Critical Questions in Enterprise Architecture Research

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ABSTRACT

The current enterprise architecture (EA) theory originates from the Business Systems Planning (BSP) methodology initiated by IBM in the 1960s and describes EA as a comprehensive blueprint of an enterprise organized according to a certain framework and describing the current state, the desired future state and the roadmap for transition between them. However, in this paper I demonstrate that the current EA theory poses more questions than answers and is, arguably, in an unsatisfactory state. This paper highlights the critical questions in EA research and is intended to spark further conversation in the EA research community. All the formulated questions address the fundamental aspects of the current EA theory that are critically important for the whole EA discipline. Although this paper does not propose any answers to these questions, it makes a non-theoretical contribution to the EA discipline by critically evaluating the current EA theory, provoking new thoughts and stimulating further research that will substantially alter the EA discipline in the future.

KEYWORDS

1. INTRODUCTION

Information systems play a critical role for the business of many modern companies. Many organizations invest substantial amounts of money in IT projects and systems. However, the maximum payoff from these IT investments can be achieved only if the IT strategy of an organization is aligned with its business strategy (Byrd, Lewis, & Bryan, 2006; Gerow, Grover, Thatcher, & Roth, 2014). Enterprise architecture (EA) is a description of an enterprise from an integrated business and IT perspective intended to bridge the communication gap between business and IT stakeholders and, thereby, to improve business and IT alignment and deliver other organizational benefits (Bradley, Pratt, Byrd, & Simmons, 2011; Schmidt & Buxmann, 2011). Presently EA as an instrument for information systems planning is used in the majority of large organizations (Ambler, 2010; van der Raadt, Slot, & van Vliet, 2007) and, if used properly, greatly contributes to their success (Ross, Weill, & Robertson, 2006).

The current EA theory originates from the Business Systems Planning (BSP) methodology initially proposed by IBM in the 1960s (BSP, 1984; Kotusev, 2016; Sidorova & Kappelman, 2010; Spewak & Hill, 1992). The EA theory explains EA as a comprehensive blueprint of an enterprise organized according to a certain framework and describing its current state, its desired future state and a roadmap describing how to migrate from the current state to the future state (Bernard, 2012; FEA, 2001; Spewak & Hill, 1992; TOGAF, 2011). The current EA theory suggests that EA is produced by a group of well-qualified experts called enterprise architects who firstly document the

current state of an enterprise, then describe its desired future state according to its business strategy, analyze the gaps between these states and finally develop a transition roadmap (Armour, Kaisler, & Liu, 1999b; Bernard, 2012; Spewak & Hill, 1992; TOGAF, 2011). After being developed, EA is used by business and IT specialists for analysis, decision-making and system implementation (Bernard, 2012; Lankhorst, 2013; TOGAF, 2011).

However, as I will demonstrate further in this paper, the current EA theory poses more questions than answers. Similarly to Chan and Reich (2007), in this paper I provide a review of the current EA theory and then discuss the most significant "blind spots" of this theory. The discourse in this paper is informational and deliberatively provocative. It highlights the critical questions in EA research and is intended to spark further conversation in the EA research community. Therefore, this paper does not propose any solutions to the discussed problems, but rather makes a non-theoretical contribution to the EA discipline by critically evaluating the current EA theory, provoking new thoughts and stimulating further research that will substantially alter the EA discipline in the future (Avison & Malaurent, 2014; Hambrick, 2007).

This paper continues as follows: (1) I describe the current EA theory, (2) I discuss the most critical questions to the current EA theory and (3) I conclude the paper.

2. CURRENT EA THEORY

The current EA theory originates from the Business Systems Planning (BSP) methodology initiated by IBM in the 1960s (BSP, 1975, 1984; Harrell & Sage, 2010; Sidorova & Kappelman, 2010; Spewak & Hill, 1992; Zachman & Ruby, 2004; Zachman & Sessions, 2007). BSP pioneered several fundamental ideas that provided the basis for the current EA theory (BSP, 1975, 1984): (1) information systems planning for an entire organization is carried out by a dedicated team of specialists (prototype of enterprise architects), (2) architecture is used for describing the relationship between business and IT (prototype of EA), (3) architecture describes business, data and information systems domains (prototype of EA domains), (4) various modeling techniques are used to describe processes, systems and data (prototype of EA diagrams), (5) formal step-wise process is used for architecture planning, including the analysis of the current state, the description of the desired state and the development of the action plan (prototype of EA methodologies).

The seminal EA frameworks, the PRISM framework (PRISM, 1986) and the Zachman Framework (Zachman, 1987), conceptualized EA as a comprehensive description of an enterprise from an integrated business and IT perspective and proposed logical structures for organizing this description, thereby, suggesting what information is necessary for a logically complete description of EA. The first EA methodology was proposed by Spewak and Hill (1992). This EA methodology "has its roots in IBM's BSP" (Spewak & Hill, 1992, p. 53) and recommends the following step-wise process to practice EA: (1) document the current state of an organization, (2) develop the desired future state of an organization, (3) analyze the gaps between the current and future states, (4) prepare an implementation plan and (5) implement the plan. Subsequently this seminal EA methodology served as the basis for many modern EA methodologies (Spewak & Tiemann, 2006).

Later many other EA frameworks proposed different structures for organizing EA suggesting what information is necessary for a holistic description of enterprises. The incomplete list of EA frameworks proposed by different authors includes EA Grid (Pulkkinen, 2006), E2AF (Schekkerman, 2006), OEAF (Covington & Jahangir, 2009), IAF (van't Wout, Waage, Hartman, Stahlecker, & Hofman, 2010) and EA[3]Cube (Bernard, 2012). The current EA theory essentially revolves around EA frameworks (Simon, Fischbach, & Schoder, 2013) and states that using EA frameworks is essential for

an EA practice or even is a necessary condition for success with EA (Armour et al., 1999b; Bernard, 2012; Finkelstein, 2006). It is recommended to start EA initiatives with a choice of an appropriate EA framework to organize the EA documentation (Armour, Kaisler, & Liu, 1999a; Armour et al., 1999b; Bernard, 2012; Boar, 1999; Schafrik, 2011).

Similarly, many other EA methodologies have been proposed by various authors (Armour et al., 1999b; Bernard, 2012; Bittler & Kreizman, 2005; Boar, 1999; Covington & Jahangir, 2009; FEAF, 1999; Longepe, 2003; Niemann, 2006; TOGAF, 2011). However, these EA methodologies are conceptually similar to the seminal EA methodology of Spewak and Hill (1992) and also recommend to (1) document the current state, (2) describe the future state, (3) analyze the gaps, (4) develop a roadmap and (5) implement it. Therefore, the current EA theory argues that EA should necessarily describe an enterprise in its current (as-is, baseline) and desired future (to-be, target) states as well as a roadmap (transition plan) describing how to migrate from the current state to the future state (Bernard, 2012; FEA, 2001). Documenting both the current and future states and developing roadmaps is considered essential for an EA practice (Joseph, 2009) and is recommended by the majority of the existing EA methodologies.

The current EA theory suggests that EA is based on a business strategy (Bernard, 2012; Finkelstein, 2006; Longepe, 2003; Niemann, 2006; Spewak & Hill, 1992), "no strategy, no enterprise architecture" (Schekkerman, 2006, p. 6). After being developed, EA is used by IT staff since it provides an actionable guidance for implementing the necessary information systems and transforming an enterprise into the desired target state (Bernard, 2012; Spewak & Hill, 1992; TOGAF, 2011). However, EA can also be used for communication, analysis and decision-making by executives, managers and other stakeholders (Armour et al., 1999a; Bernard, 2012; Lankhorst, 2013; TOGAF, 2011).

To summarize, the current EA theory originates from BSP and conceptualizes EA as a logically complete and comprehensive description of an enterprise organized according to a certain framework. EA always describes the current state of an enterprise, the future state of an enterprise and a roadmap describing how to migrate from the current state to the future state. At first, the current state of an enterprise is documented and the desired future state is described, then the gaps are analyzed and a roadmap is developed, finally the roadmap is implemented. EA is always based on a business strategy. After being developed, EA is used by IT staff, executives, managers and other stakeholders for information systems implementation, communication, analysis and decision-making. The current EA theory is summarized in Table 1.

3. QUESTIONS TO THE CURRENT EA THEORY

The current EA theory looks solid and is widely supported by the vast majority of authors. However, a deeper analysis of EA literature shows that the current EA theory poses more questions than answers.

Table 1. Summary of the current EA theory

Aspect of EA theory	Description
Origin of EA	The BSP methodology initiated by IBM in the 1960s
Cornerstone of EA	EA frameworks
Necessary elements of EA	Current state, future state and roadmap
Methodology	Document the current state, describe the future state, analyze the gaps, develop a roadmap and implement it
Basis for EA	Business strategy
Usage of EA	IT staff, executives, managers and other stakeholders use EA for information systems implementation, communication, analysis and decision-making

In the following sections I will discuss five critical aspects of the current EA theory which, arguably, have a profound significance for both EA theory and practice, but are still poorly understood.

3.1. EA Frameworks

The current EA theory essentially revolves around EA frameworks and states that EA frameworks are necessary for an EA practice. However, the strict following of EA frameworks is recognized as one of the worst EA practices (Burton, 2009). Full implementation of EA frameworks is typically found impractical and rejected (Gerber, Meyer, & Richert, 2007). "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, p. 40). "[EA] frameworks have been suggested as guidelines to [EA] implementation, but our experience indicates that very few companies follow the steps prescribed by such frameworks" (Haki, Legner, & Ahlemann, 2012, p. 1). Molnar and Proper (2013) argue that EA frameworks are too rigid and complex to be used in some companies even after appropriate tailoring. Buckl, Ernst, Lankes, Matthes, and Schweda (2009, p. 15) argue that EA frameworks "appear theoretical and impossible to implement". "Many practitioners see frameworks as theoretical or conceptual rather than a highly practical everyday device for managing and thinking about architectures" (Evernden, 2015, p. 29). EA practitioners argue that working with frameworks only wastes their efforts and does not solve any real problems (Bloomberg, 2014b). Robertson-Dunn (2012) argues that EA frameworks are hardly applicable in the modern dynamic technology and business environment. Vivek Kundra, the federal chief information officer of the United States, reportedly argued that EA frameworks "are worse than useless" (Tucci, 2011, p. 1). "Frameworks are cocaine for executives - they give them a huge rush and then they move to the next framework", comments a practicing senior enterprise architect (Bloomberg, 2014b, p. 1).

Unsurprisingly, organizations practicing EA either do not use EA frameworks at all or, if use, simplify them for their needs or use them only as idea contributors (Anderson, Backhouse, Townsend, Hedges, & Hobson, 2009; Aziz & Obitz, 2007; Bloomberg, 2014a; Buckl et al., 2009; Lange & Mendling, 2011; Obitz & Babu, 2009; Smith, Watson, & Sullivan, 2012; Winter, Buckl, Matthes, & Schweda, 2010).

Are EA frameworks really necessary for an EA practice? Do they really represent best practice in EA? Are they useful? Are they feasible? What role do they play in an EA practice? How exactly are they adapted? Which exactly recommendations of EA frameworks are reasonable, which are not reasonable? Did they really originate from proven industry practices? Are EA frameworks really valuable? All these questions have no answers.

3.2. Current States, Future States and Roadmaps

The current EA theory states that the current state of an enterprise, the future state of an enterprise and the roadmap for transition between them are the fundamental components of EA that essentially define the very meaning of an EA practice. However, numerous surveys consistently demonstrate that the situation in real EA practices is significantly different. For instance, the survey of 56 companies by Winter et al. (2010) shows that only 45.1% of companies document both current and future states as suggested by the current EA theory, while 37.3% of companies document only their current states and 9.9% of companies document only their target or planned future states. The survey of 140 companies by Roth, Hauder, Farwick, Breu, and Matthes (2013) shows that 81.4% of companies model their current states, 66.4% of companies model their planned states and 45.7% of companies model their long-term target states. The survey of 47 companies by Schneider, Gschwendtner, and Matthes (2015) shows that 36 companies model their as-is states, 26 companies model their planned states and 23 companies model their to-be states. Similarly, the surveys show that only 60% (Aziz & Obitz, 2005), 71% (Aziz & Obitz, 2007), 58% and 71% (Obitz & Babu, 2009) of companies develop roadmaps as

suggested by the current EA theory. Therefore, *all the three* components of EA that are considered essential for an EA practice by the current EA theory seem to be optional in real EA practices.

Why different companies develop different components of EA? What is going on in these companies and how do they work? Are all these three components of EA really necessary for an EA practice? Is it always beneficial to develop all these three components? If all these three components are optional, then what components are really essential? Do these three components really define the essence of an EA practice? All these questions have no answers.

3.3. Strategy as the Basis for EA

The current EA theory suggests that EA is always developed on the basis of a business strategy. However, a business strategy has long been widely recognized as a poor basis for information systems planning (Baets, 1992; Chan & Reich, 2007; Kotusev, Singh, & Storey, 2016; Lederer & Mendelow, 1986, 1987, 1988, 1989; Ross, 2005; Ross et al., 2006; Segars & Grover, 1996; Shpilberg, Berez, Puryear, & Shah, 2007; Vitale, Ives, & Beath, 1986; Weill & Ross, 2008) due to the following reasons: (1) a business strategy is often not known or absent, (2) a business strategy is often not clear enough to be actionable for IT, (3) a business strategy is often not steady enough to be taken as a basis for planning, (4) chasing the latest business strategies often results in a number of separate IT solutions implemented differently and (5) when IT is always reacting to the latest business strategies, it becomes a persistent bottleneck rather than a strategic asset supporting future opportunities. Therefore, an operating model, defined as the necessary level of business process integration and standardization for delivering goods and services to customers, has been proposed as a more clear, actionable and stable basis for EA than a business strategy (Ross et al., 2006; Weill & Ross, 2008, 2009) with a very clear recommendation: "Forget Strategy: Focus IT on Your Operating Model" (Ross, 2005). Somewhat similar ideas have also been advocated by Reese (2008).

Does a business strategy really provide an adequate basis for EA? Can it be used as a single input to an EA planning process? Can organizations with absent or unclear business strategies benefit from using EA? Does an operating model provide an adequate basis for EA? What other considerations can or should be used as a basis for EA? All these questions have no answers.

3.4. Success Rate of EA Initiatives

The current EA theory is claimed to be based on industry best practices and supported by the real experience of multiple companies. However, attempts to organize an EA practice according to the prescriptions of the current EA theory often result in three problems (Gaver, 2010; Kim & Everest, 1994; Kotusev, 2017; Kotusev, Singh, & Storey, 2015; Lohe & Legner, 2014): (1) unreasonable efforts are needed to develop and maintain the EA documentation due to high organizational complexity, large scope and vibrant environment, (2) low utilization of the EA documentation due to its poor quality, obsolescence, wrong level of detail and mismatch with real information needs and (3) poor acceptance of an EA practice in an organization due to its isolated nature and its poor integration with normal organizational processes.

Unsurprisingly, the success rate of EA initiatives seems to be very low. For instance, the Federal Enterprise Architecture (FEA) program had largely failed and experienced a "hangover" (Gaver, 2010; Reynolds, 2010). Similarly, various authors report that as much as 40% (Zink, 2009), 66% (Roeleven, 2010), 80% (DiGirolamo, 2009) or even more than 90% (Jacobson, 2007) of EA programs fail to deliver expected business value. Bloomberg (2014b, p. 1) argues that EA has achieved "a surprisingly paltry level of success". Interestingly, even Spewak and Hill (1992, p. 19), pioneers of the current EA theory and authors of the seminal Enterprise Architecture Planning (EAP) methodology, admit that "the vast majority of enterprises that undertake Enterprise Architecture Planning are not successful".

Consequently, many authors question the very adequacy of the current EA theory. For instance, Ross et al. (2006, p. vii) argue about the historical ineffectiveness of the detailed planning advocated by the current EA theory and criticize it for "remoteness from the reality of the business and [its]

heavy reliance on mind-numbing detail represented in charts that look more like circuit diagrams than business descriptions and that are useful as little more than doorstops". "We're not sure we've yet seen an EA strategy that is anything other than impractical, unachievable and, even if it could be achieved, unsustainable" (Kemp & McManus, 2009, p. 20). Holst and Steensen (2011, p. 21) argue that "in the rapidly changing environment … it is impossible to plan and document to pre-emptively solve all of the future challenges". "[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", comments Vivek Kundra (Tucci, 2011, p. 1). Holst and Steensen (2011) even argue that a successful EA practice can hardly be established based on the current EA theory.

Why the current EA theory is so heavily criticized? Why so many EA initiatives fail? What went wrong in these reported unsuccessful cases? What are the reasons of all these failures? Can these failures be attributed merely to the poor execution of EA programs? Are these problems inherent to the very approach advocated by the current EA theory? Is the current EA theory really based on proven industry best practices? Does the current EA theory describe a reasonable approach to information systems planning? What are the limitations of this approach? When this approach can be effective? Was this approach ever used successfully? All these questions have no answers.

3.5. Legacy of the BSP Methodology

The current EA theory originates from the BSP methodology which provided the prototypes of the most essential elements of the current EA theory, as it was explained earlier in the section Current EA Theory. However, BSP proved to be an ineffective approach to information systems planning and a number of studies (Beynon-Davies, 1994; Goodhue, Kirsch, Quillard, & Wybo, 1992; Goodhue, Quillard, & Rockart, 1988; Lederer & Sethi, 1988, 1992; Shanks, 1997) questioned the very utility of BSP-like methodologies. For instance, Goodhue et al. (1988, p. 383) concluded that "for many firms, the [BSP] approach is too expensive, its benefits are too uncertain, and it is organizationally difficult to implement". Lederer and Sethi (1988, p. 455) concluded that "given their great expense and time consumption, ... findings seriously challenge the utility of the planning methodologies represented in this study [BSP]". "In summary, strategic information systems planners are not particularly satisfied with [the BSP-like approach]. After all, it requires extensive resources. … When the [BSP-like] study is complete, further analysis may be required before the plan can be executed. The execution of the plan might not be very extensive" (Lederer & Sethi, 1992, p. 76). Goodhue et al. (1992) concluded that BSP-like methodologies may not be the best way to plan information systems given the necessary investments of time and money, required level of commitment of high-qualified experts, high probability of analysis errors and very abstract nature of the planning outcomes. They argue that BSP and similar methodologies bring more problems than benefits despite their conceptual justifications. Therefore, they conclude than "the evidence ... presented here strongly supports the need for a fundamental rethinking of IS planning methodologies" (Goodhue et al., 1992, p. 28).

Interestingly, the reported practical problems with BSP (planning is very expensive and time consuming, plans are hardly understandable, very abstract and require further analysis, planning is organizationally difficult to implement, plans are carried out only partially or even shelved, etc.) (Beynon-Davies, 1994; Goodhue et al., 1992; Goodhue et al., 1988; Lederer & Sethi, 1988, 1992; Shanks, 1997) are essentially identical to the practical problems of the current EA theory (Gaver, 2010; Kim & Everest, 1994; Kotusev, 2017; Kotusev et al., 2015; Lohe & Legner, 2014), which is not surprising taking into account the conceptual similarity between these approaches.

What are the essential differences between the BSP methodology and the approach to planning advocated by the current EA theory? Are there any significant differences between them? What exactly the current EA theory learned from the problems of BSP? What are the improvements of the current EA theory over BSP? Why the current EA theory essentially repeats 50-year-old planning ideas? Taking into account that the conceptually similar predecessor of EA was unsuccessful, can

the approach recommended by the current EA theory be successful? Can similar formal planning approaches be effective? Were these approaches ever used successfully? All these questions have no answers.

3.6. Summary

In the previous sections I discussed numerous critical questions to the different aspects of the current EA theory. These questions are summarized in Table 2.

All the questions formulated above address fundamental aspects of the current EA theory, but none of them has any reasonable answers in EA literature. In light of this shattering criticism, the most critical question to the current EA theory can be formulated as follows: Does the EA theory really exist in any real sense?

4. CONCLUSION

The current EA theory originates from the BSP methodology initiated by IBM in the 1960s and describes EA as a comprehensive blueprint of an enterprise organized according to a certain framework and describing the current state, the desired future state and the roadmap for transition between them. It suggests that enterprise architects should firstly document the current state, then describe the desired future state according to the business strategy, analyze the gaps between these states and finally develop a transition roadmap.

In this paper, I demonstrated that the current EA theory poses more questions than answers and is, arguably, in an unsatisfactory state. All the formulated questions address the fundamental aspects of the current EA theory that are critically important for the whole EA discipline (see Table 2). However, all these questions do not have any meaningful answers in EA literature. This paper does not answer any of these questions either, but rather calls for future research that will address the "blind spots" of the current EA theory discussed in this paper. The purpose of this paper is to make a non-theoretical contribution to the EA discipline by critically evaluating the current EA theory, provoking new thoughts and stimulating further research that will substantially alter the EA discipline in the future (Avison & Malaurent, 2014; Hambrick, 2007).

Table 2. Critical questions to the current EA theory

Aspect of EA theory	Critical questions
EA Frameworks	Are EA frameworks really necessary for an EA practice? Are they useful? How exactly are they adapted? Are EA frameworks really valuable?
Current States, Future States and Roadmaps	Are all these three components of EA really necessary for an EA practice? If all these three components are optional, then what components are really essential? Do these three components really define the essence of an EA practice?
Strategy as the Basis for EA	Does a business strategy really provide an adequate basis for EA? Can organizations with absent or unclear business strategies benefit from using EA? What other considerations can or should be used as a basis for EA?
Success Rate of EA Initiatives	Why so many EA initiatives fail? Can these failures be attributed merely to the poor execution of EA programs? Does the current EA theory describe a reasonable approach to information systems planning?
Legacy of the BSP Methodology	What are the essential differences between the BSP methodology and the approach to planning advocated by the current EA theory? Taking into account that the conceptually similar predecessor of EA was unsuccessful, can the approach recommended by the current EA theory be successful? Were these approaches ever used successfully?

This paper is a "call to arms" for the EA research community intended to instigate meaningful discussions around the critical questions of the EA discipline and eventually invalidate the last question formulated in this paper: Does the EA theory really exist in any real sense?

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