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The theoretical basis of enterprise architecture: A critical review and taxonomy of relevant theories

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Abstract

Enterprise architecture is a collection of artifacts describing various aspects of an organization from an integrated business and IT perspective. Practicing enterprise architecture in organizations implies using these artifacts to facilitate information systems planning and improve business and IT alignment. Despite its long history, the enterprise architecture discipline still remains largely atheoretical and lacks a solid theoretical basis. Based on our previous empirical studies of the practical usage of enterprise architecture artifacts in multiple organizations and broad literature analysis, this conceptual article identifies and discusses in detail 10 theories that can be considered key for understanding how an enterprise architecture practice works: actor-network theory, boundary objects theory, cognitive fit theory, communities of practice theory, decision-making theories, information processing theory, knowledge management theory, management fashion theory, media richness theory, and uncertainty principle. Taken together, these theories offer a comprehensive theoretical view of an enterprise architecture practice explaining the role of enterprise architecture artifacts, their usability, and participation of stakeholders and, therefore, may constitute a theoretical basis of the entire enterprise architecture discipline. Although this article does not elaborate on any of these theories, it brings these theories to light, establishes their critical importance for comprehending an enterprise architecture practice, and positions them as central to the enterprise architecture discourse. Each of these theories can be leveraged by enterprise architecture scholars in their future studies for analyzing enterprise architecture practices through respective theoretical lenses. This article intends to provide fresh theoretical insights on enterprise architecture, spark new waves of theoretical enterprise architecture research, and contribute to the development of a sound theoretical foundation for the enterprise architecture discipline.

Keywords

Enterprise architecture, theoretical basis, boundary objects theory, cognitive fit theory, management fashion theory, literature review

Introduction

Nowadays, IT can be viewed as an essential competitive business asset. However, effective utilization of IT resources in organizations requires achieving close business and IT alignment (Coltman et al., 2015; Gerow et al., 2014). Enterprise architecture (EA) is a collection of special documents, typically called artifacts, describing various aspects of an organization from an integrated business and IT perspective (Kotusev, 2019a; Niemi and Pekkola, 2017). Practicing EA in organizations implies using these EA artifacts to facilitate information systems planning and improve business and IT alignment (Kotusev, 2018b; Tamm et al., 2015).

The phenomenon of EA is far from new and exists essentially as long as information systems themselves. In fact, various flowcharts and models depicting the relationship between system components and business operations that today would have been called "enterprise architecture" had been used even by the designers of LEO (Lyons Electronic Office), the very first business information system initiated by J. Lyons and Company in the late 1940s (Aris, 2000; Mason, 2004). In the mainstream literature, the roots of EA can be traced back at least to the Business

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Systems Planning (BSP) methodology initiated by IBM in the end of the 1960s (Kotusev, 2016), if not to some earlier planning approaches, for example, Study Organization Plan (SOP) promoted also by IBM (Kotusev, 2018b). Since then, the discourse in the EA discipline had been dominated by prescriptive approaches originating mostly from consultancies (Kotusev, 2018a; Langenberg and Wegmann, 2004). As Khoury and Simoff (2004) put it, "contemporary approaches to [EA] have been largely hijacked by the consulting classes" (p. 65).

Unsurprisingly, as a discipline highly influenced by the publications of consultancies, the stream of EA research has been mostly atheoretical in nature (Al-Kharusi et al., 2017; Langenberg and Wegmann, 2004; Schoenherr, 2008; Weiss et al., 2012). Although some theories, including the general systems theory (GST; Hoyland, 2011; Kloeckner and Birkmeier, 2009; Syynimaa, 2017) and institutional theory (Brosius et al., 2018; Dang, 2017; Hjort-Madsen, 2007; Weiss et al., 2013), have been leveraged relatively widely by EA researchers as theoretical lenses for analyzing EA practices, these theories do not address the core meaning of an EA practice, that is, creation and usage of EA artifacts by various organizational actors for communication and decision-making purposes. In other words, these theories fail to explain the regularities driving the practical usage of EA artifacts and how this usage helps improve business and IT alignment in organizations.

Taking into account that the EA discipline under different titles (e.g. information systems planning, data architecture, and information systems architecture) exists for decades, it would be fair to say that the theory of EA is developing very slowly, if not stuck in the dead end. On one hand, this fact suggests that the essence of an EA practice still remains insufficiently understood. On the other hand, this fact partially explains the undeserved scarcity of publications on EA, as a relevant, contemporary, and widely adopted practice, in the leading academic IS journals (Kotusev, 2017c; Mykhashchuk et al., 2011; Tamm et al., 2011).

Our observations gained from our previous extensive empirical analysis of EA practices in multiple organizations (Kotusev, 2018c, 2019a; Kotusev et al., 2017, 2020) suggest that an EA practice, as a very multifaceted organizational phenomenon, actually has many relevant theoretical interpretations explaining its various aspects, but these interpretations have been mostly unnoticed, overlooked, or ignored by the EA research community. Hence, the research question of this article can be formulated as follows: "What theories can be considered as the basis of the EA discipline?"

In order to attract the attention of EA researchers to the theories that may be necessary for understanding the meaning of an EA practice, this conceptual article highlights the existing gap in selecting appropriate theoretical lenses for studying EA practices, identifies and discusses in detail 10 theories directly related to the usage of EA artifacts, and demonstrates their applicability, potential, and value for the EA discipline. All these 10 theories are immediately relevant to EA artifacts and their practical usage in organizations and, therefore, address the very essence of an EA practice, which presently remains "theoretically shallow." Taken together, these theories offer a holistic theoretical view of an EA practice and its key aspects, including the general role of EA artifacts, their usability for decision-making purposes, and participation of stakeholders.

Importantly, this article does not intend to elaborate in detail on any of these theories, but rather to bring these theories to light, establish their critical importance for understanding an EA practice, demonstrate their applicability to EA studies, and position them as central to the EA discipline. The purpose of this article is to provide fresh theoretical insights into EA, spark new waves of theoretical EA research, stimulate future "theory-rich" EA studies, and thereby contribute to the development of a sound theoretical basis for the EA discipline.

This article continues as follows: (1) we discuss the existing situation with the use of theories in the EA discipline and explain why the current situation is unsatisfactory, (2) we describe our underlying empirical basis, key elements of an EA practice, and the process that was followed to identify relevant theories explaining the meaning of an EA practice, (3) we discuss in detail 10 theories that can arguably be considered as a theoretical basis of the entire EA discipline, but are currently underutilized or not utilized at all, (4) we provide a comprehensive summary of the 10 identified theories demonstrating their relevance, potential, and value, (5) we discuss the key findings of this study, its theoretical and practical contribution to the EA discipline, and (6) we conclude the article by describing its limitations and outlining directions for future research.

Current theoretical views of EA

Traditionally, the EA discipline was largely atheoretical, disconnected from other disciplines and developed in a standalone manner. For instance, the authors of the first comprehensive EA literature review reported that "to us it was surprising that very few [EA] papers used the value of other disciplines to build up their theories" (Langenberg and Wegmann, 2004: 7). In a similar vein, Schoenherr (2008) concluded that "there is a lack of theoretical foundation, stringent definitions or a common understanding within the authors, who publish in the context of EA" (p. 403).

More recent analyses of the EA discipline also came to analogous conclusions (Al-Kharusi et al., 2017; Syynimaa, 2017; Weiss et al., 2012). Specifically, Weiss et al. (2012) notice that "a theoretical foundation for [EA management] seems to be lacking" (p. 461). Syynimaa (2017) reports that "despite its popularity and 30 years of age, the literature review conducted on top information and management science journals revealed that EA is still lacking the sound

theoretical foundation" (p. 400). Likewise, Al-Kharusi et al. (2017) report that "one of the main findings of [our literature review] is the lack of theory utilization in EA studies" (p. 7).

Nevertheless, there were a number of deliberate attempts either to identify the theories that have been used in EA research (Al-Kharusi et al., 2017; Schilling, 2018), or to propose relevant theories to be used by researchers in the future (Syynimaa, 2017; Weiss et al., 2012). An independent search of the utilized theories had also been undertaken by the first author (S.K.) during a comprehensive review of the EA literature (Kotusev, 2017c). These efforts resulted in a combined exhaustive list of 32 theories that are used or proposed to be used in EA research provided in Appendix A (Theories Used in EA Research).

Taking into account the existence of more than a thousand various EA publications (Kotusev, 2017c), the utilization of theories in EA research can indeed be considered as pretty low (see Table 7 in Appendix A). Moreover, some of the theories are only proposed to be used, rather than actually used, for example, cognitive load, administrative behavior, and agency theories (Weiss et al., 2012). Some theories are employed only sporadically, for example, UTAUT (Hazen et al., 2014), living systems theory (Wegmann and Preiss, 2003), and dominant design theory (Bui et al., 2015). Some theories can be considered as "exotic," for example, morphogenetic theory (Alwadain et al., 2014, 2016), or as very narrow-focused and single-purposed, for example, IS success model (Lange et al., 2016; Niemi and Pekkola, 2009). Some theories arguably offer little explanatory power, at least in the context of the EA discipline, for example, chaos theory (Saat et al., 2009) and contingency theory (Aier et al., 2011; Haki et al., 2012; Lahrmann et al., 2010; Leppanen et al., 2007; Riege and Aier, 2008). Other theories, though can be considered as explanatory, and are still employed only by separate authors or groups of authors, for example, boundary objects theory (Abraham, 2013, 2018; Abraham et al., 2013, 2015) and actor-network theory (Sidorova and Kappelman, 2010, 2011a, 2011b).

At the same time, "grand" theories found relevant by many different authors and rather widely discussed in the context of the EA discipline, for example, institutional theory (Aier and Weiss, 2012; Brosius et al., 2018; Dang, 2017; Hjort-Madsen, 2007; Weiss et al., 2013) and GST (Hoyland, 2011; Kloeckner and Birkmeier, 2009; Syynimaa, 2017; Weiss et al., 2012), may help understand only the notion of EA or an EA practice in general at a very high level, but these theories barely explain the internal mechanisms constituting the essence of an EA practice at the level of specific actors, documents, and decisions. For instance, all the 16 studies by different groups of authors using the institutional theory (see Table 7 in Appendix A) analyze EA practices on an organization-wide scale, not at the level of specific EA artifacts and their usage scenarios, while the applicability of the GST in relation to EA is an evident truism and tautology since this theory by its very definition applies to all systems of physical, biological, social, or any other nature ranging from separate atoms to transcendental systems (Boulding, 1956; von Bertalanffy, 1968). Consequently, the theoretical foundation of the EA discipline still seems to be rather rudimentary and is developing very slowly, arguably showing little or no substantial progress over the years.

On one hand, this lack of a sound theoretical understanding may signify that the core meaning of an EA practice is still poorly understood beyond certain abstract generalities, for example, thinking systematically, creating some EA artifacts, making optimal planning decisions, and managing complexity. Most importantly, the existing EA literature does not explain clearly what theoretical mechanisms enable business and IT alignment in organizations, how these mechanisms work together as part of an EA practice, in which circumstances they may not work as expected, and why EA practices in organizations often fail. Although EA initiatives are infamously known for their low success rates (DiGirolamo, 2009; Jacobson, 2007; Roeleven, 2010; Zink, 2009), the existing EA literature rarely goes beyond the superficial identification of various success factors and pitfalls of an EA practice (Ambler, 2010; Jusuf and Kurnia, 2017; Kurnia et al., 2020a; Lange et al., 2016; Levy, 2014) and does not provide any deeper insights or coherent theories explaining the underlying mechanisms of these successes and failures. For example, stakeholder involvement is widely recognized as one of the most critical success factors of an EA practice (Bricknall et al., 2006; Kotusev and Kurnia, 2019; Schmidt and Buxmann, 2011; van der Raadt et al., 2010), but it is barely understood *why* stakeholder involvement is so critical.

On the other hand, the lack of theoretical foundation for the EA discipline can be partially accountable for the fact that EA research is scarcely represented in the leading academic IS journals (Kotusev, 2017c; Mykhashchuk et al., 2011; Tamm et al., 2011), which welcome mostly "theory-rich" papers (Dennis, 2019; Hirschheim, 2019). As noted by Al-Kharusi et al. (2017):

> [the lack of theory utilization in current EA studies] gives an opportunity for future studies to take advantage of theories to enhance their understanding of EA phenomena. This is in alignment with IS journals recommendation of grounding researchers work on theory. (p. 10)

In light of these considerations, developing a consistent theoretical foundation for the EA discipline can be considered as an important goal for the EA research community. As Saint-Louis and Lapalme (2016) put it, "without a common structure and a core theory, it will be always complicated to talk about EA as a discipline" (p. 75).

Table 1. Underlying empirical basis of this study.

Primary research focus	Time period	Organizations	Interviews
EA artifacts and their practical usage	2014–2017	35 in total	87 in total
Engagement between architects and EA stakeholders	2016–2019	26 in total	46 in total

EA: Enterprise architecture.

Identification of theories explaining EA

The identification of theories explaining the phenomenon of EA has been conducted by means of comparing our observations on the practical usage of EA artifacts in multiple organizations made as part of our previous extensive empirical studies (Kotusev, 2018b, 2018c, 2019a, 2020; Kotusev and Kurnia, 2019; Kotusev et al., 2015, 2016, 2017, 2020; Kurnia et al., 2020a, 2020b) with the list of theories widely used in IS research (Larsen et al., 2015) and other conceptual lenses found in the EA literature (see Table 7 in Appendix A).

Underlying empirical basis of this study

This study leverages an extensive empirical base of observations on EA practices accumulated by the authors of this article during the past 5 years as part of the previous qualitative EA studies addressing the core of an EA practice (i.e. usage of EA artifacts for communication and decision-making) in which the authors were directly involved. Specifically, in these studies the authors fulfilled the roles of both data collectors and data analysts, that is, we interviewed EA practitioners and analyzed all the incoming data ourselves. In total, our empirical basis includes more than 130, 1-h interviews with practicing architects, architecture managers, and some other participants closely involved in EA practices from more than 50 diverse organizations (not to mention some other qualitative EA studies in which the authors participated only partially, for example, only as data analysts). This experience provided a broad, deep, and firsthand exposure to the empirical realities of an EA practice and the work of architects in organizations. The underlying empirical basis of this study in terms of our primary research focus, time periods, and the numbers of organizations involved and interviews taken is briefly summarized in Table 1.

Key elements and reference model of EA practice

This study intends to identify theories describing the very core of an EA practice, that is, use of EA artifacts in organizations for communication and decision-making purposes. To achieve this goal, it is important to clarify what elements constitute the core of an EA practice, explicitly define them, and explain their relationship. The vast body of the available EA literature, as well as our own empirical analysis of EA practices (see Table 1), suggest that the overall meaning of an EA practice can be explicated through three essential elements: EA artifacts, EA stakeholders, and usage of EA artifacts by stakeholders.

First, EA artifacts are descriptive documents providing certain views of an organization from the perspective of its business and IT (Abraham, 2013; Kotusev et al., 2015; Winter and Fischer, 2006). They are distinguishing elements of an EA practice without which it cannot be considered as such. EA artifacts can be very diverse in nature and differ in various important properties, for example, their representation formats, levels of granularity, organizational scopes, relevant domains, and time focus (Kotusev, 2018b; Niemi and Pekkola, 2017). Although organizations employ different sets of EA artifacts as part of their EA practices, most popular EA artifacts widely adopted in industry include business capability models, guidelines, landscape diagrams, principles, roadmaps, solution designs, solution overviews, and technology reference models (EA on a Page, 2018; Kotusev, 2017b).

Second, EA stakeholders are organizational actors representing certain interests and dealing with EA artifacts, that is, involved in some or the other way in their creation and usage (Fairhead and Good, 2009; Thornton, 2007; Verley, 2007). Although the full list of potential EA stakeholders might be very long, organization-specific, and it is almost impossible to define clearly who exactly can be considered as an EA stakeholder, most typical stakeholder groups include business leaders, CIOs, and other senior IT managers, project managers, and other members of IT project teams, business analysts, and system users, as well as different denominations of architects (Fairhead and Good, 2009; Kotusev, 2018c; Niemi, 2007). Architects represent a special category of EA stakeholders, who both represent their own interests (e.g. simplification and optimization of the organizational IT landscape) and act as chief owners of EA artifacts. Generally, all EA stakeholders can be classified according to their functional areas of expertise (e.g. marketing, finance, IT development, and IT support) and their levels in the organizational hierarchy (e.g. corporate, division, department, and project) (Fonstad and Robertson, 2006; van der Raadt et al., 2008, 2010).

Third, usage of EA artifacts is a broad set of activities performed by EA stakeholders leveraging EA artifacts for communication and decision-making purposes (Kotusev, 2019a; Niemi and Pekkola, 2017). Essentially, usage connects EA artifacts and their stakeholders. EA artifacts have multiple applications and usage scenarios in organizations

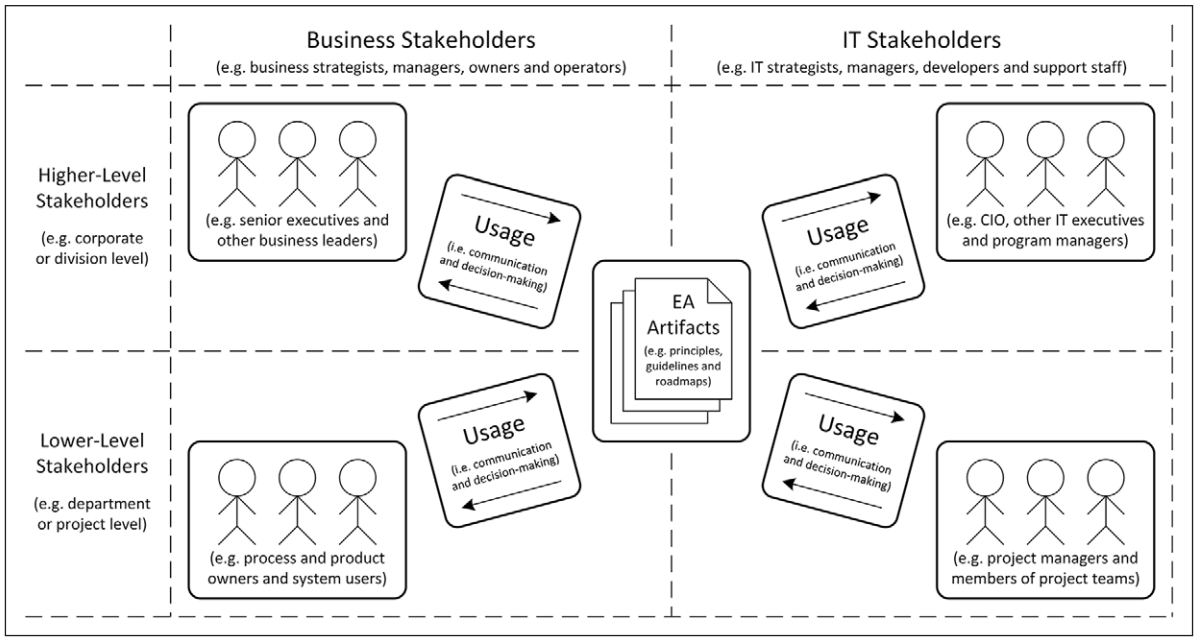

Figure 1. The reference model of an EA practice with its three key elements.

(Kotusev, 2018b; Niemi and Pekkola, 2017). These scenarios range from facilitating corporate strategic planning (Radeke and Legner, 2012; Simon et al., 2014) to supporting IT investment portfolio management (Emery et al., 2007; Makiya, 2008) to achieving harmonious fit of separate IT projects in the overall organizational context (Foorthuis and Brinkkemper, 2007; Lux and Ahlemann, 2012).

The three elements described above represent the main pillars of an EA practice defining its meaning in organizations. The essence of an EA practice can thus be illustrated graphically with these elements and their relationship. Specifically, EA artifacts can be placed in the center and surrounded by different stakeholder groups using them. For demonstrational purposes, all EA stakeholders can be grouped according to their specialization into business and IT stakeholders and separated into two organizational levels (though the model can be easily extended to any number of occupational communities and organizational levels). The resulting reference model of an EA practice with its three key elements is shown in Figure 1.

The schematic view presented in Figure 1 depicts an EA practice, its three essential elements, and their relationship. These three elements will be referred extensively in further theoretical discussions, while this view as a whole will be implicitly taken as a simple reference model of an EA practice underpinning respective interpretations.

Identification of theories relevant to EA

As a potential theoretical base for the EA discipline, we took the well-known list of theories used in IS research (Larsen et al., 2015) and then supplemented it with the additional theories that have been utilized earlier specifically in EA research (see Table 7 in Appendix A). In total, we produced a combined list of 123 theories, including all the 113 theories from the original list of Larsen et al. (2015) and 10 other theories identified in the EA literature. The full list of theories considered in this study as the potential theoretical basis for the EA discipline is provided in Appendix B (Theories Considered as the Potential Theoretical Basis). Then, we compared the theories from this list with our empirical observations and ensuing understanding of an EA practice (see Table 1) in order to determine their relevance to the EA discipline. Specifically, the assessment of theories' relevance has been guided predominantly by three factors.

First, the assessment was guided by the perceived "proximity" of a theory to the core of an EA practice, that is, to the creation and usage of EA artifacts for communication and decision-making. In particular, relevant theories should explain in some or the other explicit form the relationship between *all the three* key elements of an EA practice: EA artifacts, EA stakeholders, and usage of EA artifacts by stakeholders (see Figure 1). For example, the institutional theory may address EA stakeholders, their behavior, and decision-making aspects, but it fails to provide any specific suggestions regarding EA artifacts, as distinguishing elements of an EA practice, and their usage. Although the institutional theory may be applicable, for instance, for analyzing the acceptance and institutionalization of EA-related processes in organizations (Aier and Weiss, 2012; Brosius et al., 2018; Dang, 2017; Hjort-Madsen, 2007; Weiss et al., 2013), this theory does not clarify the meaning of an EA practice itself, that is, usage of EA artifacts by organizational actors for decision-making purposes. For this reason,

the institutional theory was considered "distant" from the core of an EA practice. At the same time, the theory of boundary objects directly explains the role of EA artifacts as communication devices helping diverse EA stakeholders cooperate and, therefore, was considered as very "close" to the core of an EA practice.

Second, the assessment was guided by the presence of articulate manifestations of a theory in the practical usage of EA artifacts. In particular, these manifestations should be *observable in the behavior* of organizational actors working with EA artifacts. For example, the GST provides some abstract suggestions for interpreting organizations as complex systems with interconnected components and these interpretations may implicitly stimulate internal thinking processes of various participants of EA practices (e.g. uncovering hidden dependencies between business processes, information systems, and other objects), but this theory has no visible external manifestations or a clearly observed traceability to their actions in relation to EA artifacts. Although the GST may be applicable for analyzing organizations and their IT landscapes as complex, interrelated systems of systems in the context of an EA practice (Hoyland, 2011; Kloeckner and Birkmeier, 2009; Syynimaa, 2017; Weiss et al., 2012), it cannot be helpful for understanding the essence of actual activities constituting an EA practice. For this reason, the GST was considered as a theory having no noticeable practical manifestations. At the same time, the theory of media richness is clearly manifested in routine actions (selection of communication approaches) of organizational actors working with EA artifacts and, therefore, was considered as a theory having evident traceability to practice.

Third, the assessment was guided by the analytical, explanatory, predictive, and prescriptive potential of a theory.[1] Gregor (2006) distinguishes four distinct goals of theories in IS research: analysis and description, explanation, prediction, and prescription. Accordingly, the existing theories have been evaluated based on their ability to accurately describe what actually works in practice, explain why it works in the way it does, predict which approaches may or may not work hypothetically, and formulate some actionable recommendations for practitioners.[2] For example, the contingency theory only suggests that there may be no single best approach to organize an EA practice (Aier et al., 2011; Haki et al., 2012; Lahrmann et al., 2010; Leppanen et al., 2007; Riege and Aier, 2008), but this theory fails to provide any more detailed clarifications regarding how these approaches are different, why they are different, when they are likely or unlikely to work, and which approach should be selected in a particular situation. For this reason, the valuable potential of the contingency theory for the EA discipline was considered as low. At the same time, the theory of cognitive fit describes what information presentation formats in EA artifacts are suitable for different decision-making tasks, explains the underlying reasons for this relationship, allows predicting which formats can be suitable or unsuitable for different tasks, and formulating certain guidelines regarding the selection of appropriate information presentation formats for EA practitioners. Therefore, this theory was considered as a powerful one. The three criteria for assessing the relevance of theories to the EA discipline described above are summarized in Table 2.

Table 2. Three criteria for assessing the relevance of theories to the EA discipline.

Criterion	Explanation
Proximity	The immediate relevance of a theory to the usage of EA artifacts for communication between stakeholders and decision-making
Manifestations	The presence of articulate, traceable, and clearly observable manifestations of a theory in the practical usage of EA artifacts in organizations
Potential	The ability of a theory to describe what works in practice, explain why it works, predict what may work, and shape actionable recommendations

EA: Enterprise architecture.

The theoretical basis of EA

The process of theories identification and assessment according to the three criteria described above (see Table 2) resulted in a set of 10 theories: actor-network theory, boundary objects theory, cognitive fit theory, communities of practice theory, decision-making theories, information processing theory, knowledge management theory, management fashion theory, media richness theory, and uncertainty principle. Although the inclusion or non-inclusion of theories in the resulting set was certainly partly subjective as their degree of relevance cannot be assessed by any objective means, high relevance of the selected theories to the EA discipline seems to be largely self-evident and is arguably beyond question.

Each of the 10 identified theories clearly satisfies all the three established selection criteria (see Table 2). First, each of these theories is immediately relevant to the usage of EA artifacts and addresses the core of an EA practice. Taken together, these theories explain the very meaning of an EA practice as a complex organizational practice of social nature that implies using EA artifacts for improving communication between diverse organizational actors and decision-makers. Second, each of these theories has rather obvious and clearly observable manifestations in the practical usage of EA artifacts described in the corresponding

sections below. Moreover, each of these theories also has articulate confirmations in the available industry literature on EA. Finally, all these theories are rooted in other established scientific disciplines (e.g. psychology, sociology, and organizational behavior) and offer sound theoretical lenses for understanding an EA practice powerful from the perspective of their analytical, explanatory, predictive, and prescriptive potential.

Although each of the 10 identified theories directly relates to the usage of EA artifacts in an EA practice, these theories can still be conditionally grouped into four different categories based on which particular aspects of their usage they address.[3] First, the boundary objects theory and actor-network theory[4] can be related to role theories, since both theories clarify the general role of EA artifacts in an EA practice as a means of horizontal and vertical communication. Second, the cognitive fit theory, information processing theory, and uncertainty principle can be related to usability theories since all these theories clarify the properties of EA artifacts that make them helpful or useless for decision-making purposes. Third, the communities of practice theory, knowledge management theory, media richness theory, and decision-making theories can be related to stakeholder theories since all these theories clarify the involvement, participation, and communication between stakeholders of EA artifacts. Finally, the management fashion theory can be related to contrast theories since this theory clarifies the sharp contrast between how EA artifacts allegedly ought to be used, as prescribed by the mainstream EA literature, and how they are actually used in established EA practices.

Role theories

Role theories include the boundary objects theory and actor-network theory since both theories clarify the general role of EA artifacts in an EA practice as a means of horizontal and vertical communication. In particular, the boundary objects theory conceptualizes EA artifacts as boundary objects enabling communication between diverse business and IT communities, while the actor-network theory interprets EA artifacts as elements of an actor-network into which the interests of human actors are inscribed and which then represent these interests on behalf of humans.

Boundary objects theory. Boundary objects are special objects that help diverse social communities cooperate, collaborate, and successfully pursue shared goals despite their different expertise, concerns, and backgrounds (Star, 2010; Star and Griesemer, 1989). Boundary objects are "both adaptable to different viewpoints and robust enough to maintain identity across them" (Star and Griesemer, 1989: 387). They exist in multiple social worlds and have different identities in each of these worlds. Boundary objects provide different information to representatives of different social groups they intend to connect. Boundary objects "both inhabit several intersecting social worlds [. . .] *and* satisfy the informational requirements of each of them" (Star and Griesemer, 1989: 393). Thereby, boundary objects help represent and transform knowledge on the boundaries of different communities (Carlile, 2002, 2004). Creating and managing boundary objects is considered as "a key process in developing and maintaining coherence across intersecting social worlds" (Star and Griesemer, 1989: 393). Boundary objects are naturally developed in the process of collaboration when groups of people from heterogeneous communities work together (Nicolini et al., 2012). Typical examples of boundary objects include aerospace system design documents (Bergman et al., 2007), project management documents (Doolin and McLeod, 2012), software architectures (Smolander et al., 2008), and ubiquitous Gantt charts (Yakura, 2002).

In the EA discipline, the theory of boundary objects has been leveraged essentially by a single group of researchers (Abraham, 2013, 2018; Abraham et al., 2013, 2015) and only briefly mentioned in relation to EA by a few other authors (Dreyfus, 2007; Korhonen and Poutanen, 2013; Magalhaes et al., 2007; Poutanen, 2012; Valorinta, 2011). Abraham (2013, 2018) and Abraham et al. (2013, 2015) studied the role of EA models as boundary objects in the context of enterprise transformations. Specifically, Abraham et al. (2013) analyzed how EA artifacts "can become boundary objects that span knowledge boundaries and alleviate communication defects among heterogeneous stakeholder groups in enterprise transformations" (p. 27) and identified a set of boundary object properties required to mitigate different types of communication defects and span different knowledge boundaries (Abraham, 2013, 2018; Abraham et al., 2015).

Our extensive empirical analysis of the practical usage of EA artifacts in organizations (see Table 1) suggests that the importance of the boundary objects theory for the EA discipline is greatly underestimated. Although the conclusions of Abraham et al. (2013) regarding the role of EA artifacts as boundary objects in enterprise transformations are perfectly valid, these conclusions can be generalized to an EA practice as a whole. In fact, most EA artifacts identified in established EA practices (EA on a Page, 2018; Kotusev, 2019a), with the exception of purely technical reference materials intended primarily for architects (e.g. landscape diagrams and inventories), *are* boundary objects and actively used as such for communication between business and IT stakeholders.

Probably the most illustrative example of a boundary object is an EA artifact often titled as a solution overview (EA on a Page, 2018; Kotusev, 2019a). On one hand, solution overviews provide the essential business information about proposed IT solutions, for example, goals, expected process changes, overall impact and value, estimated costs, and timelines. On the other hand, the solution overviews also provide the essential technical information regarding

these solutions, for example, key technologies, high-level structure, involved partners, and associated risks. Therefore, solution overviews represent classical boundary objects helping business and IT stakeholders agree on the optimal solution implementation options acceptable from both the business and IT perspectives. Analogous conclusions are also valid for principles, business capability models, roadmaps, and all other business-focused types of EA artifacts (EA on a Page, 2018; Kotusev, 2019a). For example, the boundary-spanning capacity of architecture principles had been long-recognized in the industry literature:

> Principles are simple, direct statements of an organization's basic beliefs about how the company wants to use IT over the long term. By translating the main aspects of a company's business strategy into the language of technology managers, these principles bridge the communication gap between top managers and technical experts. This way, business strategy drives technical strategy, as conventional wisdom says it should. (Davenport et al., 1989: 131)

Similarly, the role of business capability models as boundary objects between business and IT leaders is also acknowledged in the industry literature:

> [Business capability] models create a "Rosetta stone" that provides the translation between business and IT concerns. [. . .] Capabilities close the gap between business interests and IT concerns providing the right level of detail and consistency to facilitate an ongoing dialogue between business and IT leaders. [. . .] Taken together they form a model representing all the functional abilities a business needs to execute its business model and fulfill its mission. From an IT perspective, capability models provide a stable overarching view of what is important to business leaders that can link business and IT initiatives together. These relatively simple views of the business provide the foundation for complex discussions on strategy and resource allocation. (Scott, 2009: 1–2)

The theory of boundary objects can arguably be considered as the single most important theory for the EA discipline. The ability of EA artifacts to serve as boundary objects between business and IT communities is absolutely essential for a successful EA practice since it is this very property that actually leads to business and IT alignment. Specifically, EA artifacts as boundary objects enable the "horizontal" communication between business and IT stakeholders acting at the same level of the organizational hierarchy, for example, between C-level business and IT executives or between business and IT stakeholders of separate change initiatives (see Figure 1). If EA artifacts are not used as boundary objects, then they cannot help improve business and IT alignment and, in this case, an EA practice simply cannot work successfully and fulfill its goals.[5]

Actor-network theory. Actor-networks can be defined as "dynamic configurations of actors engaged in and performed by particular sociomaterial practices that produce differences that matter" (Cecez-Kecmanovic et al., 2014b: 566), where an actor can be understood broadly as "any element which bends space around itself, makes other elements dependent upon itself and translates their will into the language of its own" (Callon and Latour, 1981: 286). In the actor-network theory "actors are taken to include both human beings and nonhuman actors such as technological artifacts" (Walsham, 1997: 468). Therefore, actor-networks can contain not only people, but also computing devices, tangible objects, abstract concepts, or even entire organizations since all these entities can be viewed as actors from the perspective of the actor-network theory (Hanseth and Monteiro, 1997; Sarker et al., 2006). The actor-network theory explains the creation and evolution of socio-technical networks through the interaction of independent actors (Callon and Latour, 1981; Mitev, 2009; Walsham, 1997). Key concepts of this theory include the notions of inscription and irreversibility (Hanseth and Monteiro, 1997; Sarker et al., 2006; Walsham, 1997). Inscription is "a process of creation of artifacts that would ensure the protection of certain interests" (Sarker et al., 2006: 56), while irreversibility is "the degree to which it is subsequently impossible to go back to a point where alternative possibilities exist" (Walsham and Sahay, 1999: 42). As noted by Gasson (2006), nonhuman elements of actor-networks often represent both boundary objects between their human elements and inscriptions of human interests.

In the EA discipline, the theory of actor-networks has been leveraged only in a few conceptual papers produced by a single group of researchers (Sidorova and Kappelman, 2010, 2011a, 2011b), but did not attract noticeable attention among the broader research community and has not been explicitly mentioned or referred to by other authors. However, Kotusev (2017a) conceptualized an EA practice as a decentralized network of independent but interacting processes, artifacts, and actors, which implicitly resembles an actor-network. Sidorova and Kappelman (2010) argue that an EA practice involving multiple independent stakeholders interacting through using EA artifacts can be interpreted as a complex actor-network. In particular, Sidorova and Kappelman (2011a) explain that "enterprise architecture work helps to achieve agreement and thus alignment of the interests of internal actors within the context of enterprise interests and inscribes such agreement into architectural artifacts" (p. 39).

Our extensive empirical analysis of the practical usage of EA artifacts in organizations (see Table 1) suggests that the importance of the actor-network theory for the EA discipline may be greatly underestimated. As hypothesized by Sidorova and Kappelman (2011a), EA practices in organizations can indeed be viewed as actor-networks consisting of multiple organizational stakeholders and EA artifacts. Moreover, very articulate inscription processes and irreversibility relationships can be identified within these networks. In fact, virtually all EA artifacts used in EA practices

(EA on a Page, 2018; Kotusev, 2019a) can be considered as products of the inscription of their stakeholders' interests at higher organizational levels, which then become essentially irreversible at lower organizational levels and start to guide subsequent "downstream" decision-making and implementation processes. Put simply, stakeholder interests get inscribed into EA artifacts, which then protect these interests for the respective stakeholders without their physical presence.

The processes of initial inscription and subsequent representation of stakeholder interests, as well as the effects of irreversibility, conceptualized by the actor-network theory can be clearly observed and easily described for most EA artifacts. For example, business capability models, value chains, target states, and roadmaps are created with the involvement of C-level business stakeholders, who inscribe their interests regarding the desired strategic business development direction into these EA artifacts (Kotusev, 2019a). After being developed, these EA artifacts represent the interests of executives inscribed in them by means of steering lower level portfolio management, investment prioritization, and initiative launch activities, which may not require the direct presence of C-level executives and during which their strategic decisions are largely irreversible. Likewise, technology reference models, guidelines, and patterns are created by enterprise architects, who inscribe their views on the optimal solution implementation approaches into these EA artifacts (Kotusev, 2019a). After being developed, these EA artifacts represent the interests of enterprise architects inscribed in them via guiding lower level initiative delivery processes driven by solution architects, during which strategic technology selection and other similar decisions cannot be reversed back. Finally, solution overviews and solution designs are created with the involvement of solution architects and business representatives, who inscribe their interests regarding the desired business functionality and technical structure of new IT solutions into these EA artifacts (Kotusev, 2019a). After being developed, these EA artifacts represent the interests inscribed in them through guiding the system implementation activities carried out by project teams under only limited supervision of architects and during which architecturally significant decisions cannot be reversed. Hence, an EA practice can certainly be viewed as an actor-network, where more global stakeholder interests get inscribed into some higher level EA artifacts and then "trickle down" to shape local views which, in their turn, also get inscribed into some lower level EA artifacts, and so forth.

The ability of EA artifacts to capture stakeholder interests and then protect these interests without the actual stakeholder presence, as well as the importance of this ability, is also acknowledged in the industry EA literature, for instance, regarding architecture principles:

> Principles address the perpetual management problem of influence at a distance. Though the decision maker cannot be everywhere, and neither can nor should make every decision, agreed-to principles provide influence without presence. This is very important if one hopes to promote coordinated but independent actions across a large and often quite opinionated organizational community over time. (Boar, 1999: 39)

The theory of actor-networks can be considered as the key theory for understanding the coordination mechanisms of an EA practice and specifically the alignment of architectural decisions at different levels of the organizational hierarchy, where lower level decisions are aligned to higher level decisions. The actor-network theory explains the propagation of planning decisions down the organizational hierarchy, from C-level executives to project teams working on the ground, via inscribing these decisions into respective EA artifacts and then using these artifacts as the basis for creating "next," more detailed EA artifacts. In other words, the theory of actor-networks clarifies the process of gradual translation of the abstract business strategy formulated at the top into concrete IT projects implemented at the bottom through the inscription and subsequent representation of stakeholder interests in EA artifacts. From this perspective, the actor-network theory complements the theory of boundary objects. While the boundary objects theory addresses the "horizontal" communication between business and IT stakeholders acting at the same organizational level, the actor-network theory addresses the "vertical" communication between stakeholders occupying different organizational levels (see Figure 1).

Usability theories

Usability theories include the cognitive fit theory, information processing theory, and uncertainty principle since all these theories clarify the properties of EA artifacts that make them helpful or useless for decision-making purposes. In particular, the cognitive fit theory explains the importance of adequate information presentation formats in EA artifacts correlating with mental problem representations, the information processing theory explains the need for restraining complexity of EA artifacts for their usability, while the uncertainty principle explains the relationship between the abstractness of EA artifacts, their scopes, and appropriate planning horizons.

Cognitive fit theory. Cognitive fit is the degree of correspondence, or match, between the task being solved and the presentation of information relevant to this task (Vessey, 1991; Vessey and Galletta, 1991). The cognitive fit between mental representations of tasks and information presentation formats tends to increase the performance of problem-solvers (Smelcer and Carmel, 1997; Vessey, 1994; Vessey and Galletta, 1991). Vessey (1991) explains that "matching representation to task leads to the use of similar, and therefore consistent, problem-solving processes [. . .]. Hence, problem solving with cognitive fit leads to effective and efficient

problem-solving performance" (p. 221). For example, for certain types of problem-solving tasks, considerable differences in performance have been demonstrated for various information presentation formats including tables, graphs, and maps (Smelcer and Carmel, 1997; Vessey, 1991; Vessey and Galletta, 1991). Different approaches to information presentation render different effects on problem-solving performance in the analysis of financial statements (Frownfelter-Lohrke, 1998), accounting information (Dull and Tegarden, 1999), and geographic information (Dennis and Carte, 1998; Mennecke et al., 2000). Moreover, Hungerford and Eierman (2005) demonstrate that the selection of different modeling languages and notations for drawing system design diagrams (e.g. UML, data flow diagrams, and entity-relationship diagrams) affects the communication effectiveness of these diagrams for people with different levels of expertise in modeling. Berinato (2016) argues that different types of information and demonstration purposes require different visualization approaches.

In the EA discipline, the theory of cognitive fit, to the best of the authors' knowledge, has not been leveraged in any studies. However, this theory was briefly mentioned by Weiss et al. (2012), along with the theory of cognitive load, as potentially relevant to EA.

Our extensive empirical analysis of established EA practices in organizations (see Table 1) suggests that the cognitive fit theory can actually be considered as essential for understanding the practical usage of EA artifacts. In particular, the information presentation formats used in EA artifacts in most cases closely correlate with the types of decisions and tasks these artifacts are intended to support. Furthermore, in mature EA practices the presentation formats of all EA artifacts are constantly optimized for the purposes of more effective decision-making.

Probably the most articulate manifestation of the cognitive fit theory in relation to an EA practice is the broad industry adoption of EA artifacts typically called business capability models, or maps (Bondel et al., 2018; EA on a Page, 2018; Khosroshahi et al., 2018; Kotusev, 2019a, 2019b; Scott, 2009; Swindell, 2014). These EA artifacts provide hierarchical graphical views of all organizational business capabilities on a single page for the purposes of prioritizing and focusing future IT investments on the most strategically important business areas. Business capability models are widely adopted in organizations arguably because their presentation format clearly correlates with the mental representation of the problem they intend to address, that is, decide where future IT investments should go. At the same time, hierarchical capability decompositions in other formats (e.g. nested lists), as well as highly similar process decompositions, advocated by some consultants (Holcman, 2013; Spewak and Hill, 1992) were not adopted in industry. Although "technically" they contain exactly the same information as business capability models, its presentation format seems to be inconvenient for the purposes of allocating IT investments.

Another clear manifestation of the cognitive fit theory observed in practice is the difference between landscape diagrams and inventories from the perspective of their presentation formats (graphical and tabular, respectively) and typical use cases (EA on a Page, 2018; Kotusev, 2019a). This difference almost identically repeats the abstract of the seminal paper introducing the cognitive fit theory:

> The fundamental aspects of the theory are: (1) although graphical and tabular representations may contain the same information, they present that information in fundamentally different ways; graphical representations [i.e. landscape diagrams] emphasize spatial information, while tables [i.e. inventories] emphasize symbolic information; [. . .] (3) performance on a task will be enhanced when there is a cognitive fit (match) between the information emphasized in the representation type and that required by the task type; that is, when graphs [i.e. landscape diagrams] support spatial tasks [e.g. integration of new IT solutions into the existing IT environment] and when tables [i.e. inventories] support symbolic tasks [e.g. reuse of existing IT assets in new IT initiatives]. (Vessey, 1991: 219)

Evident correlation between their presentation formats and practical purposes can be observed for other popular EA artifacts as well, for example, roadmaps, enterprise system portfolios, and technology reference models (EA on a Page, 2018; Kotusev, 2019a). Moreover, the critical importance of convenient presentation formats, rather than only relevant informational contents, is also explicitly emphasized in the industry EA literature:

> The problem is EA information often is unintelligible. The necessary data might be there, but the presentation is so poor that the decision-maker's ability to use it is impaired. If information is not understandable [. . .], then it quickly becomes "shelfware," meaning it sits on a shelf collecting dust. Of course, the result is unsatisfied stakeholders. (Blumenthal, 2007: 63)

Relationship matrices, or CRUD matrices, actively promoted by most pre-EA information systems planning methodologies (BSP, 1975; Finkelstein, 1989; Martin, 1982), early EA methodologies (Spewak and Hill, 1992), and even modern EA frameworks (TOGAF, 2018) provide a perfect example of EA artifacts providing rich informational contents, but using inadequate presentation formats. Despite their ability to accurately reflect very complex relationships between different objects (e.g. business processes and data entities), matrices had been long-recognized as an inconvenient form of information presentation even for IT specialists (Periasamy, 1994; Periasamy and Feeny, 1997) and are currently not adopted in industry despite their broad advocacy in the literature (Kotusev, 2019a).

The theory of cognitive fit arguably represents the central theory for understanding the practical usability of EA artifacts. Specifically, the cognitive fit between information presentation formats and mental problem representations

determines whether particular EA artifacts can be helpful for certain types of decision-making activities. On one hand, this theory explains the inextricable connection between the common presentation formats and purposes of EA artifacts clearly observable in practice (Kotusev, 2019a). On the other hand, this theory also questions the value of creating some "general-purpose" EA artifacts that are not optimized specifically for concrete decision-making tasks or problems (and were actually missing in organizations). The notion of cognitive fit can be considered as one of the enablers of an EA practice reflecting the ability or inability of EA artifacts to facilitate decision-making.

Information processing theory. Information processing (not to be confused with organizational information processing (Galbraith, 1973, 1974, 1977; Tushman and Nadler, 1978) is the capacity of people to perceive, handle, and comprehend information. The emergence of the information processing theory is usually attributed to the seminal article of Miller (1956), who summarized the evidence from multiple previous studies and demonstrated that humans' short-term working memory at any moment can hold and process no more than 5–9 distinguishable chunks of information, or objects. Miller (1956) concluded that "the span of absolute judgment and the span of immediate memory impose severe limitations on the amount of information that we are able to receive, process, and remember" (p. 95). Miller (1956) also noticed that humans' information processing capacity can be increased by means of chunking the information and structuring it into multiple dimensions: "By organizing the stimulus input simultaneously into several dimensions and successively into a sequence of chunks, we manage to break (or at least stretch) this informational bottleneck" (p. 95). The information processing theory imposes significant limitations on the ability of people to receive, process, and remember information as well as to use this information for decision-making purposes. Unsurprisingly, this theory has countless implications in various areas of human activity.

In the EA discipline, the theory of information processing, to the best of the authors' knowledge, has not been leveraged explicitly in any studies. Moreover, even implicit attempts to use various aspects of this theory without referring to it seem to be missing in the EA literature.

Our extensive empirical analysis of established EA practices in organizations (see Table 1) suggests that the human limitations articulated by the information processing theory significantly influence the design of EA artifacts and determine their practical usability. Specifically, all EA artifacts intended for decision-making purposes, with the exception of extensive reference materials on the current state of the IT landscape (e.g. inventories), are developed with an idea of restraining their complexity. For this purpose, relevant objects in EA artifacts are often grouped into several higher level categories (dimensions), or even multiple separate EA artifacts are created relevant to different audiences of decision-makers.

Simplicity-driven designs can be observed in all popular graphical EA artifacts (EA on a Page, 2018; Kotusev, 2019a). For example, business capability models and enterprise system portfolios are normally structured hierarchically and have only a limited number of nested sub-capabilities at each level. Gartner even explicitly recommends to "limit the number of capabilities at each level to eight to 10, which is the number of items the average person can recall from short-term memory" (Cantara et al., 2016: 10). Roadmaps are rarely developed to encompass the whole organization, but rather on a per-business unit basis, and IT initiatives in these roadmaps are typically organized according to different business capabilities or areas having only a few initiatives related to each of them, which highly correlates with the suggestion of Miller (1956) to "arrange the task in such a way that we make a sequence of several absolute judgments in a row" (p. 90). However, large companies may produce aggregated organization-wide roadmaps via extracting only the most significant IT initiatives from local roadmaps of their business units. Likewise, technology reference models are usually structured into different technology layers (e.g. end-user applications, system software, databases, and networks) or even split into 2–3 separate reference models (e.g. application and infrastructure reference models). Even purely technical landscape diagrams often cover separate business areas with a limited number of underlying IT assets, for example, systems and databases. Furthermore, all EA artifacts intended for decision-making purposes tend to use simplistic notations (e.g. color-coded rounded rectangles) and focus only on the most essential information relevant for decision-makers in order to avoid unnecessary complexity.

At the same time, excessive complexity can render EA artifacts incomprehensible for their stakeholders, make them virtually unusable, and eventually become disastrous for an EA practice. For instance, a vivid description of this situation can be found in the industry EA literature:

> An organization that shall remain nameless established a large, award-winning architecture, which it documented in minute detail [. . .]. There was just one problem: It was so involved and complicated that no one attempting to use it had any idea where to start. [. . .] After several well-publicized project failures, with multimillion dollar consequences, the organization eventually reorganized its EA efforts and put new leadership into place. They discarded the elaborate target architecture in favor of a much simpler and more pragmatic approach. (Hobbs, 2012: 85)

Historically, the critical importance of simplicity for the usability of EA artifacts can be best illustrated based on the example of data models. While formal and comprehensive corporate data models (CDMs) prescribed by once-popular Information Engineering (Finkelstein, 1989; Martin and

Finkelstein, 1981) and Strategic Data/Information Planning (Martin, 1982; Martin and Leben, 1989) approaches turned out to be unusable because "many people withdrew in horror when it (CDM) was presented to them" (Periasamy and Feeny, 1997: 201), much simpler data models focused primarily on a few core data entities with their most essential attributes proved useful in some companies (Kotusev, 2019a).

Along with the theory of cognitive fit, the theory of information processing also plays one of the central roles in understanding the practical usability of EA artifacts. Simplicity-related considerations affect the designs of most EA artifacts in successful EA practices. However, unlike cognitive fit, which greatly contributes to the usability of EA artifacts, simplicity on its own cannot make any EA artifacts useful, but excessive complexity can still undermine their usability. Therefore, simplicity of EA artifacts can be considered as a necessary, but not sufficient condition for establishing a successful EA practice that should complement cognitive fit, but cannot substitute it. In other words, complexity of EA artifacts represents one of the inhibitors, or "hygiene factors," of an EA practice.

Uncertainty principle. Although to the best of the authors' knowledge (and surprise) it was never explicitly formulated as a consistent theoretical principle in the EA discipline, our extensive empirical analysis of established EA practices in organizations (see Table 1) suggests that due to the inherent uncertainty of the business environment, organizations can be either planned for wider scopes and longer horizons in less detail, or planned for narrower scopes and shorter horizons in more detail, but they cannot be planned for wide scopes and long horizons in great detail.

This "uncertainty theory" formulated above may be very important for understanding the practical utility of different types of EA artifacts for planning. In particular, the level of granularity and organizational scopes covered in EA artifacts directly correlate with the planning horizons for which these EA artifacts are intended. The most abstract EA artifacts are used for long-range organization-wide planning, while the most detailed artifacts are used for short-term project-specific planning. At the same time, the attempts to define the desired long-term future state in detail, as recommended by popular EA frameworks and methodologies (Bernard, 2012; Spewak and Hill, 1992; TOGAF, 2018; van't Wout et al., 2010), are not practiced.

For example, the long-range global planning in organizations is most often accomplished via identifying and highlighting strategically important areas in business capability models or value chains (EA on a Page, 2018; Kotusev, 2019a), but without specifying any additional details. The mid-term planning is typically accomplished through developing more detailed investment roadmaps for specific business areas which often only outline planned IT initiatives, but do not provide any more detailed descriptions. The short-term planning is usually accomplished via high-level solution overviews or other similar EA artifacts created for separate IT initiatives and describing only their most essential components. Finally, the planning for an immediately actionable perspective is normally accomplished via detailed solution designs developed for concrete IT projects and depicting their technical components. Moreover, futility of the efforts to define and document the long-term future state in detail had been recognized ages ago in the industry literature on information systems planning:

> In 1971, the company [Trans World Airlines] underwent some major changes, switching dp [date processing] hardware vendors and moving headquarters from New York to Kansas City. As a result, its two-volume LRP [long-range information systems plan], specifying five years worth of hardware, software, and applications, ended up in the wastebasket. (Lasden, 1981: 102)

> Detailed architectural drawings of business processes and systems applications—apart from a specific business process initiative –can make companies feel as if someone is doing something about complexity, but they are rarely acted upon. (Ross et al., 2006: 65)

> An important aspect of designing transitional architectures is to define them at the appropriate level of detail. Keep in mind that business drivers, priorities, technologies, and organizations change. Consequently, spending an enormous amount of time detailing every step of a transitional architecture is a wasted effort. We recommend documenting only the first plateau at an immediately actionable level of detail. (Erder and Pureur, 2006: 16)

> [Enterprise architects] focus on documenting the current state or what the future state should be. By the time they are done with their architectural artifact, a new technology has already killed whatever they are working on. (Tucci, 2011: 1)

Along with the theories of cognitive fit and information processing, the "theory of uncertainty" also plays an important role in understanding the practical utility of EA artifacts. Specifically, the environmental uncertainty associated with different organizational scopes and planning horizons determines and essentially limits the maximum level of granularity that can be reasonably achieved in respective EA artifacts. On one hand, this theory explains the inextricable connection between the abstractness of EA artifacts and planning horizons for which the use of these artifacts is appropriate clearly observable in practice. On the other hand, this theory also questions the very possibility of defining and documenting the desired long-term future state for the whole organization in fair detail so widely advocated in the literature (Bernard, 2012; Boar, 1999; Spewak and Hill, 1992; TOGAF, 2018; van't Wout et al., 2010). The inherent environmental uncertainty can be considered as one of the natural constraints of

an EA practice which limits the potential possibility of describing the future state in EA artifacts beyond a certain horizon-specific reasonable level of granularity.

Stakeholder theories

Stakeholder theories include the knowledge management theory, media richness theory, and decision-making theories since all these theories clarify the involvement, participation, and communication between stakeholders of EA artifacts. In particular, the knowledge management theory explains the required level of personal communication between stakeholders of EA artifacts, the media richness theory explains the selection of appropriate communication approaches for this purpose, while the decision-making theories explain the critical necessity of direct stakeholder participation in developing EA artifacts defining the future course of action.

Communities of practice theory. Communities of practice can be understood as "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger et al., 2002: 4). The concept of communities of practice has diverse implications for multiple aspects of organizational life including apprenticeship, learning, working, and innovating, as well as for the identity of individuals (Brown and Duguid, 1991, 1998; Lave and Wenger, 1991; Wenger, 1998). Since each of the publications deemed seminal for this theory (Brown and Duguid, 1991; Lave and Wenger, 1991; Wenger, 1998; Wenger et al., 2002) provides rather different perspectives on communities of practice (Cox, 2005), in our discussions of this theory we will refer predominantly to the work of Wenger (1998) as the most comprehensive, theoretically accomplished, and relevant for our purposes, and especially to its description of boundaries and connections between different communities. For instance, Wenger (1998) argues that spanning the boundaries between communities of practice requires implementing two distinct mechanisms: brokering and boundary objects. Brokering implies direct participation of individuals in the work of different communities (or multi-membership), while the use of boundary objects implies producing physical documents moving across communities. As boundary objects may be ineffectual without face-to-face interaction (Sapsed and Salter, 2004), these two mechanisms naturally complement and even reinforce each other:

> In order to take advantage of the complementarity of [brokering and boundary objects], it is often a good idea to have artifacts and people travel together. Accompanied artifacts stand a better chance of bridging practices. A document can give a less partial view of a topic, and a person can help interpret the document and negotiate its relevance. When combined, the ambiguity of [boundary objects] and the partiality of [brokering] can compensate for each other by becoming productive interactional resources. Given enough legitimacy, visitors with a carefully composed paraphernalia of artifacts can provide a substantial connection indeed. (Wenger, 1998: 111–112)

Wenger (1998) also argues that some practices can be considered as boundary practices that "deal with boundaries and sustain a connection between a number of other practices by addressing conflicts, reconciling perspectives, and finding resolutions" (p. 114). He warns that boundary practices "present the danger of gaining so much momentum of their own that they become insulated from the practices they are supposed to connect" (Wenger, 1998: 115).

In the EA discipline, the theory of communities of practices has been leveraged only recently by Dale and Scheepers (2020), who viewed different groups of EA stakeholders as communities of practice. They analyzed the interpersonal factors influencing the ability of architects to establish effective connections with their stakeholders through three essential dimensions of communities of practice: mutual engagement, joint enterprise, and shared repertoire.

Our extensive empirical analysis of established EA practices in organizations (see Table 1) suggests that the importance of the communities of practice theory for the EA discipline may be greatly underestimated. As proposed by Dale and Scheepers (2020), different groups of participants of EA practices in organizations can indeed be conceptualized as communities of practice consisting of people who possess similar knowledge and share analogous concerns. Especially, articulate characteristics of communities of practice can be observed at the boundaries between different participant groups involved in an EA practice. In particular, organizations with EA practices always implement both brokering mechanisms, in the form of direct face-to-face conversations between representatives of different communities, and boundary objects mechanisms, in the form of various EA artifacts used by their members. Furthermore, from the perspective of the communities of practice theory, the occupation of architects can be viewed as a boundary practice that intends to connect other practices together. On one hand, architects act as brokers communicating with members of other communities, resolving conflicting interests and proposing mutually acceptable solutions. On the other hand, architects are also chief owners of the paraphernalia of EA artifacts serving as boundary objects helping formalize and stipulate the reached agreements.

Organizationally, boundary-spanning processes between different communities of practice are most vividly manifested in constant meetings happening as part of an EA practice. These meetings usually involve representatives of multiple different communities and often result in new or updated EA artifacts. For example, strategic meetings normally include business leaders with different profiles, senior

IT managers, and architects. These meetings are often supported by business capability models, roadmaps, or some other high-level EA artifacts (EA on a Page, 2018; Kotusev, 2019a) as boundary objects and, if any significant planning decisions are made, lead to updates of these artifacts. Project-level meetings may include, depending on the current project phase, business sponsors of respective IT initiatives, solution architects, project managers, system end users, and senior representatives of IT delivery and support teams. These meetings typically revolve first around developing abstract solution overviews at the early project stages and then around creating more detailed solution designs at the later project stages (EA on a Page, 2018; Kotusev, 2019a) as boundary objects. During these meetings, each community of practice voices its key concerns to be satisfied. For example, senior business executives advocate strategic value, product managers—time-to-market, program, and project managers—resources and deadlines, delivery teams—solution feasibility and support teams—its maintainability.

The criticality of using both personal brokering and physical boundary objects for bridging the boundaries between different communities in an EA practice is also acknowledged in the industry EA literature:

> The Strategic Dialogue determines which business objectives will be pursued [. . .]. This dialogue defines a business objective in a business case and then elaborates the objective as a concrete project proposal. This process is a collaboration of business and IT management who together determine which business objectives should be pursued. (Wagter et al., 2005: 71)

The theory of communities of practice can be considered as the key theory for understanding different stakeholder groups in an EA practice, their boundaries and the ways of connecting them with the help of EA artifacts. Most importantly, the communities of practice theory explains the necessity of combining boundary objects mechanisms (i.e. EA artifacts) and brokering mechanisms (i.e. direct personal contacts) for aligning the interests of different communities. Essentially, this theory largely mirrors and is reciprocal to the theory of boundary objects. While the boundary objects theory focuses on boundary objects themselves and explains why they are so valuable for communication between different communities, the communities of practice theory, on the contrary, focuses specifically on communities and explains why they need boundary objects for productive collaboration. Moreover, this theory also explains the general role of the community of architects as a boundary practice aimed at linking other communities. Among other implications, it effectively predicts one of the most widely reported problems with an EA practice: the so-called "ivory tower" syndrome, when architects start to focus excessively on their own practice instead of connecting other communities together, create irrelevant EA artifacts and eventually become isolated from the rest of the organization (Ambler, 2010; Burton, 2009; Hauder et al., 2013b; Hobbs, 2012; Kotusev and Kurnia, 2019; Levy, 2014; van der Raadt and van Vliet, 2008; van der Raadt et al., 2010).

Knowledge management theory. Knowledge management can be defined as "a systemic and organizationally specified process for acquiring, organizing and communicating [. . .] knowledge of employees so that other employees may make use of it to be more effective and productive in their work" (Alavi and Leidner, 1999: 6). The knowledge management theory suggests that knowledge can take two different forms, which require different strategies and systems for managing it. Specifically, knowledge tends to be either explicit, which can be easily formalized and documented, or tacit, which is embedded in the human brain and cannot be easily formalized (Alavi and Leidner, 1999, 2001; Grover and Davenport, 2001; Polanyi, 1966; Sambamurthy and Subramani, 2005). Two different strategies for managing knowledge are codification, which relies on recording knowledge in documents and sharing them between people, and personalization, which relies on organizing direct interaction between people possessing knowledge (Grover and Davenport, 2001; Hansen et al., 1998). Finally, knowledge management systems can be classified into repositories, which provide searchable document databases for capturing knowledge, and maps, which provide catalogs of people possessing necessary expertise (Gray, 2000; Kankanhalli et al., 2005; Ruggles, 1998; Wu and Wang, 2006). The codification strategy is more suitable for managing explicit knowledge and can be supported by knowledge repositories, while the personalization strategy is more appropriate for tacit knowledge and can be based on using knowledge maps (Grover and Davenport, 2001; Hansen et al., 1998; Kankanhalli et al., 2005).

In the EA discipline, the theory of knowledge management has been leveraged only by a single group of researchers (Buckl et al., 2009c; Struck et al., 2010), but did not attract noticeable attention among the broader research community. Buckl et al. (2009c) and Struck et al. (2010) consider an EA practice as a way of managing knowledge and analyzed the existing EA frameworks from the perspective of a typical knowledge management lifecycle.

Our extensive empirical analysis of established EA practices in organizations (see Table 1) suggests that the knowledge management theory may be very important for understanding the practical usage of EA artifacts. In particular, EA artifacts representing explicit and tacit knowledge in different proportions require different knowledge management strategies and storage approaches. On one hand, EA artifacts depicting predominantly explicit knowledge (e.g. the structure of the existing IT landscape independent of people's interpretation) are managed according to the classical codification strategy and stored in searchable document repositories. On the other hand, EA artifacts

reflecting highly tacit knowledge (e.g. based on executives' understanding of the market environment and business needs) are managed more according to the personalization strategy and very closely associated with specific people who contributed to their creation.

The form of knowledge most susceptible to codification is the knowledge on the current IT landscape most often captured in landscape diagrams and inventories (EA on a Page, 2018; Kotusev, 2019a). Both these EA artifacts essentially represent classical codified knowledge repositories, where the comprehensive information on the existing IT assets and their relationship can be easily looked up by everyone when needed. On the contrary, the form of knowledge least susceptible to codification is the knowledge of the external market environment, business opportunities, problems, and needs, which in most cases is present only implicitly in business-focused types of EA artifacts (EA on a Page, 2018; Kotusev, 2019a). For example, business capability models and value chains often reflect strategic priorities of a small group of C-level executives, but do not explain explicitly how and why these priorities have been identified leaving this tacit knowledge in the heads of business executives. Similarly, solution overviews typically do not provide a comprehensive description of the business motivation behind respective IT initiatives, but rather refer to business sponsors of these initiatives from whom the necessary information can be obtained essentially representing knowledge maps. A generalized observation regarding the relationship between EA artifacts and respective knowledge management approach can arguably be formulated as follows: more personalization and less codification are required for EA artifacts that reflect more tacit knowledge, and vice versa.

The impossibility of capturing tacit business goals and strategy in formal architectural diagrams in the same way in which the existing landscape structure can be depicted is acknowledged by reflective EA practitioners as well:

> I have my doubts that modeling intentions and strategy are actually very useful. Modeling strategy cannot be much more than illustrative for what in reality is a narrative that has many aspects that practically can't be modeled at all in the same way that intelligent behavior cannot be caught in rules. Both intentions and strategy are domains that are far from logical in the real world and trying to map them onto a logical structure [in a way similar to regular modeling of the IT landscape] will have serious limitations. (Wierda, 2017: 17)

The theory of knowledge management arguably plays a critical role in understanding the stakeholder-related aspects of the practical usage of EA artifacts. Specifically, this theory explains the degree of immediate stakeholder involvement required for using EA artifacts as part of an EA practice. Most importantly, it establishes the necessity of direct contact with stakeholders for EA artifacts reflecting tacit knowledge, that is, essentially for all EA artifacts having subtle meaning and allowing subjective interpretation. The knowledge management theory helps understand why some EA artifacts can be simply retrieved from document repositories and studied to obtain knowledge, while for other EA artifacts identification and communication with their stakeholders might be critical for their usage. From this perspective, the knowledge management theory complements the theory of communities of practice. While the communities of practice theory explains the very necessity of combining EA artifacts and personal communication, the knowledge management theory explains in which cases one of these two mechanisms can be more appropriate than the other.

Media richness theory. Media richness is the capacity of a communication medium to transmit rich information, which is characterized by four main criteria: instant feedback, multiple cues, language variety, and personal focus (Daft and Lengel, 1984, 1986; Daft et al., 1987). Various communication media range in their richness, in increasing order, from unaddressed numerical reports and written letters to telephone calls and personal face-to-face conversations (Daft and Lengel, 1984, 1986; Daft et al., 1987). Daft et al. (1987) demonstrate that managers tend to prefer less rich communication media for unequivocal messages and richer media for equivocal messages since "equivocality leads to the exchange of subjective views among managers to define the problem and resolve disagreements" (p. 357) (equivocality is understood specifically as "the existence of multiple and conflicting interpretations about an organizational situation" (Daft and Lengel, 1986: 556). In other words, necessary media richness directly correlates with the equivocality of conveyed messages (Daft and Lengel, 1984; Trevino et al., 1987). Daft et al. (1987) also explain that

> the organization reduces equivocality by pooling opinions and overcoming disagreement. This leads to a shared understanding and social agreement about the correct response. The response to equivocality comes from within the management group in the form of defining what events mean and enacting a solution. (p. 357)[6]

In the EA discipline, the theory of media richness, to the best of the authors' knowledge, has not been leveraged in any studies. Put simply, in the existing EA literature, communication between architects and other EA stakeholders was never analyzed or differentiated from the perspective of its media.

Our extensive empirical analysis of established EA practices in organizations (see Table 1) suggests that the media richness theory may be very important for understanding the practical usage of EA artifacts. In particular, EA artifacts of different equivocality require adequate means of communication corresponding to their equivocality. On one hand, EA artifacts associated with less equivocality (e.g.

focused on the current state) are often exchanged via emails, shared electronically, or published on document portals to be studied. On the other hand, EA artifacts associated with great equivocality (e.g. focused on the long-term future) are always discussed during personal meetings, group workshops, and presentations. Essentially, these EA artifacts only support and complement conversations, but never substitute them.

Probably the least equivocal of all widely used EA artifacts are landscape diagrams and inventories (EA on a Page, 2018; Kotusev, 2019a). Both these EA artifacts aim primarily to accurately depict the existing IT landscape and imply little or no ambiguity and controversy. Accordingly, these EA artifacts are most often stored in shared drives, corporate portals, or specialized architectural repositories, typically accessed electronically and discussed only occasionally. By contrast, two of the most equivocal EA artifacts are business capability maps and roadmaps (EA on a Page, 2018; Kotusev, 2019a). Both these EA artifacts focus on the long-term future and deal with strategic investment priorities of organizations, which normally represent the subjects of major debates, disagreements, and disputes between senior executives. Unsurprisingly, these EA artifacts are never distributed electronically simply to be downloaded and studied, but rather are very intensively discussed with the involvement of all their stakeholders. A generalized observation regarding the relationship between EA artifacts and respective media richness can arguably be formulated as follows: greater media richness is required for EA artifacts that reflect more opinions and less facts, and vice versa.

The necessity of using rich communication media for EA artifacts reflecting far-reaching planning decisions that naturally imply considerable ambiguity is also acknowledged in the industry EA literature:

> [The CIO] estimated that the management team at Delta Air Lines required sixty iterations [of meetings and discussions] to complete the drawing of its core diagram. (Ross et al., 2006: 66)

Generally, effective communication and mutual understanding between business and IT stakeholders have been long-recognized as core enablers of business and IT alignment in organizations (Chan and Reich, 2007; Luftman and Brier, 1999; Nath, 1989; Preston and Karahanna, 2009; Reich and Benbasat, 2000; Teo and Ang, 1999).

The theory of media richness arguably plays a critical role in understanding the communicational aspects related to the practical usage of EA artifacts. Specifically, this theory explains the selection of suitable communication approaches required for using EA artifacts as part of an EA practice. Most importantly, it establishes the primacy of personal verbal communications over electronic documents exchange for all EA artifacts dealing with ambiguity, that is, essentially for all EA artifacts focused on the future. The media richness theory helps understand why some EA artifacts can be simply uploaded to corporate web portals or distributed to their stakeholders remotely, while other EA artifacts might be effectively useless without direct face-to-face conversations between their stakeholders. From this perspective, the media richness theory complements the theories of communities of practice and knowledge management. While these two theories explain, respectively, the very necessity and relative degree of direct interaction with stakeholders, the media richness theory explains the choice of appropriate communication media for this purpose.

Decision-making theories. Decision-making is the process of formulating managerial decisions in organizations. Traditionally, decision-making has been a subject of intense academic research conducted at least for several decades (Cyert and March, 1992; Lindblom, 1959; March and Simon, 1993; Mintzberg et al., 1976; Simon, 1960), which produced a vast body of literature on strategic decision-making processes (Eisenhardt and Zbaracki, 1992; Huff and Reger, 1987; Hutzschenreuter and Kleindienst, 2006; Papadakis et al., 2010; Rajagopalan et al., 1993; Schwenk, 1995). For this reason, there may be no single theory of decision-making, but rather a broad family of theories related to decision-making and addressing various aspects of decision-making processes in organizations including, among others, such well-known theories as the theory of administrative behavior, or the so-called bounded rationality (Simon, 1997), and the garbage can theory (Cohen et al., 1972).

In the EA discipline, the theories on decision-making, to the best of the authors' knowledge has not been leveraged in any studies. However, the administrative behavior theory was identified by Weiss et al. (2012) as potentially relevant to EA and some elements of decision-making theories have been mentioned in the recent study of van den Berg et al. (2019).

Our extensive empirical analysis of established EA practices in organizations (see Table 1) suggests that the family of decision-making theories may actually be considered as very relevant for understanding the practical usage of EA artifacts. In particular, all EA artifacts shaping the future course of action essentially represent formalized and explicitly documented planning decisions and, therefore, all theories explaining decision-making processes in organizations relate to the development processes of these EA artifacts.

The literature on decision-making typically conceptualizes the process of strategic decision-making in organizations as two separate phases, formulation and implementation (Huff and Reger, 1987; Hutzschenreuter and Kleindienst, 2006; Papadakis et al., 2010; Pettigrew, 2003), often with the formal approval gate between them (Mintzberg et al., 1976; van den Berg et al., 2019). This generic process accurately describes the lifecycle of all EA artifacts focused on

the future. Specifically, all these EA artifacts emerge and undergo through the formulation stage, where the corresponding planning decisions are developed, then the decisions reflected in these artifacts are officially authorized by relevant architecture governance bodies, and finally these decisions are implemented either via influencing some lower level planning decisions, or directly in concrete IT systems. For example, architecture principles get initially formulated, then endorsed by the top-level governance committee (e.g. architecture governance council), and finally implemented via aligning all subsequent architectural decisions to their suggestions (EA on a Page, 2018; Kotusev, 2019a). Business capability models get "heatmapped," then the corresponding investment priorities get approved by the senior governance committee (e.g. strategy board), and finally implemented via guiding lower level portfolio shaping and prioritization processes. In a similar vein, solution designs are formulated, then endorsed by the low-level technical committee (e.g. architecture review board), and finally implemented directly by IT project teams.

Evident similarity between organizational decision-making processes and lifecycles of future-focused EA artifacts suggests that many or even most conclusions of the theories on decision-making may be directly applicable to EA artifacts representing planning decisions. However, arguably the single most important lesson from these theories for the EA discipline is that significant decisions and plans should not be created by architects on behalf of other EA stakeholders, but rather developed collectively by architects and all these stakeholders together. Undermined productivity and satisfaction from executing decisions and plans made by others, as well as their underlying reasons, had been recognized long ago, for instance, by Bass (1970):

> Productivity and satisfaction are lower when planning for others because (1) sense of accomplishment is less when executing someone else's plan; (2) there is less tendency to try to confirm the validity of another's plan by executing it successfully—less confidence that it can be done; (3) there is less commitment to see that the plan works well; (4) there is less flexibility and less room for modification and initiative to make improvements in an assigned plan; (5) there is less understanding of an assigned plan; (6) human resources are not so well utilized; (7) there are more communications problems and consequent errors and distortions in following instructions; (8) there are competitive feelings aroused between planners and doers, to such an extent that it appears that if the former "win," the latter "lose." (p. 159, 163)

Bass (1970) concludes that "ideally, planners should be those who execute the plans" (p. 163). In the context of an EA practice, the problems associated with the attempts to plan for others may be especially acute and exacerbated by the fact that planners (i.e. architects) have lower status, authority, and power than many other stakeholders of the resulting plans (e.g. C-level executives and other business leaders). Furthermore, stakeholder involvement can be necessary to ensure their commitment to the decisions being made: "Involvement of some constituency in decision making, even if the involvement is symbolic rather than actual, can have effects on developing commitment to the decisions that are reached" (Pfeffer, 1981: 207).

These conclusions suggest that in order to maximize the success rate of EA efforts, all EA artifacts reflecting certain planning decisions should be produced collaboratively by architects and other stakeholders, never by architects alone. Moreover, involving others in decision-making processes also helps develop more balanced plans, minimize the harmful influence of cognitive biases, and avoid dangerous decision-making traps inherent even to experienced and highly qualified individuals (Davenport, 2009; Hammond et al., 1998; Kahneman et al., 2011; Lovallo and Kahneman, 2003; Sibony et al., 2017). Unsurprisingly, stakeholder participation and buy-in are widely recognized among the most critical success factors of EA practice in the academic EA literature (Bricknall et al., 2006; Kotusev and Kurnia, 2019; Schmidt and Buxmann, 2011; van der Raadt et al., 2010). The need for the collective development of architectural plans is recognized in the industry EA literature as well:

> The idea that enterprise architecture discussions should involve senior management will not be a surprise to most IT executives. But many IT leaders find themselves taking the lead. We have seen two successful strategies to involve senior executives: IT-facilitated senior management discussions and senior management approval of IT-led designs. (Ross et al., 2006: 65–66)

Besides involving EA stakeholders in architectural decision-making processes as part of in-house EA practices, analogous conclusions are also valid for the relationships between external EA consultancies and client organizations and the consequences of insufficient involvement of clients in consultants-driven EA efforts may be very disappointing:

> Gartner has observed [. . .] clients who have derailed the EA effort [and any subsequent attempts] through improper use of consultants. This usually happens when the client engages a consultant to do the architecture "to them" rather than "with them." Without the active participation of the client in the EA effort, the critical link to the business is lost. (Lapkin and Allega, 2010: 3)

The theories on decision-making are critical for understanding the decision-making aspects related to the practical usage of EA artifacts representing some planning decisions, that is, essentially all EA artifacts having certain articulate implications for the future. Specifically, these theories interpret the process of creation and usage of future-focused EA artifacts as the process of organizational

decision-making. Most importantly, they establish the necessity of active involvement and participation of stakeholders in the development of EA artifacts shaping the future course of action. The decision-making theories help understand why it is impractical to create EA artifacts for someone, but only together with someone, as well as why EA artifacts are often ignored by the stakeholders who did not participate in their development. From this perspective, the decision-making theories complement the theories of communities of practice, knowledge management, and media richness. While these three theories explain the necessity and degree of personal communication as well as the selection of communication media, the decision-making theories explain the necessity of involving EA stakeholders in defining the future course of action.

Contrast theories

Contrast theories include only the management fashion theory since this theory clarifies the sharp contrast between how EA artifacts allegedly ought to be used, as prescribed by the mainstream EA literature, and how they are actually used in established EA practices. In particular, the management fashion theory explains the wide presence of EA frameworks in the current EA discourse, despite the fact that these frameworks actually proved their practical ineffectiveness long ago.

Management fashion theory. Management fashions are inefficient managerial innovations promoted by fashion-setting networks (e.g. consultancies, gurus, and business mass-media) and temporarily adopted by organizations under conditions of high uncertainty (Abrahamson, 1991, 1996). Fashion-setters create "transitory collective beliefs that certain management techniques are at the forefront of management progress" (Abrahamson, 1991: 254). The resulting management fashions "tend to have a lifecycle characterized by a long latency phase followed by a wave-like, often asymmetrical and ephemeral popularity curve" (Abrahamson and Fairchild, 1999: 731). Although the theory management fashions is often credited to the seminal work of Abrahamson (1991), the very tendency of organizations to blindly follow questionable managerial approaches and techniques without sufficient rational justifications had been noticed by many authors much earlier (Hackman, 1975; Horton, 1977; Lawler and Mohrman, 1985; Mintzberg, 1981). Widely acknowledged management fashions that emerged unexpectedly, enjoyed broad adoption, then proved their practical ineffectiveness, and faded away without a trace include, among others, business process reengineering (BPR), Japanese management (Theory Z), job enrichment, management by objectives (MBO), self-managed teams (SMT), quality circles (QC), and total quality management (TQM) (Abrahamson and Fairchild, 1999; Carson et al., 1999, 2000; Gibson and Tesone, 2001; Kieser, 1997; Miller et al., 2004).

In the EA discipline, the theory of management fashions has been leveraged only once by Hjort-Madsen and Pries-Heje (2009) to investigate whether the adoption of EA in governmental organizations can be considered as a temporary passing fashion or as a genuine long-lasting trend.

Our extensive empirical analysis of established EA practices in organizations (see Table 1) suggests that the management fashion theory may be critical for understanding the complex situation in the EA discipline and the curious relationship between superficial EA rhetoric and actual EA practice. On one hand, rhetoric in the EA discipline has been traditionally dominated by EA frameworks (Bui, 2017; Matthes, 2011; Schekkerman, 2004; Simon et al., 2013), which describe in great detail what steps should be followed by architects, what EA artifacts should be created, and how these artifacts should be structured. On the other hand, our in-depth studies of the practical usage of EA artifacts in multiple organizations demonstrate the absence of any observable correlation between the prescriptions of EA frameworks and real activities of architects, even when the use of EA frameworks is formally declared. Put simply, successful EA practices do not resemble the recommendations of EA frameworks in any aspect, with the exception of trivial generalities, for example, some EA artifacts are developed which may describe different domains of organizations from business and applications to infrastructure and security.

First, successful EA practices do not resemble linear step-wise processes described by popular EA frameworks and methodologies (Armour et al., 1999; Bernard, 2012; Bittler and Kreizman, 2005; Boar, 1999; Carbone, 2004; Covington and Jahangir, 2009; Federal Enterprise Architecture Framework (FEAF), 1999; Holcman, 2013; IBM, 2006; Longepe, 2003; Niemann, 2006; Schekkerman, 2008; Spewak and Hill, 1992; TAFIM, 1996; Theuerkorn, 2004; TOGAF, 2018; van't Wout et al., 2010), but rather represent much more complex constellations of activities. Second, established EA practices are based on pragmatic collections of EA artifacts that only slightly overlap with the lists of EA artifacts recommended by the mainstream EA literature for practitioners (Bernard, 2012; Spewak and Hill, 1992; TOGAF, 2018; van't Wout et al., 2010). Third, real EA artifacts used in organizations are not structured (and even cannot be structured hypothetically) according to some logical taxonomies widely advocated in the literature (Bernard, 2012; Connor, 1988; PRISM, 1986; Pulkkinen, 2006; Schekkerman, 2006; Sowa and Zachman, 1992; TEAF, 2000; van't Wout et al., 2010; Wardle, 1984; Zachman, 1987).

These and some other significant differences between the suggestions of mainstream EA literature and established industry practices pose a number of important questions regarding the status of the EA discipline and the theory of management fashions helps answer these questions. On one hand, all popular EA frameworks and methodologies either originate directly from fashion setting networks, including

major consulting companies (Bittler and Kreizman, 2005; Covington and Jahangir, 2009; IBM, 2006; van't Wout et al., 2010), specialized EA consultancies (Holcman, 2013; Schekkerman, 2008; Spewak and Hill, 1992), individual gurus (Bernard, 2012; Boar, 1999; Carbone, 2004; Longepe, 2003; Niemann, 2006; Theuerkorn, 2004; Zachman, 1987), and industry consortia (TOGAF, 2018), or are inspired by these networks (Armour et al., 1999; FEAF, 1999; TAFIM, 1996). The practical applicability and effectiveness of these approaches were implicitly assumed, but never explicitly proven with evidence. For instance, regarding the Zachman Framework, which is considered by some authors as seminal for the entire EA discipline (Simon et al., 2013), Ylimaki and Halttunen (2006) concluded that "there is a lack of scientific studies on the application of the Zachman framework—and analyzing its applicability—in practice" (p. 190). Similar observations have also been made regarding TOGAF: "There is a pressing need for some detailed worked examples and use cases. Although these were requested, they were not forthcoming from TOGAF trainers or The Open Group" (Anderson et al., 2009: 66). The later comprehensive EA literature review (Kotusev, 2017c) confirmed these conclusions and made analogous observations regarding other popular EA frameworks as well.

On the other hand, negative evidence against popular EA frameworks is abundant (Kotusev, 2018a). For example, case studies demonstrate that the Zachman Framework was not found helpful by EA practitioners (Buckl et al., 2009a; Janssen and Hjort-Madsen, 2007). Attempts to implement DoDAF wasted up to US$400 million in the Department of Defense (U.S. Government Accountability Office (U.S. GAO), 2004, 2005, 2013, 2015): "Hundreds of millions of dollars had been spent on a business enterprise architecture (BEA) that had limited use" (U.S. GAO, 2007: 1–2). FEAF wasted up to US$1 billion dollars in the US Federal Government (U.S. GAO, 2011): "Literally more than a billion dollars have been spent so far on Enterprise Architecture by the federal government, and much, if not most of it has been wasted" (Gaver, 2010: 52). Lohe and Legner (2014) report that the attempts to follow the prescriptions of EA frameworks in organizations lead to significant practical problems. Buckl et al. (2009a) conclude that EA frameworks "appear theoretical and impossible to implement" (p. 15). Unsurprisingly, recent case studies demonstrate that EA frameworks are either not used in organizations at all (Fallmyr and Bygstad, 2014; Haki et al., 2012; Kotusev et al., 2016; Molnar and Proper, 2013), or used purely declaratively (Kotusev, 2018c; Kotusev et al., 2020; Smith et al., 2012). Obvious inconsistencies between the "promises" of EA frameworks and realities of their practical implementation are also noticed by reflective EA practitioners:

> Let's face our own inconvenient truth: enterprise architecture doesn't really work the way we have assumed for thirty years it would. (Wierda, 2015: 31)

> For a subject that is over thirty years old, there is pretty little empirical proof that any of the proposed methods of frameworks actually work. (Wierda, 2015: 65)

> Most EA methods and frameworks claim that [their prescriptions] can be applied to the development of an EA for an entire organization, but attempts to develop architecture on this scope routinely fail. (Trionfi, 2016: 40)

All these observations suggest that the EA discipline has suffered from an uncritical acceptance of faddish ideas promoted by fashion-setters without their appropriate empirical validation. In fact, modern step-by-step EA methodologies closely resemble all previous information systems planning approaches, including IBM's BSP (1975, 1984), Arthur Andersen's Method/1 (Arthur Andersen, 1979, 1987), James Martin's Strategic Data Planning (Martin, 1982; Martin and Leben, 1989) and Information Engineering (Arthur Young, 1987; Davids, 1992; Finkelstein, 1989), and the first EA methodology Enterprise Architecture Planning (EAP) (Spewak and Hill, 1992: 53) even explicitly acknowledged its origination from these approaches: "EAP has its roots in IBM's BSP. Strategic Data Planning, Information Engineering, [. . .] have also contributed techniques and ideas to EAP." However, all these pre-EA methodologies also proved their practical ineffectiveness (Beynon-Davies, 1994; Goodhue et al., 1988, 1992; Kotusev, 2018d; Lederer and Sethi, 1988; Periasamy, 1994; Shanks, 1997) and faded away like all management fashions.

The theory of management fashions can be considered as the key theory for understanding the curious situation that can be observed in the EA discipline today, which is manifested in considerable discrepancies between the mainstream EA literature and practice. Although these inconsistencies have been reported earlier by many researchers (Haki et al., 2012; Holst and Steensen, 2011; Niemi and Pekkola, 2017; Tanigawa, 2004; Ylimaki and Halttunen, 2006), no explanations regarding the underlying root cause of these differences have been provided. The unique perspective on the diffusion of inefficient managerial innovations offered by the management fashion theory helps explain the wide presence of unmotivated beliefs on the practical value, utility and importance of popular EA frameworks disseminated by commercially motivated fashion-setters. Being aggressively promoted, these EA frameworks create a deceptive illusion of understanding an EA practice in great detail including its artifacts, activities, steps, and maturity, though their prescriptions actually never proved practical and even discredited themselves in industry long ago.

Generally, the tendency of academic researchers to enthusiastically embrace management fashions without appropriate skepticism has been noticed earlier, for instance, by Aldag (1997): "[Management fashions], in fact, often are seen [by academics] as self-evidently correct, somehow above the need for empirical proof" (p. 13).

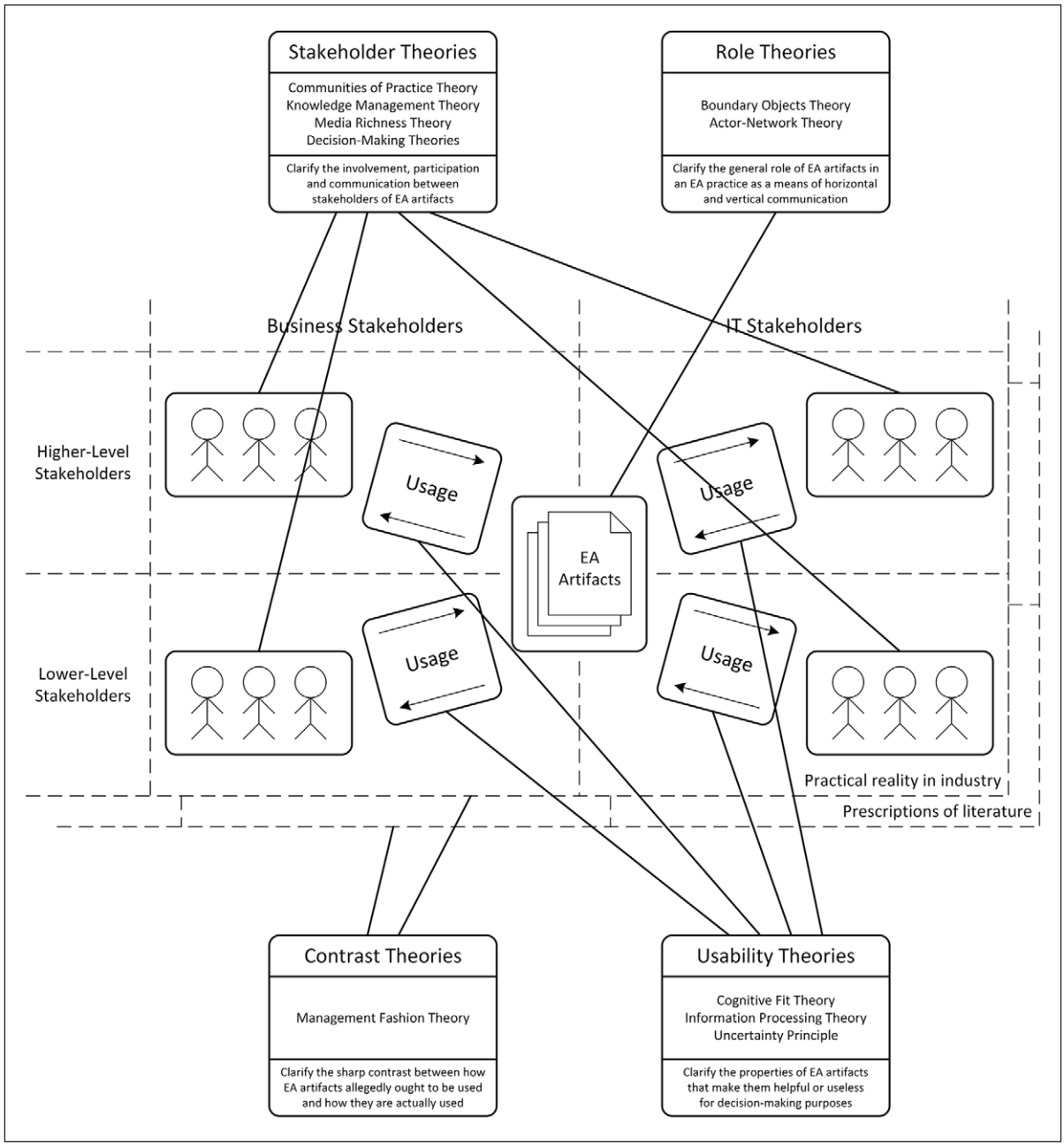

Figure 2. The reference model of an EA practice with the 10 relevant theories.

Donaldson and Hilmer (1998) argue that "faddism in management studies has created an impediment to greater intellectual productivity by allowing unproven and incorrect ideas to go unchallenged" (p. 18).

Summary of the 10 identified theories

The 10 theories discussed above explain the meaning of the complex organizational phenomenon of an EA practice. Unlike most other theories leveraged previously in the EA discipline (see Table 7 in Appendix A), these theories focus on the very essence of an EA practice, that is, creation and usage of EA artifacts by various organizational actors for communication and decision-making purposes. The schematic reference model of an EA practice explained earlier (see Figure 1) with the 10 identified theories related to the key elements of an EA practice is shown in Figure 2.

Due to their immediate relevance to the practical usage of EA artifacts for communication and decision-making purposes in organizations (see Figure 2), the 10 identified theories can arguably be considered as core theories for the entire EA discipline. However, in the current academic EA literature these theories are either mentioned only superficially

Table 3. Summary of the identified theories, their proximity and manifestations.

Theory	Meaning of the theory	Proximity to the core	Practical manifestations
Boundary objects theory	Boundary objects meaningful to diverse social communities facilitate communication between these communities	Views EA artifacts as boundary objects between business and IT communities	Most EA artifacts are used as instruments for communication between business and IT stakeholders
Actor-network theory	Human actors inscribe their interests in inanimate objects, which then represent these interests for them in actor-networks	Views EA artifacts as elements of an actor-network into which human interests are inscribed	EA artifacts tend to represent the interests of their creators without their physical presence
Cognitive fit theory	Cognitive fit between the mental representations of tasks and information presentation formats increases problem-solving performance	Addresses the relationship between the presentation formats and use cases of EA artifacts	Presentation formats of EA artifacts closely correlate with their usage scenarios
Information processing theory	Information processing capacity of people is limited to memorizing and processing only about 5–9 distinct chunks of information simultaneously	Addresses the relationship between complexity and usability of EA artifacts	All EA artifacts intended for decision-making purposes have limited numbers of elements often organized hierarchically
Uncertainty principle	Organizations can be planned either for wider scopes and longer horizons in less detail, or for narrower scopes and shorter horizons in more detail	Addresses the relationship between the abstractness of EA artifacts, scopes and planning horizons	All EA artifacts intended for global long-range planning are very abstract, and vice versa
Communities of practice	Organizations can be viewed as configurations of diverse but interacting communities of practice	Addresses the overall stakeholder context in which EA artifacts are used	Communication between different stakeholder groups involves both EA artifacts and direct contacts
Knowledge management theory	Explicit and tacit knowledge require different management strategies and systems	Addresses the degree of direct stakeholder involvement required for using EA artifacts	All EA artifacts reflecting tacit knowledge are discussed with their stakeholders
Media richness theory	Necessary media richness directly correlates with the equivocality of conveyed messages	Addresses the selection of suitable communication approaches required for using EA artifacts	All EA artifacts that imply equivocality are discussed during face-to-face meetings
Decision-making theories	Most importantly, decision implementers should participate in its formulation (among many others)	Addresses the need for stakeholder participation in the development of EA artifacts	All EA artifacts defining the future course of action are developed collaboratively
Management fashion theory	Inefficient management innovations can be temporarily adopted by organizations when promoted by fashion-setters	Addresses the gap between the prescribed and actual usage of EA artifacts	Prescriptions of popular EA frameworks are ignored, even if their usage is declared

EA: Enterprise architecture; IT: Information Technology.

and not considered as central to the EA discipline, or not mentioned at all (see Table 7 in Appendix A). The 10 identified theories, their general meaning, proximity to the core of an EA practice, and observable practical manifestations are summarized in Table 3.

The 10 identified theories also have a considerable capacity to accurately describe what works in practice, explain why it works in the way it does, predict what may work hypothetically, and formulate actionable recommendations for EA practitioners. The 10 identified theories and their analytical, explanatory, predictive, and prescriptive potential are summarized in Table 4.

An understanding of the relevance (see Table 3) and theoretical power (see Table 4) of the 10 identified theories allows contrasting their deserved positions in the EA discipline with their current status in the literature (see Table 7 in Appendix A). The 10 identified theories and their deserved and current places in the EA discipline are summarized in Table 5.

Discussion of findings

This article was intended to answer the following research question: "What theories can be considered as the basis of the EA discipline?" Based on the observations gained from our previous in-depth empirical studies of EA practices in multiple organizations (Kotusev, 2018c, 2019a; Kotusev et al., 2017) and the analysis of the common theories relevant to IS research (Larsen et al., 2015), we identified 10 theories that can be considered as the theoretical foundation of the EA discipline (see Figure 2). These theories are directly related to the core of an EA practice (i.e. to the

Table 4. Summary of the identified theories and their theoretical potential.

Theory	Analytical	Explanatory	Predictive	Prescriptive
Boundary objects theory	Describes the usage of EA artifacts for communication between business and IT stakeholders	Explains the value of EA artifacts through their boundary-spanning capacity	May predict which informational contents can span communication boundaries	Can help formulate certain guidelines for creating boundary-spanning EA artifacts
Actor-network theory	Describes the usage of EA artifacts for communication between different organizational levels	Explains the value of EA artifacts through their ability to protect the inscribed interests	May predict the situations where high-level decisions are not translated downwards	Can help formulate certain guidelines for establishing uninterrupted translation networks
Cognitive fit theory	Describes what presentation formats in EA artifacts are suitable for different tasks	Explains the correlation between formats and tasks through the notion of cognitive fit	May predict which formats can be suitable or unsuitable for different tasks	Can help formulate certain guidelines for the selection of best presentation formats
Information processing theory	Describes the fact that complex EA artifacts are not used for decision-making purposes	Explains the uselessness of complex EA artifacts by inherent limitations of the human brain	May predict which EA artifacts can be suitable or unsuitable for decision-making	Can help formulate certain guidelines for the creation of simple EA artifacts for decision-making
Uncertainty principle	Describes the fact that global, long-term planning is supported by very abstract EA artifacts	Explains the inability to plan the future in detail by the inherent uncertainty of the environment	May predict which granularity can be appropriate for specific scopes and planning horizons	Can help formulate certain guidelines for EA artifacts intended for specific scopes and horizons
Communities of practice	Describes the place and usage of EA artifacts in the organizational social landscape	Explains both the necessity of using EA artifacts and their futility without personal contacts	May predict the need for using EA artifacts at the boundaries between communities	Can help formulate certain guidelines for effective inter-community communication
Knowledge management theory	Describes different usage of EA artifacts capturing IT landscapes and business visions	Explains different usage through the difference between explicit and tacit knowledge	May predict which usage scenarios of EA artifacts can potentially work in practice	Can help formulate certain guidelines for the usage of different types of EA artifacts
Media richness theory	Describes different communication patterns for EA artifacts reflecting opinions and facts	Explains different patterns through different requirements to media richness	May predict which communication medium can be appropriate for specific EA artifacts	Can help formulate certain guidelines for communicating around different types of EA artifacts
Decision-making theories	Describe the participation of stakeholders in the creation of future-focused EA artifacts	Explain the need for participation by the reluctance of people to execute plans created by others	May predict the problems with the implementation of plans reflected in EA artifacts	Can help formulate certain guidelines for the creation of EA artifacts defining the course of action
Management fashion theory	Describes dramatic differences between recommended and actual usage of EA artifacts	Explains the flood of impractical recommendations as management fashions	May predict the problems with the attempts to follow prescriptions of EA frameworks	Can help formulate certain guidelines for dealing with faddish EA-related prescriptions

EA: Enterprise architecture; IT: Information Technology.

creation and usage of EA artifacts for communication and decision-making) and have evident practical manifestations in organizations (see Table 3). These theories also have considerable analytical, explanatory, predictive, prescriptive potential, and therefore, offer powerful theoretical lenses for understanding an EA practice (see Table 4). For these reasons, the 10 identified theories arguably deserve to occupy the central place in the EA discourse, as opposed to the marginal role that these theories play now (see Table 5). By bringing these theories to light, this article makes a significant theoretical and practical contribution to the EA discipline.

Theoretical contribution

The 10 theories discussed in this article open plenty of opportunities for future interpretations of an EA practice and its core activities. Each of these theories offers a solid

Table 5. Summary of the identified theories and their places in the EA discipline.

Category	Theory	Deserved place in the EA discipline	Current place
Role theories	Boundary objects theory	The core theory of the entire EA discipline, explains how EA artifacts bridge the horizontal communication gap between business and IT	Leveraged by one group of authors and only in relation to enterprise transformations
	Actor-network theory	The key theory for understanding vertical communications, explains how higher-level EA artifacts shape lower-level decisions	Leveraged by one group of authors and only hypothetically
Usability theories	Cognitive fit theory	The central theory for understanding the usability of EA artifacts, explains why EA artifacts are able to facilitate decision-making	Essentially not leveraged in the EA discipline
	Information processing theory	The theory important for understanding the usability of EA artifacts, explains why EA artifacts may be unable to facilitate decision-making	Not leveraged in the EA discipline at all
	Uncertainty principle	The principle important for understanding the utility of EA artifacts, explains why granularity and scope of EA artifacts correlate with their planning horizons	Not even clearly formulated in the EA discipline
Stakeholder theories	Communities of practice	The key theory for understanding the ways of connecting different stakeholder groups, explains why EA artifacts are necessary but insufficient for this purpose	Leveraged only in one publication
	Knowledge management theory	The critical theory for understanding the usage of EA artifacts, explains the level of direct stakeholder involvement in an EA practice	Leveraged by only one group of authors
	Media richness theory	The critical theory for understanding the usage of EA artifacts, explains the selection of communication approaches in an EA practice	Not leveraged in the EA discipline at all
	Decision-making theories	The critical theories for understanding the usage of EA artifacts, explain the participation of stakeholders in developing EA artifacts defining the future	Essentially not leveraged in the EA discipline
Contrast theories	Management fashion theory	The key theory for understanding the overall situation in the EA discipline, explains the existence of critical differences between popular EA literature and practice in relation to EA artifacts and their use	Essentially not leveraged in the EA discipline

EA: Enterprise architecture; IT: Information Technology.

theoretical lens leveraging the knowledge accumulated previously in other mature scientific disciplines, such as psychology, sociology, and organizational behavior, through which a fruitful analysis of EA artifacts and their practical usage can be produced. For this reason, the set of theories identified in this article can guide future EA research in selecting the most appropriate theoretical lenses according to the study focus (e.g. EA artifacts, their usability, or EA stakeholders; see Figure 2) and integrating multiple different theoretical perspectives together to provide a more holistic and multifaceted view of an EA practice.

Based on a sound theoretical foundation offered by the 10 identified theories, future EA scholars can benefit from having more accurate descriptions of the observed phenomena as well as from reaching deeper conceptual explanations of their underlying reasons. Due to their considerable predictive potential (see Table 4), all these theories can also be used as the basis for formulating testable theoretical propositions regarding the usage of EA artifacts that can be verified with quantitative means, for example, via structured surveys. Furthermore, each of these theories asks a number of new questions in the EA discipline the critical importance of which becomes evident from the perspective of respective theoretical lenses.

Specifically, the boundary objects theory interprets EA artifacts as boundary objects between diverse business and IT communities and, therefore, raises many important questions regarding their desirable informational contents and other related properties. By the present moment, no empirical analysis of EA artifacts from the perspective of their informational contents and respective boundary-spanning capacity has been conducted. Although some analysis of the properties of EA artifacts as boundary objects in enterprise transformations had been already undertaken (Abraham, 2013, 2018), this analysis cannot be considered as sufficient, taking into account the pivotal role of the concept of boundary objects in an EA practice, as demonstrated above.

The actor-network theory interprets an EA practice as a complex network of EA stakeholders and EA artifacts connected by the interests inscription and interests representation relationships and, therefore, raises many important questions regarding the structure of this network. Although some hypothetical discussion of an EA practice as an actor-network has

been provided (Sidorova and Kappelman, 2010, 2011a), no empirical studies have been conducted to analyze an EA practice as an actor-network in-depth. For this reason, the topology of a typical actor-network representing an EA practice still remains unclear.

The cognitive fit theory suggests that the information presentation formats in EA artifacts should match cognitively to the nature of problems and decisions these artifacts are intended to address and, therefore, raises many important questions regarding the most convenient presentation formats suitable for different types of decisions and problems in the context of an EA practice. However, to the best of the authors' knowledge, no such studies have ever been undertaken in the EA discipline.

The information processing theory suggests that excessive complexity of EA artifacts makes them essentially unsuitable for decision-making purposes due to the inherent limitations of the human brain and, therefore, raises many important questions regarding the relative criticality of different information included in EA artifacts as well as regarding the practical ways of decreasing their complexity without reducing their information richness. However, no studies addressing these and other similar questions related to the complexity of EA artifacts have been attempted.

The uncertainty principle suggests that the level of granularity in EA artifacts should correspond to their organizational scopes and planning horizons due to the inherent environmental uncertainty and, therefore, raises many important questions regarding the appropriateness of different abstractions for planning specific scopes and time horizons. For example, it is not clear from the current EA literature which abstractions and notions may be most helpful for planning the future up to 5 years ahead, 3 years ahead, and 1 year ahead. However, to the best of the authors' knowledge, such analysis was never undertaken in the EA discipline.

The communities of practice theory views an EA practice as a social configuration of diverse communities of practice and suggests that these communities need both personal interaction and EA artifacts as boundary objects to establish inter-community communication. Moreover, the community of architects, as a boundary practice, can be considered as the link between other communities. Therefore, this theory raises many important questions on various aspects of communities involved in an EA practice and especially on cross-boundary knowledge transfer and organizational learning. However, the available analysis of an EA practice from the perspective of communities of practice is very scarce (Dale and Scheepers, 2020), it barely covers these areas and leaves much to be desired.

The knowledge management theory interprets an EA practice as a knowledge management activity and suggests that not all knowledge can be codified and documented in EA artifacts, while tacit knowledge requires other knowledge management strategies based on knowledge maps and personalization of knowledge. Therefore, this theory raises many important questions regarding the proper balance between explicit and tacit knowledge in the context of an EA practice as well as regarding the practical ways of identifying and involving relevant stakeholders possessing required knowledge in discussions of EA artifacts. However, the available EA literature offers only a rather superficial analysis of an EA practice from the perspective of knowledge management that does not address any of these questions (Buckl et al., 2009c; Struck et al., 2010).

The media richness theory suggests that EA artifacts of different equivocality require different communication media ensuring sufficient richness of information and, therefore, raises many important questions regarding the most appropriate approaches for dealing with different types of EA artifacts in organizations. However, no efforts focused specifically on analyzing communication approaches in the context of an EA practice have been undertaken in the EA discipline.

The decision-making theories interpret the creation of EA artifacts defining the future course of action as organizational decision-making processes and suggest that their development requires collective participation. Therefore, this theory raises many important questions regarding the stakeholder participation in EA-related processes, for example, who should participate, when the participation is required, and how exactly this participation should be organized. However, to the best of the authors' knowledge, none of these questions has meaningful answers in the existing EA literature or attracted significant attention among EA scholars.

Finally, the management fashion theory interprets widely known EA frameworks advocating impractical ways of using EA artifacts (e.g. TOGAF, FEAF, and DoDAF) as typical management fashions promoted by fashion-setting networks and, therefore, raises many important questions regarding the relationship between the current EA literature and actual industry practice. However, the faddish nature of popular EA frameworks is arguably still not widely recognized in the EA research community and the differences between the assumed and actual usage of EA artifacts still remain insufficiently understood.

Practical contribution

The 10 theories discussed in this article (see Figure 2) have been identified, among other factors (see Table 2), based on their theoretical power including their prescriptive potential, that is, for their ability to offer concrete actionable recommendations for EA practitioners (see Table 4). Consequently, each of these theories has certain articulate implications for practicing architects and can provide rather specific guidance regarding the usage of EA artifacts that can help establish successful EA practices in organizations. Basic guidelines for EA practitioners derived from the suggestions of the ten theories discussed in this article are provided in Table 6.

Table 6. Basic guidelines for EA practitioners.

Theory	Theoretical suggestions	Resulting guidelines for EA practitioners
Boundary objects theory	EA artifacts should represent true boundary objects	Create EA artifacts providing relevant information to all their business and IT stakeholders, addressing their needs and helping align their interests
Actor-network theory	An actor-network of an EA practice should have no breaches in its fabric, that is, all the stakeholder interests inscribed in EA artifacts should be protected	Establish concrete enforcement mechanisms (e.g. formal governance, peer review or direct supervision) for all EA artifacts reflecting certain planning decisions to ensure that these decisions are taken into account during decision-making processes somewhere at lower organizational levels
Cognitive fit theory	EA artifacts should be designed with an intention to achieve a cognitive fit	Align the information presentation format and structure of EA artifacts to the nature of tasks, problems and decisions that these artifacts are intended to support, make sure that their format is convenient for decision-makers
Information processing theory	Complexity of EA artifacts should not exceed the information processing capacity of average individuals	Simplify all EA artifacts intended for decision-making purposes, focus only on the most essential information critical for decision-makers, organize information hierarchically with only a limited number of significant elements at each level of the hierarchy
Uncertainty principle	Granularity of EA artifacts should correlate with the associated level of uncertainly	Develop EA artifacts using adequate abstractions appropriate for the affected organizational scopes and planning horizons, avoid attempts to describe the distant future in every detail
Communities of practice	Both personal contacts as brokering and EA artifacts as boundary objects should be used to link different communities of practice	Establish periodical meetings engaging representatives of different groups of stakeholders and also design complementary EA artifacts to facilitate these meetings, but avoid overreliance only on one of these two approaches
Knowledge management theory	Tacit knowledge should be sought directly from its possessors and there should not be any attempts to record or obtain it from EA artifacts	Do not try to document everything in EA artifacts and do not expect to find all the necessary knowledge there, in complex situations and questions seek direct conversations with competent people, include in EA artifacts the lists of their contributors so that these people can be easily identified and contacted when necessary
Media richness theory	Rich communication media should be used for working with EA artifacts of high equivocality	Seek direct face-to-face meetings with relevant stakeholders for developing EA artifacts that imply significant planning decisions to minimize the chance of misunderstanding, avoid attempts to discuss the desired future via electronic communication media, for example, emails, corporate portals, wikis, and chats
Decision-making theories	Creation of EA artifacts reflecting future plans should involve their executors	Involve all their stakeholders into the development processes of EA artifacts defining the future course of action, avoid attempts to make planning decisions on behalf of their real stakeholders
Management fashion theory	Proliferation of mainstream ideas on EA is driven by fashion, rather than by their rationality, and these ideas thus should be ignored	Understand that all prescriptive step-by-step EA methodologies and popular EA frameworks is only a management fashion actively promoted by fashion-setters, do not try to implement their recommendations in practice, seek realistic information on EA from limited evidence-based sources (Ahlemann et al., 2012; Kotusev, 2018b; Murer et al., 2011; Ross et al., 2006; Wagter et al., 2005; Wierda, 2015)

EA: Enterprise architecture; IT: Information Technology.

Guidelines regarding the practical usage of EA artifacts provided in Table 6 can be considered as complementary to the guidelines regarding the integration of the usage of EA artifacts into regular organizational processes formulated earlier by Lohe and Legner (2014: 120–131).

Conclusion

The EA discipline was traditionally considered as atheoretical in nature (Al-Kharusi et al., 2017; Langenberg and Wegmann, 2004; Schoenherr, 2008; Weiss et al., 2012), while the vast majority of theories leveraged previously by EA researchers (see Table 7 in Appendix A) are largely irrelevant to the essence of an EA practice, that is, to the creation and usage of EA artifacts for communication between stakeholders and decision-making (see Figure 1). Hence, the EA discipline essentially lacks a sound theoretical basis. In this article, we identified 10 theories that can be considered as key for the EA discipline (see Figure 2). Taken together, these theories can provide a solid theoretical foundation for future EA research.

Limitations of this study

Our study has a number of limitations that should be explicitly acknowledged and clearly understood. These limitations relate to (1) the scope of this study and (2) the research process that was followed to identify relevant theories.

Scope of the study. As noted earlier, the intention of this study was to identify theories addressing specifically the core of an EA practice, that is, creation and usage of EA artifacts for communication and decision-making. However, the EA discipline represents an incredibly broad and multifaceted area of research encompassing very diverse EA-related questions. For example, Kotusev (2017c) identified 11 general themes and 42 more narrow topics discussed in the EA literature and these topics include, among others, such disparate subjects as benefits and cultural aspects of using EA, organization of EA repositories, and automated creation of EA documentation, initiation, acceptance, and maturity of EA practices, structure of EA functions in organizations, profession of architects and EA education, as well as the relationship between EA and other management practices (e.g. outsourcing and IT service management) and technologies (e.g. cloud and SOA). In this light, the questions related to the use of EA artifacts by EA stakeholders, though can be viewed as focal to the EA discipline, are certainly not all questions relevant to it; they do not cover the EA discipline in its entirety. In other words, the EA discipline is much broader in its scope and diversity than the questions analyzed in this study.

While our study concentrated on the questions "central" to the EA discipline, all of its multifarious "peripheral" questions (e.g. EA value realization, responsibilities of architects, institutionalization of EA practices, and their integration with other organizational processes, to name a few) remained out of the scope and escaped our analysis. These questions deserve separate investigation and are likely to need their own relevant theories. For example, the institutional theory can be very appropriate and is actually used by multiple authors for analyzing the process of establishing EA practices in organizations (see Table 7 in Appendix A). Consequently, our exclusive focus on the core of an EA practice represents an obvious limitation of this study.

Identification of relevant theories. The research process that we followed in this study to identify relevant theories also has a number of limitations related to (1) the definition of theory, (2) the search for relevant theories, and (3) the overall subjectivity of their evaluation. First, there is arguably no consensus that exists among researchers on what exactly should be regarded as a "theory." On one hand, some authors name various conceptual lenses utilized in their studies as "theories," for example, theory of exit, voice, and loyalty (Hylving and Bygstad, 2018, 2019). Similarly, Al-Kharusi et al. (2017) consider analytic hierarchy process (Bakar et al., 2016), chain model (Hauder et al., 2013a), and enterprise transformation (Chuang and van Loggerenberg, 2010) as "theories" used in EA research, while we did not consider any of these notions as full-fledged theories during our analysis. For this reason, some ideas, concepts, or models considered as "theories" by other authors might have remained unnoticed or unrecognized during our analysis.[7] On the other hand, some theories can be viewed as elements of hierarchies of related theories, where "grander" theories underpin multiple narrower theories. For example, the theory of rational choice (March and Simon, 1993), the theory of bounded rationality (Simon, 1997), the theory of power (Pfeffer, 1981), and the garbage can theory (Cohen et al., 1972) all represent constituents of a more general theory of decision-making in organizations (March, 1994). Likewise, the SECI (socialization, externalization, combination, internalization) model of knowledge creation (Nonaka, 1994) can be considered as a sub-theory of the overarching theory of knowledge management. For this reason, the choice of the right level and "granularity" of theories can always be debatable. This uncertainty around what can or should be regarded as a theory represents an inherent limitation of this study.

Second, there are no exhaustive lists of theories or any other perfect sources where relevant theories can be searched. On one hand, the list of widely acknowledged theories in IS research maintained by Larsen et al. (2015) is evidently incomplete as it does not include some of the theories used in EA research, for example, viable system model (Buckl et al., 2010; Kandjani and Bernus, 2012; Kandjani et al., 2013; Zadeh et al., 2014) and communities of practice (Dale and Scheepers, 2020), and even some of the theories used in IS research, for example, the theory of sociomateriality (Cecez-Kecmanovic et al., 2014a). For this reason, it cannot be taken as a definitive list or the only source of theories (at the same time, no other lists exist on the subject). On the other hand, theories utilized in other organizational disciplines (e.g. marketing, accounting, social psychology, and organizational behavior) can also be potentially relevant to the EA discipline, but their search will require studying essentially all the available management literature and is arguably practically unrealizable. The lack of definitive sources of theories to be searched and potential incompleteness of every search effort represents another limitation of this study.

Finally, since the relevance and potential of a theory cannot be evaluated with any objective means, the presence of a certain subjective bias in our selection of theories cannot be avoided. Although we explicitly provided a complete list of considered theories (see Table 8 in Appendix B), formulated the adopted set of criteria for assessing theories for their relevance to the EA discipline (see Table 2),

and provided our argumentation, the choice of the 10 resulting theories may not be indisputable. Therefore, the overall subjectivity of theories' evaluation also represents a limitation of this study.

Direction for future research

Each of the 10 theories discussed in this article deserves further elaboration in the EA discipline. Moreover, since all these theories relate to the very essence of an EA practice, it would be arguably fair to say that until the questions provoked by these theories have no definite answers in the EA literature, the phenomenon of an EA practice cannot be considered as sufficiently understood. At the same time, developing meaningful views and comprehensive interpretations of an EA practice from the perspective of each of these theories can enrich our theoretical understanding of EA and eventually turn it into a mature academic discipline. For this reason, developing such interpretations can be considered as an important direction for future theoretical research in the EA discipline.

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Notes

1. The properties of a "good" theory are persistently debated in the literature for decades and there is still no single widely accepted set of quality criteria for theories (Christensen and Raynor, 2003; Gregor, 2006; Mueller and Urbach, 2013; Rivard, 2014; Sutton and Staw, 1995; Van de Ven, 1989; Weber, 2003; Weick, 1989; Whetten, 1989). However, we believe that the taxonomy proposed by Gregor (2006) offers the most powerful framework for assessing theories. This taxonomy is used here and further in this article to evaluate the potential of theories in relation to an EA practice.
2. The relationship between theory and practice is also persistently debated in the literature for decades and the ability of theory to inform practice has been periodically questioned (Alvesson et al., 2017; Benbasat and Zmud, 1999; Buckley et al., 1998; Churchman and Schainblatt, 1965; Dennis, 2019; Dyckman, 1967; Gill and Bhattacherjee, 2009; Grayson, 1973; Hirschheim, 2019; Kock et al., 2002; Latham, 2007; Moody, 2000; Oviatt and Miller, 1989). Nevertheless, we believe that each of the theories identified in this article *can* inform practice (e.g. explain practical successes and failures), which is substantiated by the quotes from the industry EA literature provided in the respective sections and aligned with the corresponding theoretical suggestions.
3. The proposed classification into role, usability, stakeholder, and contrast theories represents an attempt to organize the 10 identified theories and fit them into some logical structure. Although this classification is rather loose, imperfect, and partly subjective, the alternative approach would be only to present the identified theories as an unstructured list.
4. Since actor-networks encompass both people (EA stakeholders) and inanimate objects (EA artifacts), the actor-network theory can be equally related to both role and stakeholder theories. However, it is EA artifacts, not people, that represent distinguishing elements of an EA practice which roles should be better understood. For this reason, the actor-network theory has been allocated specifically to roles theories.
5. Business and the IT alignment literature generally deals with very high-level concepts (e.g. structural, functional, and temporal alignment), but barely explains how exactly the alignment is operationalized at the "micro" level of specific actors, documents, and decisions (Chan and Reich, 2007; Coltman et al., 2015; Karpovsky and Galliers, 2015; Negoita et al., 2013; Sabherwal et al., 2001). For example, Negoita et al. (2013) noticed that "beyond studies related to the importance of strategic alignment [. . .] as well as establishing a number of enablers and inhibitors, there is a paucity of research on how organizations actually achieve strategic alignment" (p. 1) and even added that "essentially we do not know how it is achieved" (p. 3). Likewise, Karpovsky and Galliers (2015) argued that "we still know little about what it is that organizational actors actually do, on a day-to-day basis, to align IS and related concerns with business imperatives" (p. 136). Consequently, the discussion of EA artifacts as boundary objects enabling alignment provided here complements the "macro" view of business and IT alignment offered in the respective literature and represents one of the practical mechanisms for operationalizing alignment in organizations.
6. Since its emergence in the 1980s, the media richness theory has been questioned by some authors (Suh, 1999) and a number of attempts have been made to refine the theory in light of new electronic communication technologies (D'ambra et al., 1998; Dennis et al., 1998; Rice and Shook, 1990). However, recent studies of managerial work and communication patterns in organizations suggest that the fundamental premises of the media richness theory have not been significantly affected by new communication media, and remain unchanged and valid. For example, the findings of Pentland (2012) repeat this theory almost verbatim: "The most valuable form of communication is face-to-face. The next most valuable is by phone or videoconference, but with a caveat: Those technologies become less effective as more people participate in the call or conference. The least valuable forms of communication are e-mail and texting" (p. 65). Likewise, Mintzberg (2009) concludes that the nature of managerial work did not change with the emergence of electronic communication technologies and managers still rely primarily on face-to-face meetings for equivocal tasks, in the same way as before. Besides that, validity of the core ideas of the media richness theory is also confirmed by our own empirical observations on the usage of EA artifacts in organizations (see Table 1).

7. Since most, if not all, submissions to the leading academic IS journals are expected to make a strong theoretical contribution, the findings of virtually every article that appears in those journals can be considered as a "bigger" or "smaller" theory. For this reason, strict and objective boundaries of theory suitable for the purposes of this study are fundamentally impossible to define.

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Appendix A

Theories used in EA research

This appendix provides an exhaustive list of 32 theories used in EA research. These theories have been identified based on a comprehensive EA literature review conducted by the first author (Kotusev, 2017c) and other studies that analyzed actual or potential utilization of theories in the EA discipline (Al-Kharusi et al., 2017; Schilling, 2018; Syynimaa, 2017; Weiss et al., 2012). The most articulate theories used or proposed to be used in EA research are listed in alphabetical order with relevant explanations in Table 7.

Table 7. Theories used in EA research.

Theory	Proposals to use	Actual usage	How it is applied in relation to EA
Actor-network theory (ANT)	Weiss et al. (2012)	Sidorova and Kappelman (2010), Sidorova and Kappelman (2011a) and Sidorova and Kappelman (2011b)	Interprets an EA practice as an actor-network where actors inscribe their interests in EA artifacts
Administrative behavior theory	Weiss et al. (2012)		An EA practice can push the limits of rationality in decision-making
Agency theory	Weiss et al. (2012)		Posits that an EA practice can mitigate principal-agent problems
Archetype theory		Haki and Legner (2013)	Posits that architectural adaptation can be structured in different archetypes
Boundary objects theory		Abraham (2013), Abraham et al. (2013), Abraham et al. (2015) and Abraham (2018)	Views EA artifacts as boundary objects helping overcome knowledge boundaries during enterprise transformations
Chaos theory		Saat et al. (2009)	Views the dynamics of EA planning essentially as chaotic in nature
Cognitive load theory	Weiss et al. (2012)		An EA practice can be considered as a means for optimizing cognitive load for managers
Communities of practice theory		Dale and Scheepers (2020)	Interprets different groups of EA stakeholders as communities of practice
Complex adaptive systems theory		Janssen and Kuk (2006), Schilling et al. (2017) and Haki et al. (2020)	Posits the complex and adaptive character of IT architecture
Contingency theory	Weiss et al. (2012)	Leppanen et al. (2007), Riege and Aier (2008), Lahrmann et al. (2010), Aier et al. (2011) and Haki et al. (2012)	Posits that there is no single "best" way to organize an EA practice
Diffusion of innovations theory	Weiss et al. (2012)		Posits that EA can ease and facilitate technology adoption
Dominant design theory		Bui et al. (2015)	Helps explain the EA adoption patterns across the industry
Dynamic capabilities theory	Weiss et al. (2012)	Abraham et al. (2012), van de Wetering (2019a) and van de Wetering (2019b)	An EA practice itself can be considered as a dynamic capability
Game theory		Abraham and Aier (2012)	Interprets coordination in an EA practice as a game
General systems theory (GST)	Weiss et al. (2012) and Syynimaa (2017)	Kloeckner and Birkmeier (2009) and Hoyland (2011)	Views an enterprise as a complex interrelated system of systems, or as multiple parts forming a whole
Institutional theory	Weiss et al. (2012)	Hjort-Madsen (2006), Hjort-Madsen and Burkard (2006), Hjort-Madsen (2007), Aier and Weiss (2012), Weiss and Winter (2012), Weiss et al. (2013), Dang and Pekkola (2016), Bui and Levy (2017), Dang (2017), Dang and Pekkola (2017), Ajer (2018), Ajer and Olsen (2018), Brosius et al. (2018), Dang (2019), Dang and Pekkola (2020) and Levy and Bui (2019)	Interprets the establishment of an EA practice in an organization as a process of gradual institutionalization
IS success model		Niemi and Pekkola (2009), Lange et al. (2012a), Lange et al. (2012b) and Lange et al. (2016)	Offers a basis for measuring the success of an EA practice
Knowledge management theory		Buckl et al. (2009c) and Struck et al. (2010)	Views an EA practice as a way of managing knowledge
Living systems theory		Wegmann and Preiss (2003)	Views an enterprise as a multilevel hierarchical living system for the purposes of modeling
Management fashion theory		Hjort-Madsen and Pries-Heje (2009)	Questions whether the adoption of EA in governmental organizations is only a temporary fad
Morphogenetic theory		Alwadain et al. (2013b), Alwadain et al. (2013a), Alwadain et al. (2014) and Alwadain et al. (2016)	Interprets the process of EA evolution in organizations as morphogenetic cycles

(Continued)

Table 7. (Continued)

Theory	Proposals to use	Actual usage	How it is applied in relation to EA
Normalized systems theory		Huysmans and Verelst (2013)	Lessons from the normalized systems theory can be used to improve EA frameworks
Organizational information processing theory	Weiss et al. (2012)		An EA practice can be considered as a means for boosting information processing capability
Resource-based view (RBV) theory		Dang et al. (2019) and Ahlemann et al. (2020)	Views EA-related capabilities and prerequisites as organizational resources
Social network theory	Weiss et al. (2012)		Social networks can provide useful abstractions for understanding EA
SSM	Weiss et al. (2012)		SSM can help improve the EA development processes representing "soft" problems
Stewardship theory		Brosius (2016)	Views decision-makers in an EA practice as collectivistic actors
Structuration theory		Mezzanotte et al. (2010), Iyamu and Mphahlele (2014) and Iyamu (2019)	Posits that an EA practice as a social system depends on both structure and agents
Task-technology fit model		Narman et al. (2012)	Used for analyzing EA diagrams
Technology acceptance model (TAM)		Guo et al. (2019)	Views organizational acceptance of an EA practice as technology acceptance
Unified theory of acceptance and use of technology (UTAUT)		Hazen et al. (2014)	Used to analyze the relationship between the use of EA and EA training
Viable system model (VSM)		Buckl et al. (2009b), Buckl et al. (2010), Kandjani and Bernus (2012), Zadeh et al. (2012a), Zadeh et al. (2012b), Campbell (2013), Holst (2013), Kandjani et al. (2013) and Zadeh et al. (2014)	Views an enterprise as a viable system operating according to the laws of cybernetics

EA: Enterprise architecture; SSM: Soft systems methodology.

Appendix B

Theories considered as the potential theoretical basis

This appendix provides a united list of 123 theories that have been considered in this study as the potential theoretical basis for the EA discipline. This list combines the general list of 113 theories used in IS research provided by Larsen et al. (2015) and the list of 32 theories used specifically in EA research (see Table 7 in Appendix A), where 22 theories are present in both these lists. All the theories assessed in this study for their relevance to the EA discipline are listed in alphabetical order with their sources (IS list, EA list, or both lists) in Table 8.

Table 8. Theories considered as the potential theoretical basis.

Theory	List	Theory	List
Absorptive capacity theory	IS	Morphogenetic theory	EA
Accountability theory	IS	Multi-attribute utility theory	IS
Actor-network theory (ANT)	Both	Multi-motive information systems continuance model (MISC)	IS
Adaptive structuration theory	IS	Normalized systems theory	EA
Administrative behavior theory	Both	Organizational culture theory	IS
Agency theory	Both	Organizational information processing theory	Both
Archetype theory	EA	Organizational knowledge creation	IS
Argumentation theory	IS	Organizational learning theory	IS
Behavioral decision theory	IS	Portfolio theory	IS
Belief-action-outcome framework	IS	Process virtualization theory	IS

(Continued)

Table 8. (Continued)

Theory	List	Theory	List
Boundary objects theory	Both	Prospect theory	IS
Chaos theory	Both	Protection motivation theory	IS
Cognitive dissonance theory	IS	Punctuated equilibrium theory	IS
Cognitive fit theory	IS	Real options theory	IS
Cognitive load theory	Both	Resource dependency theory	IS
Communities of practice theory	EA	Resource-based view (RBV) theory	Both
Competitive strategy theory	IS	Selective organizational information privacy and security violations model (SOIPSVM)	IS
Complex adaptive systems theory	EA	Self-efficacy theory	IS
Complexity theory	IS	Semantic theory of survey response	IS
Contingency theory	Both	SERVQUAL theory	IS
Critical realism theory	IS	Signaling theory	IS
Critical social theory	IS	Social bond theory	IS
Critical success factors theory	IS	Social capital theory	IS
Customer focus theory	IS	Social cognitive theory	IS
Customer-based discrepancy theory	IS	Social comparison theory	IS
Deferred action theory	IS	Social exchange theory	IS
Design theory	IS	Social identity theory	IS
Diffusion of innovations theory	Both	Social influence theory	IS
Dominant design theory	EA	Social information processing theory	IS
Dynamic capabilities theory	Both	Social learning theory	IS
Elaboration likelihood model	IS	Social network theory	Both
Embodied social presence theory	IS	Social penetration theory	IS
Equity theory	IS	Social shaping of technology	IS
Evolutionary theory	IS	Socioemotional selectivity theory	IS
Expectation confirmation theory	IS	Socio-technical theory	IS
Feminism theory	IS	Soft systems methodology (SSM)	Both
Fit-viability theory	IS	Stakeholder theory	IS
Flow theory	IS	Stewardship theory	EA
Game theory	Both	Structuration theory	Both
Garbage can theory	IS	Structured process modeling theory (SPMT)	IS
General deterrence theory	IS	Task closure theory	IS
General strain theory	IS	Task-technology fit model	Both
General systems theory (GST)	Both	Technological frames of reference	IS
Hedonic-motivation system adoption model (HMSAM)	IS	Technology acceptance model (TAM)	Both
Hermeneutics	IS	Technology dominance theory	IS
Illusion of control	IS	Technology threat avoidance theory	IS
Impression management theory	IS	Technology-organization-environment framework	IS
Information asymmetry theory	IS	Theory of collective action	IS
Information processing theory	IS	Theory of organizational creativity	IS
Information warfare	IS	Theory of organizational sensemaking	IS
Institutional theory	Both	Theory of planned behavior	IS
International information systems theory	IS	Theory of reasoned action	IS
IS success model	Both	Theory of slack resources	IS
Keller's motivational model	IS	Theory of swift trust	IS
Knowledge management theory	EA	Transaction cost economics	IS
Knowledge-based view (KBV) theory	IS	Transactive memory theory	IS
Language action perspective	IS	Unified theory of acceptance and use of technology (UTAUT)	Both
Living systems theory	EA	Usage control model	IS
Management fashion theory	Both	Viable system model (VSM)	EA
Media richness theory	IS	Work systems theory	IS
Media synchronicity theory	IS	Yield shift theory of satisfaction	IS
Modal aspects theory	IS		

EA: Enterprise architecture.