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Conceptual Model of Enterprise Architecture Management

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Enterprise architecture (EA) is a description of an enterprise from an integrated business and IT perspective. Enterprise architecture management (EAM) is a management practice embracing all the management processes related to EA aiming to improve business and IT alignment. EAM is typically described as a sequential four-step process: (i) document the current state, (ii) describe the desired future state, (iii) develop the transition plan and (iv) implement the plan. This traditional four-step approach to EAM essentially defines the modern understanding of EA. Based on a literature review, this paper demonstrates that this four-step approach to EAM, though practiced by some companies, is inadequate as a model explaining the EAM phenomenon in general. As a substitute, this paper synthesizes the generic conceptual model of EAM providing a more realistic conceptualization of EAM describing it as a decentralized network of independent but interacting processes, artifacts and actors.

Keywords: Enterprise architecture; enterprise architecture management; traditional approach; generic conceptual model.

1. Introduction

The role of IT for modern enterprises is significant. Companies spend considerable amounts of money investing in IT. However, in order to realize the full potential value of IT investments, the IT strategy of a company should be aligned with its business strategy.[1–3] Enterprise architecture (EA) is a description of an enterprise from an integrated business and IT perspective recognized as an instrument for facilitating business and IT alignment. Enterprise architecture management (EAM) is a management practice embracing all the management processes related to EA aiming to achieve business and IT alignment.[4,5]

Spewak and Hill[6] presented the first comprehensive approach to EAM. They describe EAM as a sequential step-wise project with essentially the following steps: (i) document the current state of the whole enterprise in detail, (ii) describe the desired future state of the whole enterprise in detail, (iii) develop the transition plan describing how to migrate from the current state to the future state and (iv) implement the plan. This traditional four-step approach to EAM was later

supported by other authors[7–10] who proposed its different variations. This approach to EAM dominates and essentially defines the current EA literature since many authors[11–14] use it as a reference model of EAM in their research. Moreover, the traditional approach to EAM[10] is considered as a de facto standard in EA practice.[15–17] Therefore, the traditional four-step approach to EAM[6] virtually became a standard way to conceptualize and understand EAM in the mainstream EA literature.

However, following recommendations of the traditional approach to EAM often leads to significant practical problems.[18] Holst and Steensen[19] even argue that a successful EAM can hardly be established based on the mainstream EA literature. The surveys[20,21] show that only 45.1% of companies document both current and future states and only 58% of companies produce roadmaps as advocated by the traditional approach to EAM. The case studies of successful companies practicing EA[22,23] demonstrate that working EAM differs from the descriptions provided by the popular EA literature.[7,10] Moreover, many companies are too large to be comprehensively described and planned in a centralized manner as recommended by the traditional approach to EAM.[23] EAM should also be able to struggle with the environmental instability,[24–26] react on emergent needs[27,28] and should be embedded into normal organizational processes to be successful,[18] however, the rigid traditional four-step approach to EAM hardly explains how it can be done.

Therefore, the traditional four-step approach to EAM, though widely supported by the EA literature and practiced by *some* companies, is inadequate as a *generic* conceptual model explaining the EAM phenomenon in general. However, no other alternative models describing EAM have been presented in the EA literature. At the same time, the lack of a commonly accepted conceptual model of EAM precludes the EA research from deeper studies of this phenomenon. For instance, even EA publications in the leading academic outlets analyze EAM only as a black box which adds value to organizations,[29] has some maturity[30] and success factors,[31] depends on strategy[32] and can be institutionalized,[33] while the basic question on what EAM is has no definite answers but is not discussed. Unsurprisingly, the inability of EA theory to provide adequate answers to the basic questions leads to problems in EA practice[18,19] and results in poor success rates of EA initiatives.[34–37]

The inadequacy of the traditional four-step model of EAM as a *generic* conceptual model and the lack of any alternative models serve as a motivation for this paper. This paper, based on an extensive literature review, synthesizes the generic conceptual model of EAM describing its essential elements. The resulting model describes EAM as a decentralized network of independent but interacting processes, artifacts and actors.

This paper continues as follows: (i) discusses the traditional approach to EAM, its role in the EA literature and its problems, (ii) describes the review methodology, (iii) discusses the review results, (iv) synthesizes the generic conceptual model of EAM, (v) discusses the resulting model from different perspectives, (vi) describes the contribution of the new model to the EA discipline and (vii) discusses the limitations and directions for future research.

2. The Traditional Approach to EAM, its Role and Problems

This section will discuss the traditional approach to EAM, its role in the EA literature and its inherent problems.

2.1. *The traditional approach to EAM and its variations*

The earliest origins of EAM can be traced back to the Business Systems Planning (BSP) methodology initiated by IBM in the 1960s.[38–41] However, the first comprehensive description of EAM in the modern understanding of this notion has been presented by the Enterprise Architecture Planning (EAP) methodology proposed by Spewak and Hill.[6] EAP "has its roots in IBM's BSP" (see Ref. 6, p. 53) and describes EAM as a sequential step-wise project with essentially the following four steps: (i) document the current state of the whole enterprise in detail, (ii) describe the desired future state of the whole enterprise in detail according to its business strategy, (iii) analyze the gaps between the current and future states and develop the transition plan describing how to migrate from the current state to the future state and (iv) implement the plan. This traditional four-step approach to EAM influenced many other later EA methodologies[42] and was supported by many other authors[7–10,43,44] who proposed different variations of this approach. Some variations of the traditional approach to EAM are more "lightweight",[44] others emphasize the importance of a formal EA development process,[6,10] extensive formal modeling[8,43] or partitioning enterprises into independent units.[7,9] However, all these variations support the original step-wise logic of the traditional approach to EAM proposed by Spewak and Hill[6] and, therefore, are conceptually similar.

2.2. *Role of the traditional approach to EAM in the EA literature*

The traditional four-step approach to EAM essentially defines the current understanding of EA. For instance, Joseph (Ref. 45, p. 9) argues that "the essence of Enterprise Architecture is to document the current and future states of an enterprise and to institute a reasonable transition process from current to future state so that any enterprise can sustain in vibrant environment". Bernard[7] argues that the documentation of current and future states are the essential elements of EA. The authors of FEA (Ref. 46, p. 5) argue that "enterprise architecture includes a baseline architecture, target architecture, and a sequencing plan". Therefore, the traditional four-step approach to EAM is generally considered as the "proper" way to practice EA and is inseparably associated with the very notion of EA. Unsurprisingly, the first course book specifically developed for the EA university program[47] presents EA largely from the perspective of the traditional approach to EAM.

Moreover, the most widely supported and highly cited[5] variation of the traditional approach to EAM recommended by The Open Group[10] is even considered as a de facto industry standard in EAM practice.[15–17,48–50] TOGAF is an "industry consensus framework for enterprise architecture" (Ref. 10, p. xxiii). "TOGAF has

been developed through the collaborative efforts of 300 Architecture Forum member companies and represents best practice in architecture development" (Ref. 14, p. 778). TOGAF architecture development method (ADM) "is a well-recognized and up-to-date process model compiled from best practices of many practitioners" (Ref. 12, p. 4). "The TOGAF ADM is the result of continuous contributions from a large number of architecture practitioners" (Ref. 10, p. 45). Unsurprisingly, many authors[11–14,51–56] use the traditional four-step approach to EAM as a generic reference model of EAM in their research.

Consequently, the traditional approach to EAM[6] is generally considered as the right way to practice EA[7,45,46] and many authors[12,52,55] believe it is actually practiced by the vast majority of companies. This four-step approach to EAM essentially provides a "standard" way to conceptualize and understand EAM. Unsurprisingly, most EA publications discuss EA only in the context of the traditional four-step approach to EAM.

2.3. *Problems of the traditional approach to EAM*

Although the traditional four-step approach to EAM is presented in the EA literature as the proper way to understand, conceptualize and practice EA, this approach can be criticized from three different perspectives. The following sections will analyze the traditional approach to EAM and discuss its problems as a prescriptive, descriptive and theoretical reference model.

2.3.1. *Problems as a prescriptive model*

Numerous evidence suggest that following prescriptions of the traditional approach to EAM rarely leads to successful EAM. Ross *et al.*[57] argue about the historic ineffectiveness of the traditional approach to EAM. Wagter[58] criticize the traditional approach to EAM for its impracticality and notice that following recommended processes and filling the cells of recommended frameworks often results in useless "paper tigers" instead of working architecture. Hobbs[59] reports that comprehensive detailed architectural diagrams, even award-winning ones, often turn out to be unusable, self-serving and do not deliver any expected business value. Lagerstrom *et al.*[60] notice the criticism from practitioners towards the traditional heavyweight approaches to EAM prescribing following complicated processes and creating excessive amounts of models. Gerber *et al.*[22] argue that in real practice full-fledged implementations of the traditional approach to EAM are often rejected because of their impracticality. Erder and Pureur (Ref. 25, p. 10) argue that "even the best architecture models and blueprints do not help much with the actual implementation of the architecture over time". They argue that detailed documentations and transition plans are a wasted effort.

Lohe and Legner[18] show that following the traditional approach to EAM often leads to three significant problems: (i) unreasonable efforts are needed to create and maintain the EA documentation due to high organizational complexity, dynamic

environment and large scope, (ii) low utilization of the EA documentation due to its poor quality, obsolescence, wrong level of detail and mismatch with the real information needs and (iii) poor acceptance of EAM in the organization due to an isolated nature of an EA program. Holst and Steensen[19] even argue that successful EAM can hardly be established based on the traditional approach to EAM. Kemp and McManus[61] also express doubts about the adequacy of the traditional approach to EAM. Bloomberg (Ref. 62, p. 1) argues that the traditional approach to EAM has achieved "a surprisingly paltry level of success". Unsurprisingly, the Federal Enterprise Architecture (FEA) program based on the traditional approach to EAM had largely failed and experienced a "hangover".[34,63]

Therefore, the adequacy of the traditional approach to EAM as a prescriptive model guiding an EA practice is at least questionable because of its numerous problems and a poor success rate.

2.3.2. *Problems as a descriptive model*

Numerous evidence suggest that the description of EAM provided by the traditional approach to EAM poorly correlates with the actual EAM in real companies. For instance, the survey of 56 companies by Winter *et al.*[21] shows that only 45.1% of companies document both current and future states as recommended by the traditional approach to EAM, 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 *et al.*[64] shows that only 81.4% of companies model their current states, 66.4% model their planned states and 45.7% model their target states. The survey of 47 companies by Schneider *et al.*[65] shows that only 36 companies model their as-is states, 26 companies model their planned states and 23 companies model their to-be states. The surveys show that only 60%,[66] 71%,[67] 58% and 71%[20] of companies develop roadmaps as EA deliverables as advocated by the traditional approach to EAM. Therefore, all the essential elements of the traditional approach to EAM (current states, future states and roadmaps) are missing in many companies practicing EA.

Haki *et al.*[68] argue that prescriptions of the traditional approach to EAM are rarely followed in practice. In four case studies they demonstrate different approaches to EAM used by these companies and only one of them correlates with the traditional approach to EAM. Similarly, Holst and Steensen[19] based on four case studies argue that EAM in these companies do not correlate with the traditional approach to EAM. They argue that successful EAM is organic rather than mechanistic because "empirical findings confirmed this with an absence of the mechanistic concept of a large formalized documentation framework, and the lack of any theoretically-based concept of gap analysis or detailed as-is and to-be architecture" (Ref. 19, p. 20). The case studies of the world-leading companies[22,23] also demonstrate that EAM in these companies hardly resembles the traditional approach to EAM.

Therefore, the traditional approach to EAM is inadequate as a descriptive model of EAM because it is unable to describe the actual EAM in many companies.

2.3.3. *Problems as a theoretical reference model*

From the conceptual perspective the traditional approach to EAM essentially neglects at least four inherent practical issues: large scope of modern enterprises, dynamic nature of the organizational environment, integration of EAM into organizational processes and the influence of "soft" human factors on EAM. The next paragraphs will discuss these issues in detail and their implications.

First, the traditional approach to EAM largely neglects the large scope of modern enterprises. Large enterprises operate hundreds and thousands of information systems.[23,69] Global banks have about 20% of all their employees working in IT departments resulting in tens of thousands of IT professionals.[70] For enterprises of comparable or even smaller sizes it is impractical to create and maintain detailed architectural descriptions of entire enterprises in a centralized manner. Instead, federated or decentralized EAM is essential for large enterprises, especially composed of autonomous divisions or operating on different territories.[23,59,71] At the same time, the development of architectural descriptions for different parts and levels of an enterprise (for instance, an enterprise level architecture and several division level architectures) is typically carried out by different architecture teams in parallel and should be coordinated in order to achieve a shared architectural vision as well as to ensure that local plans and initiatives correlate with global business goals and standards[8,11,72–76] The case studies of successful EAM at large enterprises[22,23,77] demonstrate that these enterprises indeed employ a decentralized multi-level EAM with coordination mechanisms as described above. Although some variations of the traditional approach to EAM[7,9,10] advocate the partitioning of large enterprises into independent units, none of these variations reflects the fact that decentralized EAM involves different architecture teams and requires certain processes to coordinate their activities. Therefore, the traditional approach to EAM as a four-step model, though recognizes the potential need to partition large enterprises, arguably does not provide adequate conceptual mechanisms for decentralization and coordination of EA-related activities.

Second, the traditional approach to EAM neglects a dynamism, volatility and unpredictable nature of both the external and internal organizational environments. The traditional approach to EAM relies on an extensive proactive planning and recommends describing a desired future state for several years ahead.[6,47,78] However, the external organizational environment is unpredictable and constantly changing with much faster pace.[79,80] For instance, Sauer and Willcocks[26] after surveying 97 executives report that half of them do not extend their plans beyond one year while many companies update their plans quarterly. Erder and Pureur[25] argue that even technology details might be unknown for several years ahead. The internal organizational environment is also unstable and unpredictable. Legner and Lohe[27] argue

that individual EA components change every day and deviate slightly from their planned states due to operational needs, unexpected changes and urgent bug fixes that should also be handled properly by EAM. Radeke and Legner[28] argue that unplanned and spontaneous emergent initiatives and operational demands require reactive responses from EAM in order to ensure that these unexpected changes comply with established architectural standards and to support their alignment with the overall strategic direction. Unsurprisingly, Holst and Steensen[19] argue that the traditional approach to EAM is based on the false presumption that future challenges can be solved through a careful upfront planning. Beeson *et al.*[24] argue that for most organizations the complexity and volatility of both the external business environment and internal IS development context make a stable or fully articulated EA unachievable in practice. They argue that business and IT alignment in practice results not from an overarching plan or model, but rather from "a continuous process of adjustment and readjustment of plans and goals, in which local and relatively short-term plans are formulated and weighed against current understanding of the business's key interests" (Ref. 24, p. 320). "The problem here is that the enterprise isn't an ordinary system like a machine or a building, and can't be architected or engineered as such" (Ref. 62, p. 1). Unsurprisingly, 71.4% of companies recognize a quickly changing environment as a challenge for EAM.[81] However, the traditional approach to EAM ignores the dynamic nature of the organizational environment and does not provide any conceptual mechanisms to deal with unexpected changes.

Third, the traditional approach to EAM neglects the necessity to integrate EA-related processes with normal organizational activities. Successful EAM is not an isolated process, but rather is an organic part of daily organizational activities,[82,83] for instance strategic planning,[28,84] operations[27] and project management.[27] Lohe and Legner[18] formulate four requirements addressing the integration of EAM into organizations: (i) existing processes should continuously produce and maintain EA artifacts, (ii) existing processes should consume relevant EA artifacts, (iii) existing roles and committees should assume responsibility for EA-related activities and (iv) EAM should be embedded in existing organizational structures. However, the traditional approach describes EAM as an isolated planning exercise carried out by a dedicated EA team embodied in a standalone iterative process with its own independent step-wise life cycle unrelated to the organic organizational environment with its continuous processes and, thereby, ignores the necessity to integrate EAM into organizations and does not provide any conceptual mechanisms for integration.

Fourth, the traditional approach to EAM neglects the potential influence of human-related factors on EA-related activities. EAM can be considered as a network of interacting actors with their own concerns, motivations and interests.[41,85] Therefore, various "soft" human factors, including cultural, social and political issues, can have a significant influence on EAM.[51,86–90] Janssen (Ref. 91, p. 24) argues that EAM "is influenced by the social interdependencies and interactions

among stakeholders in which it is embedded" and "the use and acceptance [of EA] is determined by the social processes surrounding the architecture" (Ref. 91, p. 34). Holst and Steensen (Ref. 19, p. 16) even argue that "one reason for failed EA efforts could be that in parts of EA theory there is still is a very mechanistically focused mind-set". However, the traditional approach describes EAM as a purely mechanistic documents-oriented engineering activity and, thereby, ignores the complex influence of various "soft" human-related factors on EA-related processes.

Therefore, the traditional approach to EAM is inadequate as a theoretical reference model of EAM because it largely ignores four critical practical issues: large scope of modern enterprises, dynamic nature of the organizational environment, integration of EAM into organizational processes and the influence of "soft" human factors on EAM.

2.4. *Summary of the traditional approach to EAM*

The previous sections described the traditional approach to EAM as a sequential four-step process: (i) documenting the current state, (ii) describing the future state, (iii) developing the transition plan and (iv) implementing the plan. This traditional approach to EAM essentially defines the current understanding of an EA practice and is generally considered as the "proper" way of using EA. Unsurprisingly, it is included in university programs on EA and used as a generic reference model of EAM by many researchers. Therefore, this four-step approach essentially provides a "standard" way to conceptualize EAM. However, the traditional approach to EAM has numerous problems as a prescriptive, descriptive and theoretical reference model of EAM. These problems are summarized in Table 1.

Therefore, the traditional four-step approach to EAM, though widely supported by the EA literature and practiced more or less successfully by *some* companies, is inadequate as a *generic* conceptual model explaining the EAM phenomenon in general. In other words, the traditional approach to EAM can be considered *only as a special case* of EAM, but not as a representation of EAM in general. Consequently, it can hardly be used as a generic conceptual model of EAM by the EA research community. At the same time, arguably, no other alternative models describing

Table 1. Problems of the traditional approach to EAM.

Traditional approach to EAM	Adequacy	Reason
As a prescriptive model	Questionable	Associated with numerous problems and poor success rates
As a descriptive model	Inadequate	Unable to describe the actual EAM in many companies
As a theoretical reference model	Inadequate	Ignores large scope of modern enterprises, dynamic nature of the organizational environment, integration of EAM into organizational processes and the influence of "soft" human factors on EAM

EAM have been presented in the EA literature. Therefore, it is not clear what exactly EAM is, new conceptual model explaining EAM is needed.

3. Review Methodology

In order to develop a new conceptual model of EAM it is necessary to identify all described approaches to EAM and on their basis synthesize a generic conceptual model embracing all of them. For the purpose of identifying all existing approaches to EAM the available EA literature has been reviewed.

3.1. *Search criteria*

To conduct a comprehensive EA literature review a broad set of source journals and conferences has been selected.[92] Due to the significant influence of non-academic EA publications,[5,29,93] industry EA publications were also considered. Therefore, this literature review was based on 229 ranked IS journals recommended by the Australian IS research councils,[94,95] 234 ranked IS conferences recommended by the Australian Research Council[96] and available books for EA practitioners. Additionally, unranked but EA-related Journal of Enterprise Architecture (JEA), Trends in Enterprise Architecture Research Workshop (TEAR), International Workshop on Enterprise Modelling and Information Systems Architectures (EMISA), Working Conference on Practice-Driven Research on Enterprise Transformation (PRET) and EA research briefings of MIT Center for Information Systems Research (CISR) were also included as potential sources of relevant EA publications.

Publications written in English with the titles containing the following keywords have been searched as part of this review: "Enterprise Architecture", "Enterprise Architectures", "Enterprise Architecting", "Enterprise Architectural", "Enterprise Architect", "Enterprise Architects" as well as the popular abbreviations "EA" and "EAM". In the edited books with the titles containing the required keywords all the chapters were treated as relevant to EA regardless of their titles. In the sources specifically focused on EA (JEA, TEAR, CISR) all publications were treated as relevant regardless of their titles. Additionally, all the top-cited EA publications[5,93] were treated as relevant regardless of their titles or origins.

Google Scholar was used as the primary search engine for this review. However, IEEE Xplore, AIS Electronic Library, SpringerLink and ACM Digital Library were also used as secondary search engines to double check all the results. Additionally, books for EA practitioners were searched from the Amazon website. Relevant publications found through references were also examined.

The literature review started in the second half of 2013 and finished in the middle of 2014. After that, all the results were double-checked and updated in the beginning of 2015. Therefore, this review covers all the available EA publications up to the end of 2014. Totally 1133 publications (332 journal articles, 554 conference proceedings, 58 books, 111 book chapters and 78 other publications) have been

identified as potentially relevant to EA. The content of all these publications has been studied to discover all approaches to EAM described in literature.

3.2. *Selection criteria*

Three selection criteria were used by the author to distinguish approaches to EAM from other publications relevant to EA. First and most importantly, an approach to EAM should provide a comprehensive end-to-end description of EAM, including the answers to the following essential questions: what EA artifacts are developed, what is the basis for EA artifacts, who develops EA artifacts, how are EA artifacts developed, when are EA artifacts developed, what do EA artifacts describe, how are EA artifacts structured, who uses EA artifacts, how are EA artifacts used and when are EA artifacts used. For instance, the Zachman Framework[97,98] and some other frameworks[99] were not classified as approaches to EAM because they describe only how EA artifacts should be structured, but do not provide any answers to other questions.

Second, an approach to EAM should provide an original description of EAM rather than repeat, support, cite or refer to the descriptions provided by other sources. For instance, numerous publications supporting TOGAF[12–14,52,53,55,100–110] were not classified as approaches to EAM.

Third, different publications describing the same approach to EAM (or its different versions) were classified as one approach. In these cases the most comprehensive publications were selected as key publications describing the approach. For instance, different publications describing the approach to EAM recommended by Bernard[7,111] were classified as one approach represented by the most comprehensive of these publications.[7] Similarly, different versions of TOGAF[10,112] and FEAF[9,46] were reduced to their most comprehensive descriptions.[9,10]

4. Review Results

As a result of the review, 15 publications describing consistent approaches to EAM and satisfying the required selection criteria have been identified. 13 of these publications[6–10,43,44,71,78,113–116] describe different variations of the well-known traditional approach to EAM discussed above. However, in addition to the traditional four-step approach two alternative well-described and consistent approaches to EAM have been identified,[57,58] which will be discussed further under the titles MIT[57] (because it was developed at MIT) and DYA[58] (because this title was given by its authors) since they do not have any established titles in literature.

Both these approaches explicitly oppose themselves to the traditional approach to EAM and criticize it, however, from different perspectives. For instance, Ross *et al.* (Ref. 57, p. vii) criticize the traditional approach for its "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" and propose more business-oriented approach. Wagter *et al.*[58] criticize the traditional approach for producing comprehensive but useless architectures ("paper tigers") and propose more pragmatic "just enough, just in time" approach. The next sections will briefly describe the essence of these alternative approaches and then compare them with the traditional approach to EAM.

4.1. *The MIT approach to EAM*

The MIT approach to EAM was developed at Massachusetts Institute of Technology (MIT) by Ross *et al.*[57] The MIT approach suggests that EAM starts from the development of a core diagram by the collaborative efforts of business and IT executives based on the operating model of an enterprise. The core diagram is a pivotal EA document describing main business and IT capabilities, corporate data, principal customers and key technologies. The core diagram represents a long-term abstract enterprise-wide architectural vision. Then business and IT executives should implement the IT engagement model including three essential elements: (i) enterprise-wide IT governance, (ii) disciplined project delivery methodology with necessary checkpoints and (iii) processes and committees ensuring the connection between enterprise-wide decisions and project-level activities. The purpose of the IT engagement model is ensuring that the global architectural vision represented by the core diagram is taken into account by decision-makers at all organizational levels, thereby, influencing IT project implementation. Balancing local and global concerns allows individual IT projects to build enterprise-wide capabilities, not only fulfill immediate needs. The essence of EA in the MIT approach is represented by the abstract core diagram. The MIT approach relies on the global architectural direction setting and subsequent translation of this direction into concrete project-level decisions.

4.2. *The DYA approach to EAM*

The DYA (DYnamic Architecture) approach to EAM was developed at Sogeti Nederland in 2001 and presented internationally by Wagter *et al.*[58] DYA advocates "just enough, just in time" architecture, no EA is developed until there is a need for it. EAM activities in the DYA approach are triggered by concrete business initiatives appearing in the process of a strategic dialogue. As a response to a new business initiative, architectural services create relevant business and IT diagrams to facilitate informed decision-making and then prepare a project-start architecture for the corresponding new IT project in order to ensure that this new project fits seamlessly into the existing IT landscape. Enterprise-wide architecture in the DYA approach is represented only by the set of architectural principles and standards. Detailed architectural diagrams play only a temporary role in DYA since they are developed only when necessary to facilitate discussions for particular initiatives but not maintained purposefully afterwards, however, they are reused when possible.

The DYA approach relies on the ability to support forthcoming business initiatives with adequate project-start architectures in order to preserve the overall architectural consistency.

4.3. *Comparison of the three approaches to EAM*

Each of the three approaches to EAM gives significantly different answers to the essential questions related to EA practice. The comparison of the three approaches to EAM from the perspective of the essential questions is summarized in Table 2 as follows:

Therefore, despite the fact that each of the three identified approaches to EAM describes how to use EA for improving business and IT alignment, the actual recommendations of these approaches regarding its usage are significantly different. Unsurprisingly, a common understanding of the broad picture in the EA research is still missing.[5,93]

5. Synthesis of the Conceptual Model of EAM

The previous section discussed and compared existing approaches to EAM described in the EA literature. This section will synthesize a generic conceptual model of EAM embracing all the described approaches based on commonalities between them. First this section will develop a simplified conceptual model of EAM for centralized enterprises and then generalize this model to decentralized enterprises.

5.1. *Conceptual model of EAM for centralized enterprises*

The comparison of existing approaches to EAM (see Table 2) shows that they have more differences than commonalities. For instance, all the approaches recommend developing conceptually different EA artifacts on different bases and structure them differently (see questions 1, 2 and 7). While the traditional approach recommends using a formal step-wise process to develop EA, other approaches do not imply any formal processes (see question 4). In the traditional approach all EA artifacts are developed in the beginning of an iteration, in the MIT approach EA artifacts are developed when business significantly changes, while in the DYA approach they are developed only when they are needed (see question 5). Most importantly, EA artifacts in each approach describe different objects and scopes. For instance, in the traditional approach EA artifacts describe detailed current and future states of the whole enterprise as well as transition roadmaps, in the MIT approach EA artifacts describe abstract future states of the whole enterprise, while in the DYA approach EA artifacts describe only future states of individual business initiatives, not the whole enterprise (see question 6). The usage of EA artifacts also differs accordingly among the existing approaches to EAM (see questions 9 and 10). Therefore, types of EA artifacts (different types of models, core diagrams, project-start architectures, etc.), bases for EA artifacts (business strategy, operating model, business

Table 2. Comparison of the three approaches to EAM.

Approach to EAM	Traditional	MIT	DYA
Definitive source(s)	Refs. 6, 7, 10 and ten other publications	Reference 57	Reference 58
1. What EA artifacts are developed?	Comprehensive lists of artifacts including various diagrams, models, charts, matrices, principles, standards and many other types of artifacts	Core diagrams	Principles, standards, diagrams and project-start architectures
2. What is the basis for EA artifacts?	Business strategy and goals	Operating model	Individual business initiatives
3. Who develops EA artifacts?	Enterprise architects after interviewing senior business managers	Senior business and IT managers together	Enterprise architects in a strategic dialogue with senior business managers
4. How are EA artifacts developed?	Formal step-wise process starting with business architecture and ending with technical architecture	Informal process	Informal process but starting with diagrams and ending with project start architectures
5. When are EA artifacts developed?	In the beginning of an iteration or project	When business changes significantly	When EA is needed for particular business initiatives
6. What do EA artifacts describe?	Detailed current and future states of the whole organization and a roadmap for transition	Abstract future state of the whole organization	Detailed future states of particular business initiatives
7. How are EA artifacts structured?	According to various frameworks	No specific structure	According to the DYA framework
8. Who uses EA artifacts?	Largely IT staff, but also various business managers and architects	Various business managers, architects and IT staff	Business managers, architects and project teams
9. How are EA artifacts used?	Roadmaps are implemented by IT staff under the supervision of architects, models and diagrams support the decision-making of business managers and architects	Core diagrams support the decision-making of business managers and architects and influence on IT project implementation by IT staff under the supervision of architects	Diagrams support the decision-making of business managers and architects, project-start architectures are implemented by project teams under the supervision of architects
10. When are EA artifacts used?	After EA for the whole organization is developed	After EA for the whole organization is developed	Each artifact is used immediately after being developed
11. How are large organizations handled?	Partitioned to independent lines of business, segments or capabilities and then multiple levels of architecture are used (for instance, enterprise level and business unit level)	Each division has its own architecture in the context of enterprise-wide architecture	Enterprise level and business unit level architectures are used

initiatives, etc.), ways to structure EA artifacts (various frameworks), process steps (architecture vision, business architecture, information systems architecture, migration planning, etc.), objects of description (current state, future state, roadmaps, etc.), scopes of description (entire enterprises or individual initiatives) and ways to use EA artifacts (following roadmaps, implementing project-start architectures, etc.) all can vary depending on an approach to EAM and, therefore, cannot form the basis for a generic conceptual model of EAM.

On the other hand, all approaches to EAM have several high-level commonalities. First, EA in each approach is a collection of some artifacts (see question 1), but specific types of artifacts, structures, objects and scopes of their description can differ (see questions 1, 6 and 7). Second, main actors of EAM in each approach include architects, business managers and IT staff (see questions 3 and 8), but specific titles beyond these broad categories can differ (see questions 3 and 8). Third, each approach implies an EA development process when EA is produced according to the business vision by architects with some involvement of business managers (see questions 3 and 4), but their level of involvement, bases, specific steps and timing of the development process can differ (see questions 2–5). Fourth, each approach implies a decision-making process when business managers and architects use EA to make informed decisions for business and IT planning (see questions 8 and 9), but specific ways to use artifacts for that purpose can differ (see questions 8–10). Fifth, each approach implies an implementation process carried out by IT staff under the supervision of architects when EA is used to guide the actual information systems development (see questions 8 and 9), but specific ways to use artifacts for that purpose can differ (see questions 8, 9 and 10). However, unanticipated operational needs during the implementation process can also influence back on EA.[27] In a general case all these processes are largely independent and continuous in nature.

Therefore, for centralized enterprises EA is a centralized collection of artifacts resulting from the development process carried out by architects and managers. EA is used during the decision-making process by managers and architects, and during the implementation process by IT staff and architects. Unanticipated operational needs during the implementation process influence back on EA. All EAM processes are largely independent and continuous in nature. These processes, artifacts and actors constitute the essence of EAM for centralized enterprises. The resulting conceptual model of EAM for centralized enterprises is shown in Fig. 1.

5.2. *Conceptual model of EAM for decentralized enterprises*

Figure 1 presents a conceptual model of EAM for centralized enterprises with consolidated decision-making and architecture teams. However, for large decentralized enterprises all approaches to EAM recommend partitioning EA on higher level architectures (larger scopes, less detail) and lower level architectures (smaller scopes, more detail) (see question 11), but specific ways to partition it can differ (see question 11). In this case different parts of EA (for instance, enterprise level and

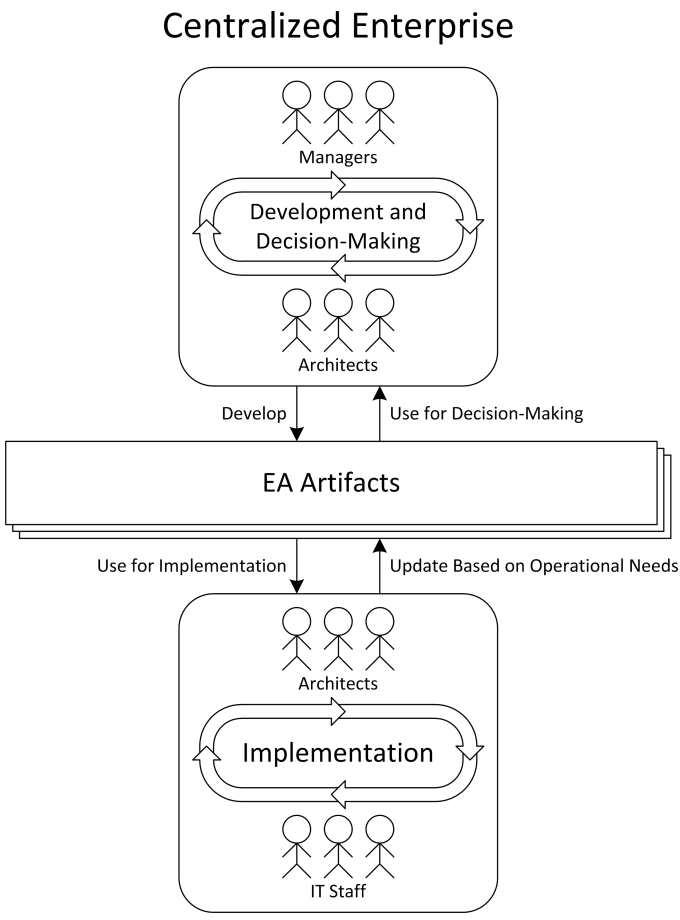

Fig. 1. Conceptual model of EAM for centralized enterprises.

business unit level architectures) have different groups of relevant stakeholders and architects. Consequently, EAM at decentralized enterprises implies coordination processes when global and local needs are balanced between different architecture teams working on different parts and levels of EA. These coordination processes are poorly described or ignored in most publications classified as approaches to EAM (except the detailed description in Ref. 57 (Chap. 6) and the limited description in Ref. 8 (Chap. 4), however, they are discussed by many authors[11,72–76] and supported by a number of case studies.[22,23,77]

Therefore, in a general case EA is a multi-level decentralized collection of artifacts (for instance, enterprise level EA artifacts and business unit EA artifacts) resulting from the development processes carried out by relevant groups of architects and managers (for instance, enterprise level and business unit architects and managers). Different parts of EA are linked together through the coordination processes carried out by corresponding architects (for instance, enterprise level architects and

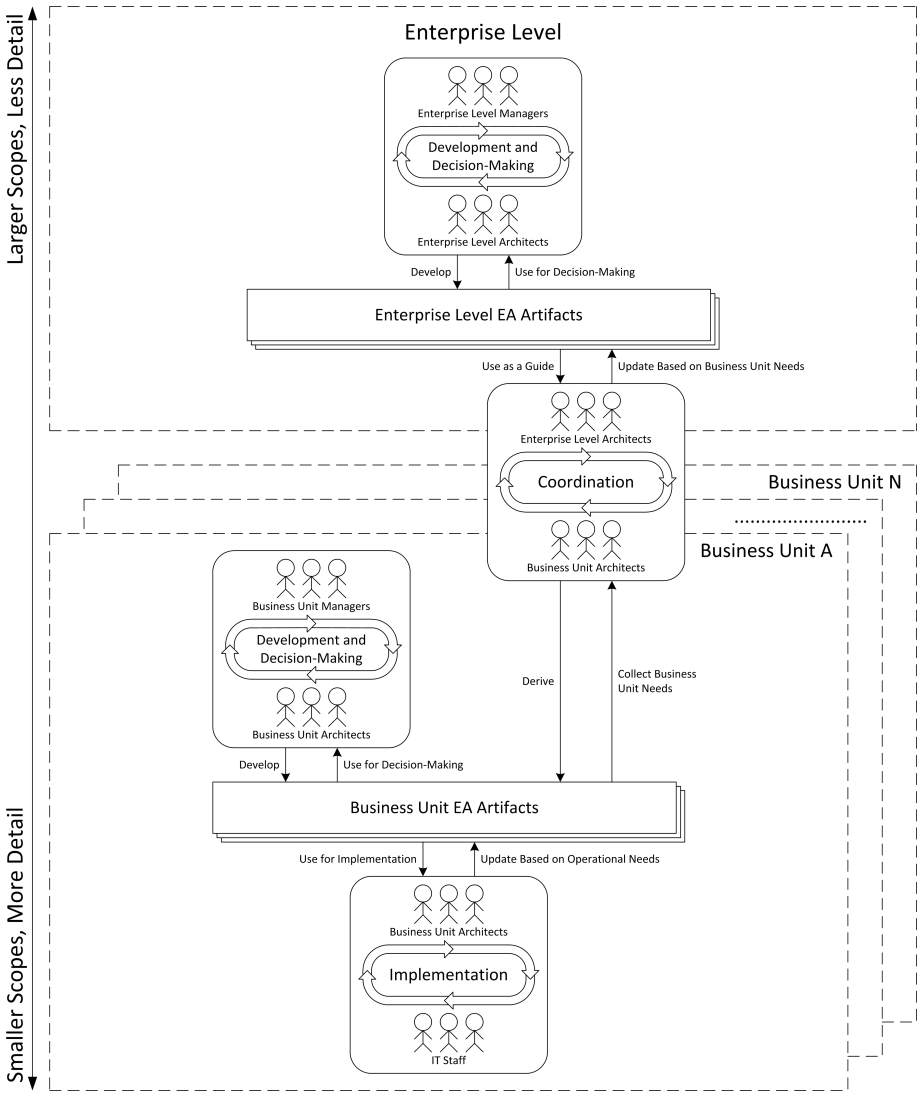

Fig. 2. Conceptual model of EAM for decentralized enterprises.

business unit architects). EA is used during the decision-making processes by relevant groups of managers and architects, while lower levels of EA (for instance, business unit EA artifacts) are also used during the implementation processes by IT staff and architects. Unanticipated operational needs during the implementation process influence back on lower levels of EA. These processes, artifacts and actors constitute the essence of EAM in a general case for decentralized enterprises, while centralized EAM at centralized enterprises (see Fig. 1) is only a special case of this generic model. The resulting generic conceptual model of EAM for decentralized enterprises is shown in Fig. 2. For the sake of simplicity this model is two-level

(enterprise level and business unit level). However, in a general case it can have any number of levels (including one level for centralized enterprises).

The generic conceptual model of EAM for decentralized enterprises describes EAM as a decentralized network of independent but interacting elements: processes (development, decision-making, coordination and implementation), artifacts (enterprise level and business unit EA artifacts) and actors (managers, architects and IT staff). Descriptions of these elements of the generic conceptual model of EAM are provided in Table 3.

The generic conceptual model of EAM (see Fig. 2) implies four specific features. First, all EA artifacts in the model can describe architectures of *entire organizational units* (whole enterprises, lines of business, divisions, segments, etc.)

Table 3. Elements of the conceptual model of EAM.

Processes	
Process	Description
Development	Architects collaborate with managers to translate their business visions into corresponding EA artifacts (enterprise level or business unit). Business visions taken as the basis for EA development can include business strategy (see Refs. 7, 44 and 71), operating model (Ref. 57) and individual business initiatives (Ref. 58). Architects and managers can follow a formal step-wise development process (Refs. 6 and 10) as well as an informal unstructured process (Ref. 57). This process can be initiated in the beginning of a project or iteration (Refs. 6 and 10), when major business changes occur (Ref. 57) or when EA artifacts are needed (Ref. 58).
Decision-making	Managers and architects use corresponding EA artifacts (enterprise level or business unit) for making strategic (Ref. 84), IT investments (Ref. 117) or other important decisions (Refs. 118 and 119).
Coordination	Enterprise level and business unit architects collaborate to balance local and global needs and to achieve a shared architectural vision (Refs. 72, 73, 75 and 76).
Implementation	IT staff and architects use business unit EA artifacts to implement the information systems described in these artifacts. They can use project-start architectures (Ref. 58) as well as roadmaps (Refs. 6 and 10) as the basis for implementation activities. Different techniques, for instance compliance checks and assessments, can be used to facilitate conformance to EA (Refs. 120–125).
Artifacts	
Entity	Description
Enterprise level EA artifacts	Enterprise level EA artifacts describe larger scopes in less detail and relevant for enterprise level architects and managers. Enterprise level EA artifacts can be business objectives, principles, company structures, core diagrams, capability maps, business process models as well as many other types of artifacts (Refs. 6, 7, 10, 57, 58 and 116). They can be structured according to EA frameworks (Refs. 97, 99 and 116) or without any frameworks (Ref. 57). Enterprise level EA artifacts can describe any combination of current states, future states and roadmaps (Refs. 10 and 57). Scopes of their description can vary from entire enterprises (Ref. 57) to individual transformation initiatives (Ref. 58).

Table 3. (*Continued*)

Business unit EA artifacts	Business unit EA artifacts describe smaller scopes in more detail and relevant for business unit architects and managers as well as for IT staff. Similarly to enterprise level EA artifacts, they can be different types of artifacts, can be structured in any reasonable ways and can describe any combination of current states, future states and roadmaps. Scopes of their description can vary from independent lines of business (Ref. 7), divisions (Ref. 57), segments (Ref. 9) or capabilities (Ref. 10) to individual initiatives (Ref. 58).
	Actors
Actor	Description
Managers	Managers include CEOs, executives, mid-level managers, business unit leaders and other managers at different organizational levels (Refs. 126–130). Managers provide information and collaborate with architects to develop corresponding EA artifacts (enterprise level or business unit) and then use them for decision-making.
Architects	Architects include enterprise architects, business unit architects, CIOs and other senior IT managers responsible for IS planning (Refs. 10, 57 and 58). Architects work with managers to develop corresponding EA artifacts (enterprise level or business unit), use them for decision-making and collaborate with other architects working on different parts of EA to achieve a shared architectural vision. Business unit architects also supervise IT staff implementing the information systems described in business unit EA artifacts. However, same architects can work at different levels simultaneously or be periodically rotated to avoid the "ivory tower syndrome" (Refs. 23, 71 and 77).
IT Staff	IT staff include project managers, business analysts, developers, testers, database administrators and other rank and file IT specialists responsible for project implementation (Refs. 126–130). IT staff work under the supervision of business unit architects to implement the information systems described in business unit EA artifacts

or capabilities[7,9,10,57] as well as architectures of *individual changes* (initiatives, programs, projects, etc.).[58]

Second, all the processes of the model in a general case are carried out in an arbitrary temporal manner by different groups of people. In particular cases of EAM they can follow a sequential step-wise "plan then implement" logic.[6,10] However, they can also be carried out simultaneously and continuously without any predefined order as well.[57,58]

Third, all the processes of the model have bidirectional information flows. For instance, managers work together with architects to translate business visions into corresponding EA artifacts and also use existing artifacts for the strategy development and decision-making.[28,84,127] Business unit EA artifacts are usually derived from enterprise level EA artifacts, but the critical needs and feedback from business units can also influence on the enterprise level architecture.[75,76,131] IT staff under the supervision of architects develop information systems according to business unit EA artifacts, but operational needs and urgent changes can also influence on the business unit architecture.[27] Due to the bi-directional information flow the

model implies both proactive and reactive planning necessary to support emergent initiatives and operational demands.[28]

Fourth, the model in a general case can have any reasonable number of architecture levels. For instance, centralized enterprises can have only one level, while decentralized enterprises can have up to six levels.[132] However, regardless of the particular number of levels, higher architecture levels have wider scopes and less detail, while lower architecture levels have narrower scopes and more detail[133,134] and all architecture levels are linked with the coordination processes between corresponding architects working on them.[73,76,135]

5.3. *The influence of "soft" human factors on EAM*

Figure 2 and Table 3 present the generic conceptual model of EAM describing the main processes, artifacts and actors constituting the essence of EAM. However, this model describes only the "hard" side of EAM, but does not explain the influence of "soft" human factors on EAM. These human-related factors influencing EAM in organizations, arguably, can be separated into three broad groups: (i) factors determining the overall organizational acceptance of EAM, (ii) general features of the organizational culture influencing all EAM processes and (iii) differences in organizational subcultures influencing specific EAM processes involving actors from diverse subgroups.

First, the success of EAM is largely determined by the degree of organizational acceptance of EAM.[33]Ahlemann *et al.*[86] articulate six critical factors facilitating the organizational acceptance of EAM: (i) EA is useful to people, (ii) EA is fun to use, (iii) the use of EA is rewarded, (iv) benefits of EA are convincing to people, (v) management is committed to use EA and (vi) adequate support is provided to EA users. Organizational grounding, trust, governance, goal alignment, enforcement, social legitimacy and economic efficiency are also recognized as prerequisites for the successful organizational acceptance of EAM.[33,136] Hazen *et al.*[137] show that a performance expectancy and an appropriate training in EA facilitate the organizational acceptance of EAM. On the other hand, Iyamu[138] argues that an inflexible organizational structure, economic expediency, administrative process, organizational politics, poor technical capability and the lack of business buy-in can complicate the organizational acceptance of EAM. These acceptance factors, arguably, influence on all processes constituting EAM.

Second, general features of the organizational culture can have a considerable and complex impact on EAM.[139–141] Specifically, van Steenbergen[142] shows that orientation to collaboration, orientation to work, control, coordination and responsibility are the cultural dimensions significantly influencing EAM. Change versus stability and internal focus versus external focus dimensions also have substantial impact on the use of EA principles[143] as well as on EAM in general.[144] Other authors[145,146] consider leadership support, awareness of EA among stakeholders and a common understanding of EA as strong cultural factors influencing EAM.

These cultural dimensions and factors, arguably, influence on all processes constituting EAM.

Third, differences in organizational subcultures can cause communication breakdowns and, thereby, influence on EAM.[147,148] Faller and de Kinderen[87] argue that these cultural differences can be divided into two separate categories causing different types of EAM ineffectiveness: (i) cultural differences between architects and their key business stakeholders and (ii) cultural differences between architects within the EA function. Faller *et al.*[149] demonstrate that EAM is influenced by the differences in seven dimensions of culture: basis of truth and rationality, nature of time and time horizon, orientation to work, orientation to change, control, coordination and responsibility, orientation and focus and orientation to IT. Consequently, on the one hand, the differences in these dimensions of culture between architects and business managers influence on the EA development and decision-making processes in all enterprises involving both architects and business managers. On the other hand, the differences in these dimensions of culture between different architects influence on the coordination processes in decentralized enterprises involving architects from different architecture teams, especially if different organizational units are dispersed geographically.[87,149] The influence of "soft" human factors on EAM is summarized in Table 4.

Table 4. "Soft" human-related factors influencing EAM.

Factor	Explanation	Scope of influence
Overall organizational acceptance of EAM	Overall organizational acceptance of EAM, determined by enforcement, rewards, support, management commitment, social legitimacy, performance expectancy, training, business buy-in, organizational politics and other factors, significantly influences the success of EAM (Refs. 33, 86, 136–138)	All EAM processes
General features of the organizational culture	General features of the organizational culture (including leadership support, awareness among stakeholders, common understanding of EA, orientation to collaboration, control and responsibility, orientation to work, internal vs. external focus and change vs. stability) can have a considerable and complex impact on EAM (Refs. 141–146)	All EAM processes
Cultural differences between architects and managers	The cultural differences in seven dimensions of culture (basis of truth, nature of time, orientation to work, orientation to change, control and responsibility, orientation and focus and orientation to IT) can cause communication breakdowns between architects and managers and influence on EAM (Refs. 87, 147–149)	Development and decision-making processes in all enterprises
Cultural differences between different architects	The cultural differences in seven dimensions of culture (basis of truth, nature of time, orientation to work, orientation to change, control and responsibility, orientation and focus and orientation to IT) can cause communication breakdowns between architects from different architecture teams and influence on EAM (Refs. 87, 147–149)	Coordination processes in decentralized enterprises

Table 4 describes the main "soft" human factors influencing EAM, the mechanisms of their influence on EAM and the scope of their influence on EAM processes. Thereby, the generic conceptual model of EAM explicitly takes into account and explains the influence of "soft" human-related factors on the essential EAM processes.

6. Discussion

The generic conceptual model of EAM (see Fig. 2) reflects the essence of EAM for organizations of all sizes regardless of any specific approach to EAM (see Table 2). Now this section will discuss the resulting model of EAM as a prescriptive, descriptive and theoretical reference model.

6.1. *Prescriptive model*

The generic conceptual model of EAM provides only an abstract prescriptive guidance for EA practitioners. It explains only the essential elements of EAM and their relationship, but does not describe any of these elements in detail since they can vary depending on a specific approach to EAM (see Table 3). Therefore, the conceptual model of EAM shows what processes should be established around EA artifacts, what their purpose is and who should participate in them, but does not recommend how exactly to do it.

As noted by Miller and Hartwick,[150] simple, prescriptive, easy to "cut and paste" recommendations indicating specific actions to be taken are the true signs of management fads, while real management classics are "complex, multifaceted, and applied in different ways to different businesses. The classics don't come with simple primers on how to make the changes they propose nor do they have simple rules everyone must follow" (Ref. 150, p. 27). Therefore, a detailed prescriptive model of EAM, arguably, cannot be developed due to the existence of different approaches to EAM[10,57,58] and due to the general acknowledgement that there are no one-size-fits-all approaches to EAM.[32,151–156]

6.2. *Descriptive model*

The generic conceptual model of EAM embraces and reconciles all approaches to EAM described in the EA literature[10,57,58] as well as the evidence from the available EA case studies.[22,23,77]Therefore, the resulting model arguably describes the essence of EAM regardless of any specific approach to EAM. Each of its elements is an inherent part of EAM, except that the coordination processes can be absent at small companies with centralized EAM. Consequently, the model clearly separates the essential elements of EAM from its secondary optional details that can vary from company to company (see Table 3).

6.3. *Theoretical reference model*

The generic conceptual model of EAM provides the conceptual mechanisms addressing the main practical issues neglected by the traditional approach to EAM: large scope of modern enterprises, dynamic nature of the organizational environment, integration of EAM into organizational processes and the influence of "soft" human factors on EAM.

First, since decentralized EAM is essential for large decentralized enterprises,[23,59,71] the conceptual model of EAM explicitly reflects this fact. It describes EA as a decentralized collection of artifacts and includes the coordination processes essential for multi-level EAM.[8,11,72–76] Therefore, the conceptual model of EAM clearly explains how decentralized multi-level EA practices at decentralized enterprises work and how large scopes are handled.

Second, the conceptual model of EAM emphasizes that EAM is not a centralized proactive planning exercise, but rather is a complex and dynamic management practice including various processes carried out simultaneously by different teams, bidirectional information flows, decision-making at different organizational levels as well as collaboration, coordination and feedback mechanisms. The model suggests that EAM can be described as a complex "nervous system" or as an actor-network able to propagate business and IT decisions in both top-down and bottom-up directions using EA artifacts as an intermediate communication medium.[41,85] Thereby, the conceptual model of EAM explains how organizations can do IS planning in

Table 5. Summary of the conceptual model of EAM.

Conceptual model of EAM	Summary	Reason
As a prescriptive model	Provides abstract guidance	Shows what processes should be established around EA artifacts, what their purpose is and who should participate in them, but does not recommend how exactly to do it because one-size-fits-all prescriptive model of EAM, arguably, cannot be developed
As a descriptive model	Reconciles three currently identified approaches to EAM	Describes the essence of EAM regardless of any specific approach to EAM (traditional, MIT and DYA) and other details that can vary from company to company
As a theoretical reference model	Addresses four currently identified conceptual issues	Provides the conceptual mechanisms addressing the large scope of modern enterprises, dynamic nature of the organizational environment, integration of EAM into organizational processes and the influence of "soft" human factors on EAM

vibrant technology and business environments[24–26] as well as react to emergent business initiatives and urgent operational demands.[27,28]

Third, the conceptual model of EAM emphasizes that EAM is not a single standalone step-wise iterative process, but rather is a set of continuous processes performed at different organizational levels that can be integrated with relevant normal organizational processes.[82,83] For instance, strategic planning can be integrated with the development and decision-making processes of the model,[28,84] while project management can be integrated with the implementation process.[27]

Fourth, the conceptual model of EAM explicitly takes into account and explains the influence of "soft" human-related factors on EAM (see Table 4). Specifically, the model summarizes, arguably, all significant findings regarding the influence of overall organizational acceptance of EAM,[33,86,136–138] general features of the organizational culture[141–146] and the differences in organizational subcultures[87,147,149] on EAM processes.

6.4. *Summary of the conceptual model of EAM*

The generic conceptual model of EAM (see Fig. 2) reflects the essence of EAM for organizations of all sizes regardless of any specific approach to EAM. The summary of the resulting model as a prescriptive, descriptive and theoretical reference model is provided in Table 5.

7. Contribution

The generic conceptual model of EAM makes non-theoretical, theoretical and practical contributions to the EA discipline.

7.1. *Non-theoretical contribution*

From the non-theoretical perspective the conceptual model of EAM highlights a number of issues of significant importance for the EA discipline. First, the abstract nature of the resulting model of EAM, which is based on commonalities between all described approaches to EAM, suggests that the notion of EAM is insufficiently understood. The comparison of the three identified approaches to EAM (see Table 2) shows that these approaches have more differences than commonalities. Moreover, these approaches differ even in the most critical questions, for instance, what EA artifacts are developed (see question 1), how EA artifacts are structured (see question 7), what EA artifacts describe (see question 6), what is taken as the basis for EA artifacts (see question 2), how EA artifacts are developed and when (see questions 4 and 5), and how EA artifacts are used and when (see questions 9 and 10). Consequently, essentially no EAM-related questions have definite answers in the EA literature. The very existence of three significantly different approaches to EAM recommended by different authors demonstrates that the common understanding

of real EAM best practices is missing. Moreover, these best practices can be very organization-specific.

Second, the resulting conceptual model of EAM questions a number of unsubstantiated assumptions often found in EA publications. For instance, many authors[11–14,51–56] use the traditional four-step approach to EAM as a reference model of EAM in their research. However, this paper demonstrates that the traditional approach to EAM provides only a certain prescriptive model of EAM followed more or less successfully by some companies, but it can hardly be used as a representation of EAM in general. Specifically, descriptions of both current and future states can be missing, roadmaps can be missing, step-wise processes can be missing and a detailed EA documentation recommended by the traditional approach can be missing in many companies practicing EA. Nevertheless, a very significant portion of all EA publications are explicitly or implicitly based on these unsubstantiated assumptions to various extents and, therefore, can be of questionable validity. This fact suggests that the EA research community should reconsider common taken for granted assumptions on EAM and generally *should not* make any additional assumptions beyond the ones resulting from the generic conceptual model of EAM developed in this paper since any additional assumptions can hold only for specific cases of EAM, but not for EAM in general.

Therefore, this paper makes a significant non-theoretical contribution to the EA discipline by critically evaluating the current state of EA research, provoking new thoughts and stimulating future research that will substantially alter the EA theory.[157–159]

7.2. *Theoretical contribution*

From the theoretical perspective the conceptual model of EAM presents, arguably, the first deliberate attempt to formally conceptualize EAM. Although the resultant conceptual model of EAM is relatively abstract, it summarizes a considerable volume of previous EA research and is aligned to the available empirical evidence on EAM found in the EA literature. Thereby, the generic conceptual model of EAM developed in this paper overcomes the most significant problems associated with the traditional approach to EAM (see Table 1) and, arguably, provides a more adequate and realistic model of EAM for the EA discipline. The comparison between

Table 6. Comparison between the traditional approach to EAM and conceptual model of EAM.

Perspective	Traditional approach to EAM	Conceptual model of EAM
As a prescriptive model	Provides detailed guidance, but often leads to numerous practical problems	Provides abstract guidance
As a descriptive model	Describes only a special case of EAM, but not EAM in general	Reconciles three currently identified approaches to EAM
As a theoretical reference model	Ignores important conceptual issues	Addresses four currently identified conceptual issues

the traditional approach to EAM and conceptual model of EAM is summarized in Table 6.

Therefore, the generic conceptual model of EAM synthesized in this paper, arguably, provides a more adequate theoretical conceptualization of the notion of EAM, which takes into account the existence of different approaches to EAM and addresses the identified conceptual issues related to EAM.

7.3. *Practical contribution*

From the practical perspective the conceptual model of EAM describes the essential processes that should be established around EA artifacts, their purpose and main actors, but suggests that the specific implementation of these processes should be company-specific and can follow different approaches. Thereby, it provides more realistic advice than popular EA methodologies[6,7,10] recommending detailed one-size-fits-all processes to establish EAM and one-size-fits-all sets of artifacts to describe EA, while following these recommendations often results in significant practical problems.[18,19] Additionally, the conceptual model of EAM explains that successful EAM always implies not only creating necessary EA artifacts, but also establishing regular development, decision-making, coordination and implementation processes involving relevant actors. The model emphasizes that all these elements are equally important for success, while the current EA literature is largely focused only on developing and describing EA[7,116,160] naturally stimulating only the production of unused EA artifacts.[59,100,161,162] Therefore, the resulting conceptual model emphasizes the fact that EA artifacts should not be created for their own sake, but rather to be used in particular processes by specific participants.

8. Limitations and Directions for Future Research

This paper intended to synthesize the generic conceptual model of EAM which is able to explain the phenomenon of EAM in general resolving existing contradictions and conceptual issues related to EAM. Even though this paper is based on a comprehensive review of the available EA literature, the resulting conceptual model of EAM representing the current knowledge on EAM is still very high-level and abstract. Despite the existence of a large number of EA publications addressing various aspects of EA practices, systematic information on EAM in the current EA literature remains contradictory and scarce. Specifically, the EA literature describes three incompatible approaches to EAM and provides only limited information regarding the influence of "soft" human-related factors on EAM. As a result, the literature review research approach used in this paper at the present moment is unable to provide an exhaustive answer to the question "What is EAM?", more empirical research on EAM is needed. Therefore, the paucity of the available information on EAM in the current EA literature can be considered as a significant limitation of this paper.

On the other hand, the conceptual model of EAM developed in this paper is not expected to be the "final" model of EAM, but rather is only the first step towards the formal conceptualization of EAM. As noted earlier, essentially no EAM-related questions have definite answers in the current EA literature (see Table 2). This fact calls for further research on the basic EA-related questions presented in Table 2. Moreover, the very existence of three significantly different approaches to EAM demonstrates that these approaches can be very situation-specific. This fact suggests that the EA research community in the future should focus on studying strengths, weaknesses, benefits and problems of different approaches to EAM as well as on contingency factors influencing the choice of specific approaches to EAM in particular organizations.

Generally, the conceptual model of EAM developed in this paper provides only a tentative answer to the question "What is EAM?" and calls for further research in order to study in more detail the very notion of EAM, which is currently insufficiently understood, but is not investigated by the EA research community.

9. Conclusion

This paper discussed the traditional BSP-based four-step approach to EAM initially proposed by Spewak and Hill.[6] This approach, arguably, became a de facto standard way to conceptualize EAM since it is supported by numerous authors, advocated by most influential and cited EA publications, included into university EA course books, often taken as a reference model of EAM by many researchers and is strongly associated with the very notion of EA.

However, as demonstrated in this paper, the traditional approach to EAM is (i) questionable as a prescriptive model of EAM because it is associated with numerous problems and poor success rates, (ii) inadequate as a descriptive model of EAM because it is unable to describe the actual EAM in many companies and (iii) inadequate as a theoretical reference model of EAM because it largely ignores the large scope of modern enterprises, dynamic nature of the organizational environment, integration of EAM into organizational processes and the influence of "soft" human factors on EAM. Therefore, it has been concluded that the traditional four-step approach to EAM, though practiced more or less successfully by *some* companies, can hardly be used as a *generic* conceptual model of EAM by the EA research community.

In order to provide an alternative model this paper reviewed the available EA literature and synthesized the generic conceptual model of EAM embracing all the identified approaches to EAM. The resulting conceptual model of EAM describes EAM as a decentralized network of independent but interacting elements: processes (development, decision-making, coordination and implementation), artifacts (enterprise level and business unit EA artifacts) and actors (managers, architects and IT staff). This conceptual model, arguably,

reconciles all the identified approaches to EAM and addresses all the conceptual issues identified in the currently available EA literature.

The generic conceptual model of EAM developed in this paper contributes to both EA theory and practice. From the theoretical perspective this model provides the first deliberate attempt to formally conceptualize EAM and can be used as a sound reference model of EAM for further studies. From the practical perspective the model emphasizes that successful EAM always implies not only creating necessary EA artifacts, but also establishing regular development, decision-making, coordination and implementation processes involving relevant actors and all these elements are equally important for success.

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