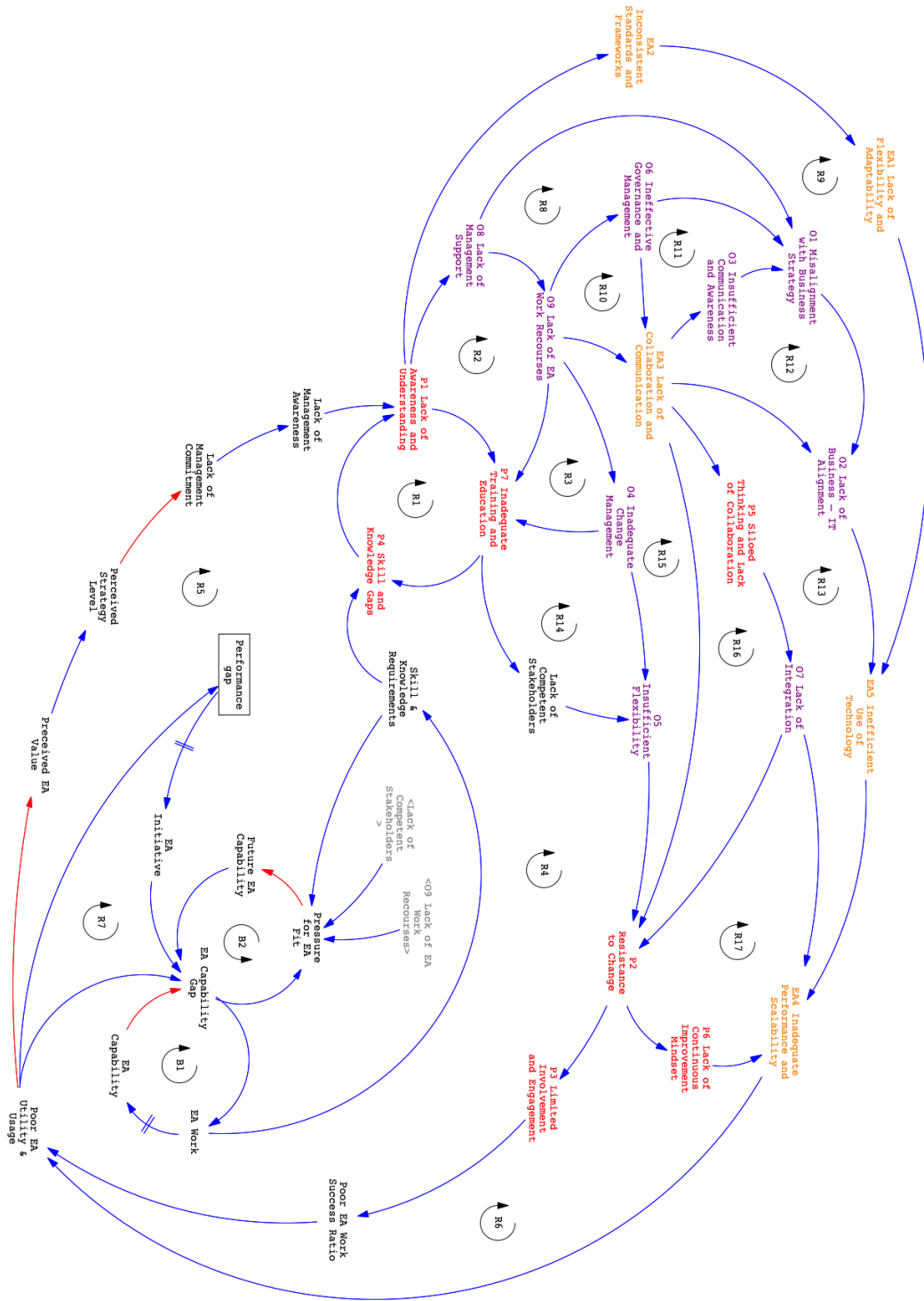
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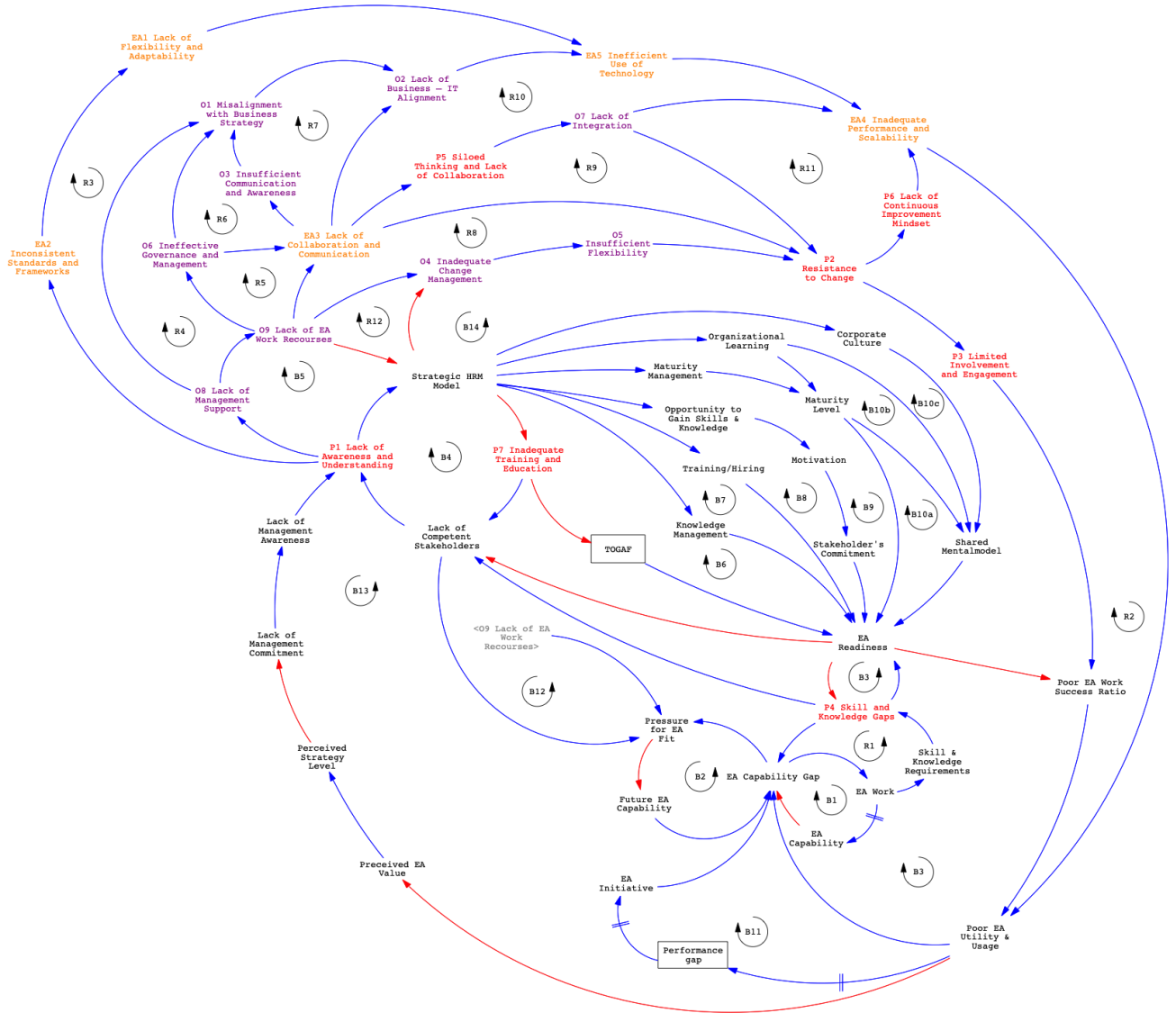
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Appendix 1. Causal Loop Diagram – EA problems.



Appendix 2. EA with Strategic HRM Model as Extended Dynamic Theory.



Appendix 3. Causes tree by open loop system - EA issues in literature.

