The Practice of Enterprise Architecture

A Modern Approach to Business and IT Alignment

Second Edition

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Appendix A: The Origin of EA and Modern EA Best Practices

The main chapters of this book provided a comprehensive description of the existing industry best practices in using enterprise architecture for improving business and IT alignment. This appendix discusses in great detail the long and intricate history of the modern EA discipline, explains the origination of the established EA best practices in their current form and clarifies their relationship to widely discussed EA frameworks. In particular, this appendix starts with describing the historical evolution of formal architecture-based planning methodologies from the 1960s to the present days. Then, this appendix discusses the three common problems of all formal architecture-based planning methodologies, demonstrates their practical ineffectiveness and analyzes the actual prevalence of these methodologies in organizations. Lastly, this appendix concludes that the modern EA best practices described in this book emerged in the industry and have no real relationship to widely promoted EA frameworks.

The Origin of Enterprise Architecture: Myths and Facts

The longstanding and widely accepted myth existing in the EA community suggests that the entire EA discipline originates from the breakthrough article of John Zachman titled "A Framework for Information Systems Architecture" published in 1987 in the IBM Systems Journal[1], which introduced the first EA framework (Zachman Framework) that subsequently provided the basis for current EA best practices reflected in modern frameworks[2], most notably in TOGAF[3]. Ironically, but an evidence-based analysis of the current and historical literature on information systems planning clearly shows that nothing could be farther from the truth, while the real origin of the EA discipline in its current form and the corresponding best practices described in this book seemingly can be best explained by the following quote of renowned management scholars:

> *"Classics [in management] typically arise not from the writings of academics or consultants but emerge out of practitioner responses to economic, social, and competitive challenges"* (Miller and Hartwick, 2002, p. 27)

On the one hand, numerous architecture-based information systems planning approaches and methodologies have been proposed by various consultancies, gurus and experts since the very early days of computing long before 1987. On the other hand, all these proposed approaches and methodologies never proved effective and current EA best practices are essentially unrelated to these approaches beyond trivial common-sense generalities, e.g. development of some EA artifacts.

The History of Architecture-Based Planning Methodologies

The idea of deliberate information systems planning is far from new and dates back to the 1960s when the first planning approaches had been proposed. Since then, the discourse around

organization-wide IT planning has gradually evolved from information systems plans to information systems architecture and finally to enterprise architecture[4]. Nevertheless, the fundamental tenets and assumptions of corresponding architecture-based planning methodologies still stayed largely the same for the last half of a century and remained virtually unchanged from the 1960s to the present days.

Information Systems Plans Epoch

Since the beginning of the commercial use of computers in large organizations, numerous approaches had been proposed to plan, design and organize corporate information systems. These early planning approaches offered various recommendations on how to plan organization-wide information systems based on a business strategy, goals and objectives[5], products and markets[6], overall organizational system[7], data flows between departments[8], suppliers and orders[9], ends and means[10], vertical and horizontal classifications[11], critical success factors[12], management decisions[13], information requirements[14] and even generic soft systems problem-solving methodology (SSM)[15]. Many of these approaches implied some form of modeling to understand the required structure of information systems as well as the creation of some explicit information systems plans.

However, the earliest rudiments of the step-wise planning methodology currently advocated by TOGAF and other EA frameworks can be seemingly traced back to the article of Marshall K. Evans and Lou R. Hague titled "Master Plan for Information Systems" published in 1962 in Harvard Business Review[16]. This article proposed to use various modeling techniques including information flows, input-output matrices and layout charts for creating the "master plan" defining the structure of required information systems (prototype of modern enterprise architecture)[17]. More importantly, the article also outlined a high-level five-step approach to information systems planning strongly resembling the general logic of all subsequent architecture-based planning methodologies. This step-wise planning approach proposed in the article, presumably the earliest published approach to information systems planning, is shown in Figure A.1.

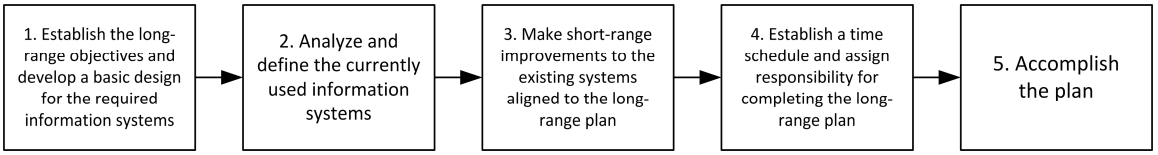

Figure A.1. The earliest step-wise approach to information systems planning (1962)[18]

Later a more detailed step-by-step approach to information systems planning based on very similar ideas had been published in Datamation magazine by M. Herbert Schwartz in 1970[19]. The step-wise planning approach proposed by Schwartz is shown in Figure A.2.

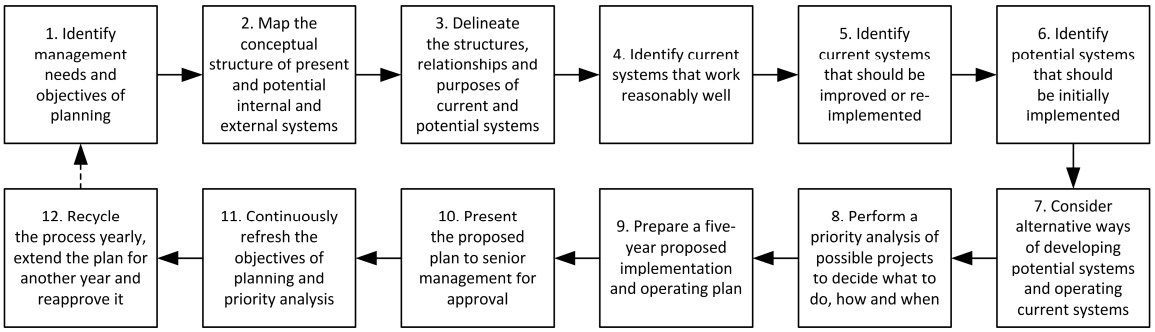

Figure A.2. The approach to information systems planning proposed by Schwartz (1970)[20]

Seemingly the first detailed structured methodology for organization-wide information systems planning was the Study Organization Plan (SOP) methodology introduced by IBM in the early 1960s and later supplemented with more extensive descriptions and teaching materials[21]. The SOP methodology was carried out by a specialized team of planners in a sequential manner and implied studying an organization and its operations by means of interviewing its business managers, then specifying requirements for the necessary information systems and finally designing the actual systems. Each of these activities, or phases, produced corresponding formal written reports using various forms, standardized sheets and simple modeling techniques. In the late 1960s, similar planning methodologies had also been proposed by some other companies and experts[22]. The step-wise planning approach recommended by the SOP methodology is shown in Figure A.3.

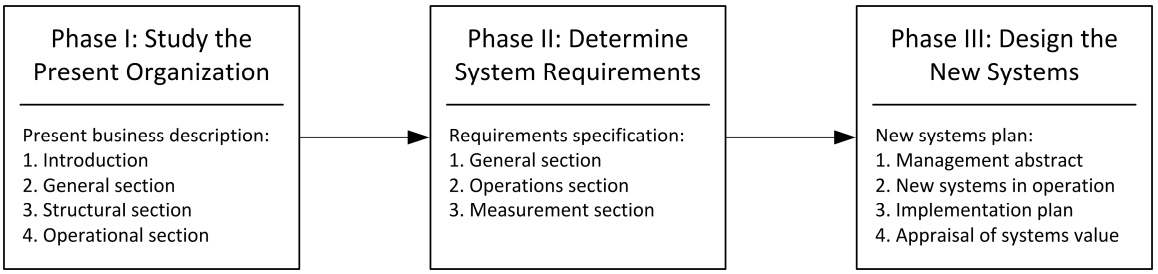

Figure A.3. IBM Study Organization Plan (SOP) methodology (1968)[23]

However, the earliest full-fledged, comprehensive and commercially promoted step-by-step information systems planning methodology that undoubtedly shaped modern EA frameworks was the Business Systems Planning (BSP) methodology[24] initiated by IBM in the late 1960s and led by P. Duane ("Dewey") Walker[25]. The first edition of BSP officially issued in 1975 introduced many novel ideas easily found in current EA frameworks and methodologies. For instance, the BSP methodology was implemented in a step-wise manner starting from identifying business objectives, defining business processes and data, analyzing the existing IT landscape and ending with developing a desired future information systems plan, preparing a detailed action plan and communicating it (prototype of the steps found in most current EA methodologies including, among others, TOGAF architecture development method). BSP activities were carried out by a

dedicated group of experts called the BSP study team and responsible for collecting data via interviewing business managers and then developing information systems plans in a top-down manner (prototype of modern architects). BSP information systems plans described the relationship between an organization, its business processes, data and information systems (prototype of the core domains found in most current EA frameworks). And lastly, BSP used relationship matrices, information systems networks, flowcharts and other formal modeling techniques to describe processes, systems and data (prototype of modern EA diagrams)[26]. The step-wise planning approach recommended by the first edition of the BSP methodology is shown in Figure A.4.

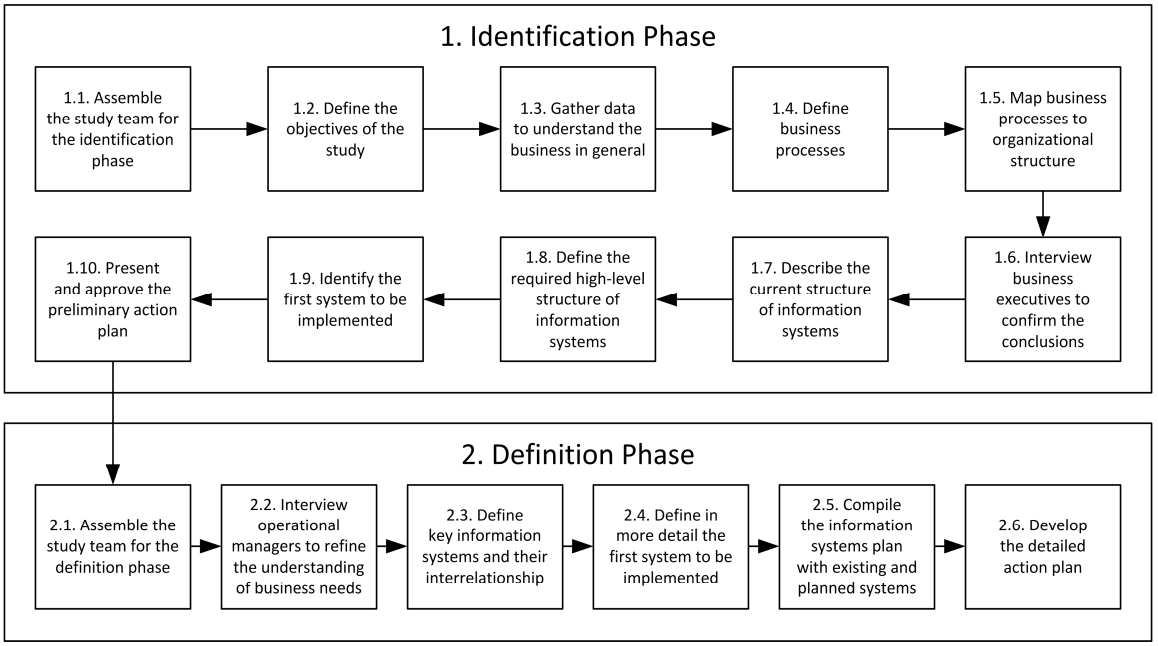

Figure A.4. IBM Business Systems Planning (BSP) methodology (1st edition, 1975)[27]

High demand for information systems planning methodologies in organizations stimulated the supply of these methodologies by consultancies[28]. As a result, after the introduction of the seminal BSP methodology by IBM, a number of similar BSP-like planning approaches quickly emerged in the market[29]. On the one hand, other BSP-based methodologies had been proposed by IBM itself, e.g. Information Quality Analysis (IQA) as a lightweight and automated version of original BSP developed by IBM Belgium[30]. On the other hand, highly similar planning methodologies had also been readily proposed by other consulting companies and experts essentially emulating and mimicking BSP in all the core aspects, i.e. step-wise, top-down and formal planning approaches producing comprehensive plans for required information systems[31].

For example, one of the most widely known BSP-like information systems planning methodologies was Method/1 promoted by Arthur Andersen (now Accenture)[32]. Method/1 advocated the same planning approach as BSP with very similar steps including studying an organization and its business strategy, analyzing the current IT landscape, developing desired

data, application and technology plans and finally producing the action plan defining necessary IT projects. The step-wise planning approach recommended by the late version of the Method/1 methodology is shown in Figure A.5.

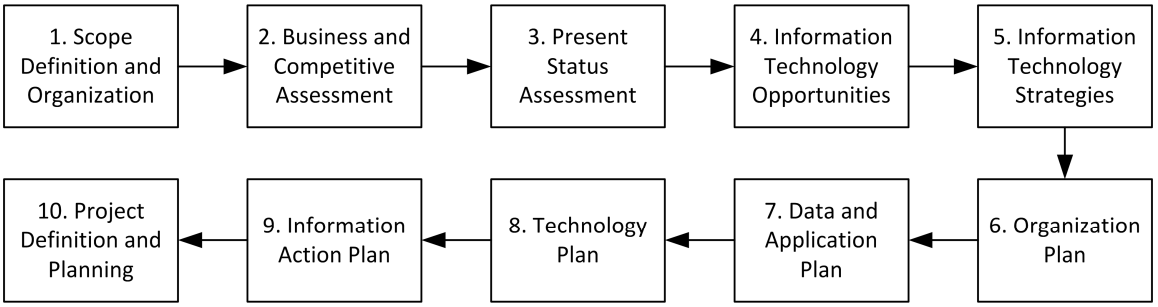

Figure A.5. Arthur Andersen Method/1 planning methodology (version 8.0, 1987)[33]

Information Systems Architecture Epoch

During the further evolution of the information systems planning consulting market, the word "architecture" gained widespread popularity in the lexicon of consultants[34]. As a result, previous information systems plans had been renamed to "newer" information systems architecture, data architecture or information architecture. This shift stimulated active discussions on how exactly architecture should be structured and first taxonomies for organizing architecture, or architecture frameworks[35], had been proposed accordingly including the early architectural model of Caroline Wardle in 1984[36], the PRISM framework in 1986[37] and only then the famous Zachman Framework in 1987[38], which gained its reputation of the first EA framework seemingly only because of its effective promotion to the masses[39].

After the main focus in the information systems planning discourse shifted to architecture, the corresponding methodologies had been renamed accordingly to architecture planning methodologies. For instance, the BSP methodology, which initially focused on old-fashioned "information systems plans" (see Figure A.4), in the later versions switched to more trendy "information architecture" to describe the relationship between business processes and data classes. The step-wise planning approach recommended by the fourth edition of the BSP methodology is shown in Figure A.6.

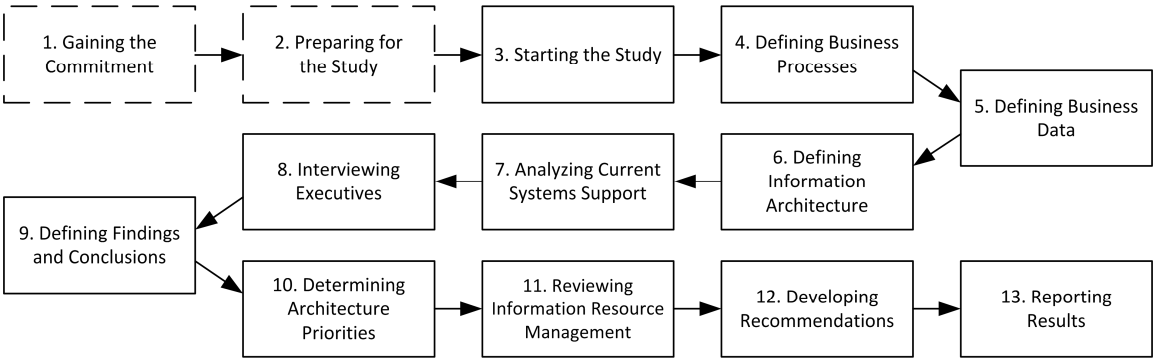

Figure A.6. IBM Business Systems Planning (BSP) methodology (4th edition, 1984)[40]

Highly similar architecture planning methodologies had also been offered by other prominent consultancies including, among others, the 4FRONT methodology by Deloitte & Touche (now Deloitte), the Summit S methodology by Coopers & Lybrand (now part of PwC)[41], the Information System Master Architecture and Plan (ISMAP) methodology by Atkinson, Tremblay & Associates (now defunct)[42] and the analogous architecture planning methodology by Nolan, Norton & Company (now part of KPMG)[43]. For example, the step-wise planning approaches recommended by Atkinson, Tremblay & Associates and Nolan, Norton & Company are shown in Figure A.7 and Figure A.8 respectively.

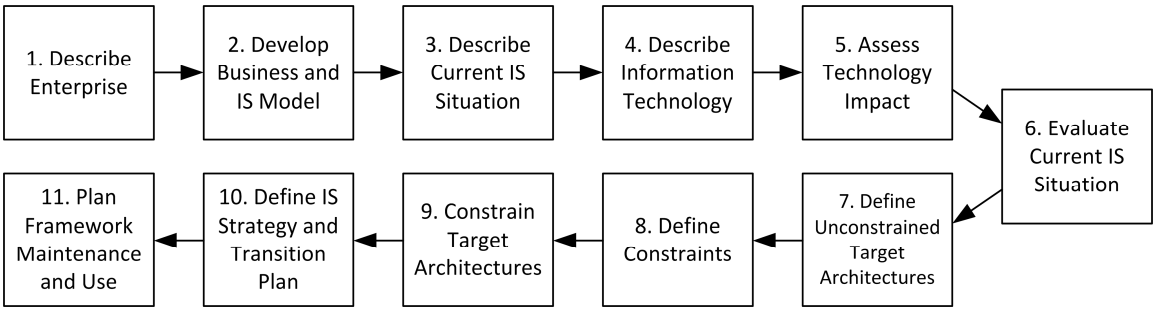

Figure A.7. Atkinson, Tremblay & Associates ISMAP planning methodology (1990)[44]

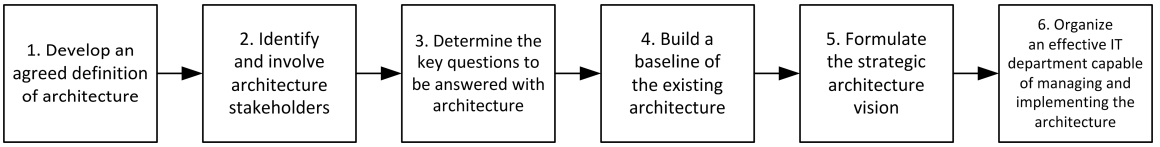

Figure A.8. Nolan, Norton & Company architecture planning methodology (1987)[45]

Aside from major consulting companies, similar architecture planning methodologies had also been actively promoted by individual consultants and gurus including Edwin E. Tozer[46], Thomas E. Gallo[47], Denis A. Connor[48], Claire M. Parker[49], William H. Inmon, now better known as an expert in data warehousing[50], and even by some academics[51]. All these methodologies advocated essentially the same planning approach as BSP that implied interviewing business

leaders, determining their business strategies, goals and information needs, assessing the current information systems support, describing the desirable architecture of future information systems and eventually formulating actionable implementation plans. For example, the step-wise planning approaches recommended by Edwin E. Tozer and Thomas E. Gallo are shown in Figure A.9 and Figure A.10 respectively.

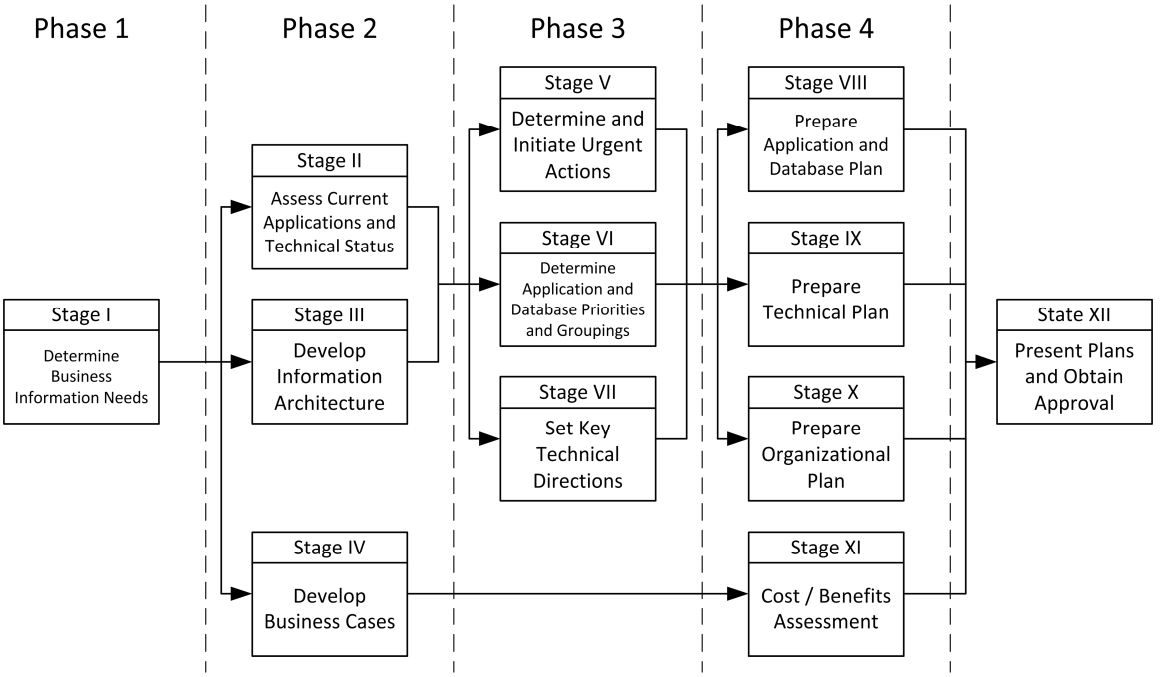

Figure A.9. The architecture planning methodology proposed by Tozer (1988)[52]

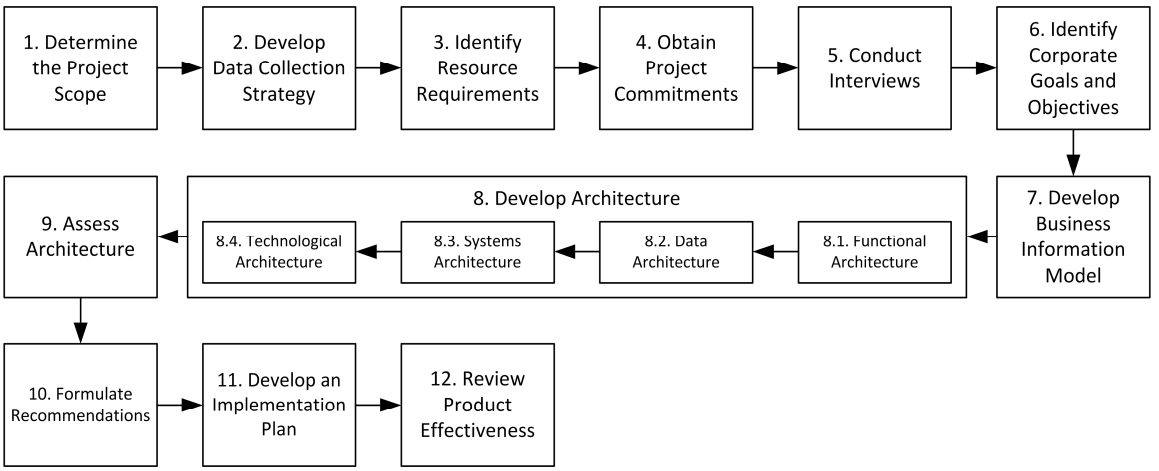

Figure A.10. The architecture planning methodology proposed by Gallo (1988)[53]

Being widely promoted in commercial private sector companies, architecture planning methodologies also started to expand into U.S. public sector and governmental organizations[54]. The Department of Defense was one of the first U.S. government agencies to develop its own architecture planning methodology. Specifically, based on the earlier approaches to architecture, the Defense Information Systems Agency (DISA) composed the Technical Architecture Framework for Information Management (TAFIM)[55]. TAFIM defined a comprehensive formal planning methodology with a familiar top-down, step-by-step logic highly resembling all the previous architecture planning methodologies. The step-wise planning approach recommended by the late version of TAFIM is shown in Figure A.11.

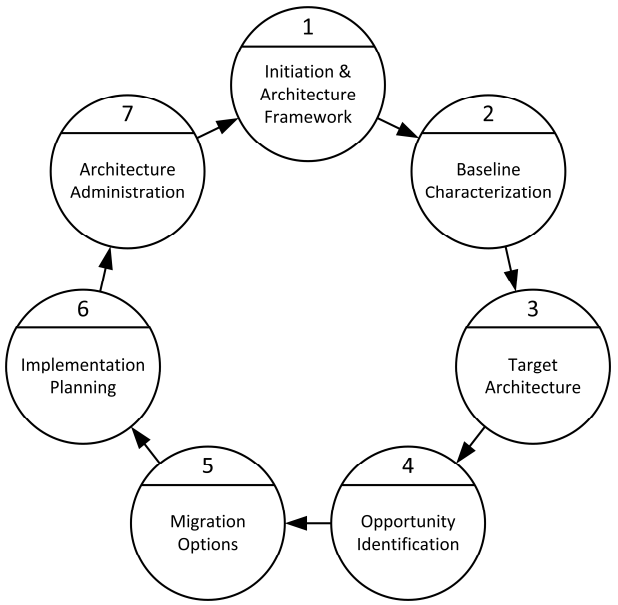

Figure A.11. TAFIM architecture planning methodology (1996)[56]

A notable branch of architecture planning methodologies is the family of approaches collectively titled as Information Engineering. The original Information Engineering methodology was initially proposed by IBM alumni Clive Finkelstein and James Martin in 1981[57], but later Information Engineering split into several slightly different sub-branches offered by various consultancies and gurus[58]. The most widely known sub-branch of the Information Engineering family is the sibling approach titled as Strategic Data/Information Planning and actively promoted by James Martin[59]. Information Engineering shifted the primary focus of architectural planning from business processes and applications to data as a "first-class citizen". While most previous architecture planning methodologies started the planning effort from identifying business processes or applications, Information Engineering recommended developing comprehensive data architecture first and only then deriving required systems, processes and procedures from this data architecture. Proponents of Information Engineering argued that data entities tend to be more stable in nature than the business processes that manipulate these entities and data-driven planning approaches, therefore, are more likely to

produce sound, reliable and long-living architecture[60]. For example, the late versions of Information Engineering recommended by Arthur Young consultancy (now part of EY) and Clive Finkelstein are shown in Figure A.12 and Figure A.13 respectively.

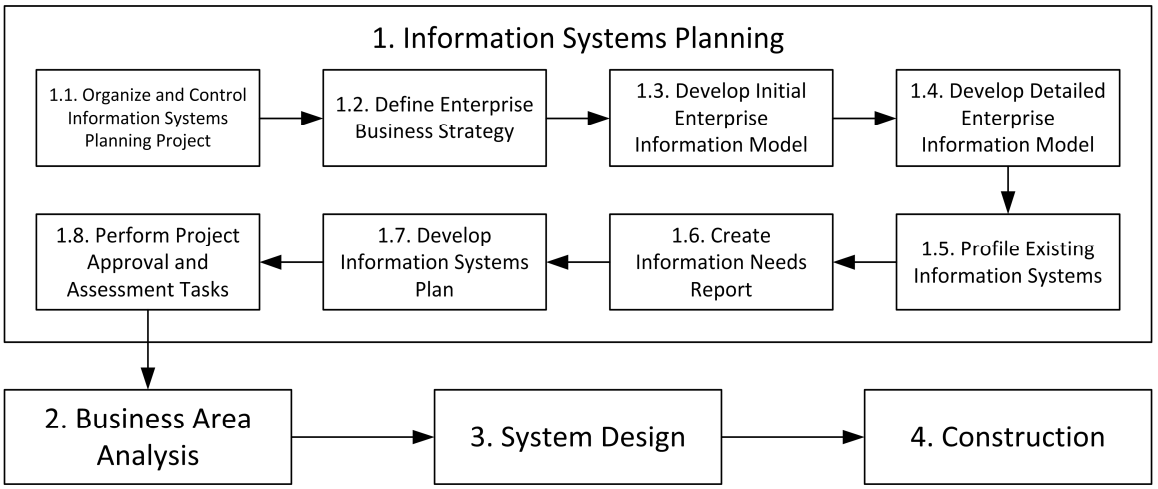

Figure A.12. Information Engineering methodology proposed by Arthur Young (1988)[61]

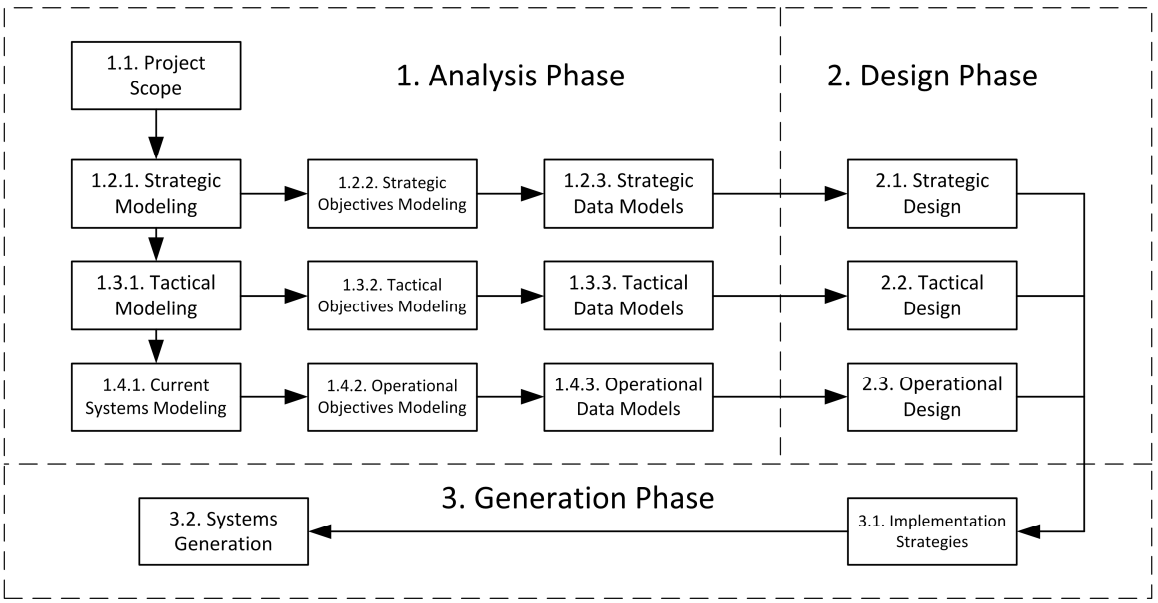

Figure A.13. Information Engineering methodology proposed by Finkelstein (1989)[62]

In the 1990s, the entire Information Engineering branch had faded away, while the "trunk" of architecture planning approaches continued its active growth and further evolution towards modern enterprise architecture methodologies.

Enterprise Architecture Epoch

At the beginning of the 1990s, the newer term "enterprise architecture" became in vogue. This term was initially introduced in the NIST model of enterprise architecture[63] and some other publications[64]. However, the first full-fledged planning methodology explicitly referring to enterprise architecture and titled simply Enterprise Architecture Planning (EAP) was proposed by consultants Steven H. Spewak and Steven C. Hill in 1992[65]. EAP was based on BSP (see Figure A.4 and Figure A.6) and recommended essentially the same formal top-down step-wise approach to develop comprehensive enterprise architecture[66]. The step-wise planning approach recommended by the EAP methodology (the so-called "wedding cake") is shown in Figure A.14.

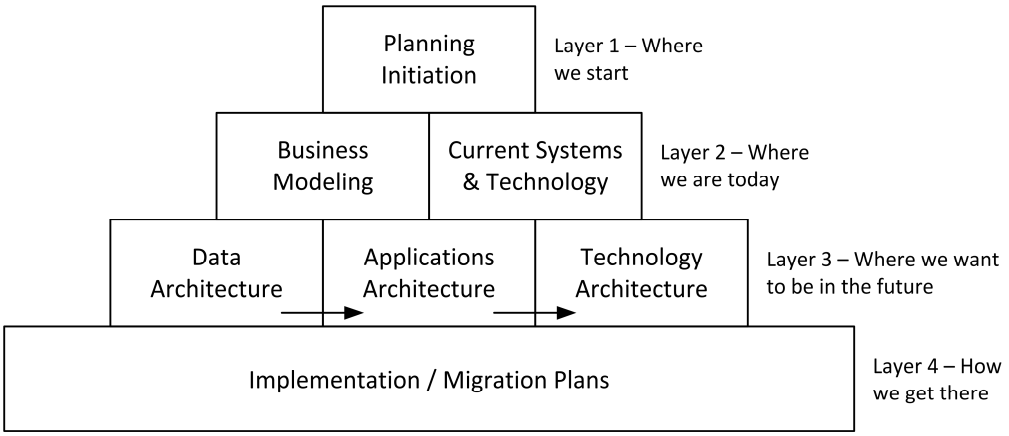

Figure A.14. Enterprise Architecture Planning (EAP) methodology (1992)[67]

The "brand new" notion of enterprise architecture had been willingly adopted by the broader consulting community. As a result, other consultants and gurus including Bernard H. Boar[68] and Melissa A. Cook[69] proposed their own, very similar step-wise methodologies for developing enterprise architectures, though under slightly different titles, e.g. enterprise IT architecture and enterprise information architecture. Also, after the further widespread popularization of the term "framework" within the EA community (and the accompanying erosion of this term), many EA methodologies became positioned as EA frameworks[70]. These trends excited a new surge of interest in architecture among U.S. government agencies. For instance, the Department of the Treasury introduced its own Treasury Information Systems Architecture Framework (TISAF) and then updated it to the Treasury Enterprise Architecture Framework (TEAF) in line with the general industry direction[71]. Likewise, the Department of Defense replaced its earlier TAFIM approach (see Figure A.11) with the Command, Control, Computers, Communications, Intelligence, Surveillance and Reconnaissance (C4ISR) architecture framework advocating an analogous six-step planning methodology[72].

In 1999, as a reaction to the Clinger-Cohen Act obliging all agencies of the U.S. Federal Government to develop consistent enterprise architectures, the U.S. Federal CIO Council initiated the Federal Enterprise Architecture (FEA) program and published the corresponding FEA Framework (FEAF) to guide the program[73]. FEAF was based on the EAP methodology (see Figure A.14), prescribed the same step-wise planning approach, but recommended to develop

enterprise architecture in a segmented manner[74]. Later, essentially the same enterprise architecture planning approach was repeated and presented as a continuous iterative process in a series of articles in IT Professional magazine authored by Frank J. Armour, Stephen H. Kaisler and Simon Y. Liu, contributors to the FEA program[75]. The step-wise planning approach recommended by Armour, Kaisler and Liu is shown in Figure A.15.

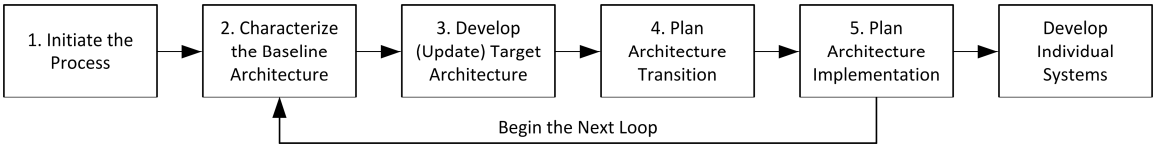

Figure A.15. The EA planning methodology proposed by Armour, Kaisler and Liu (1999)[76]

The next generation of highly similar EA methodologies, and now EA frameworks, promoted by both individual EA consultants and major consulting companies had emerged in the 2000s. On the one hand, this stream encompassed numerous slightly different EA methodologies proposed by prominent gurus from different countries including Christophe Longepe[77], Jane A. Carbone[78], Scott A. Bernard[79], Fenix Theuerkorn[80], Klaus D. Niemann[81], Jaap Schekkerman[82], Samuel B. Holcman (a former business partner of John Zachman)[83] and some other less well-known gurus[84]. For example, the four-phase 20-step enterprise architecture implementation methodology recommended by Scott A. Bernard and the eight-step iterative approach to enterprise architecture recommended by Jaap Schekkerman are shown in Figure A.16 and Figure A.17 respectively.

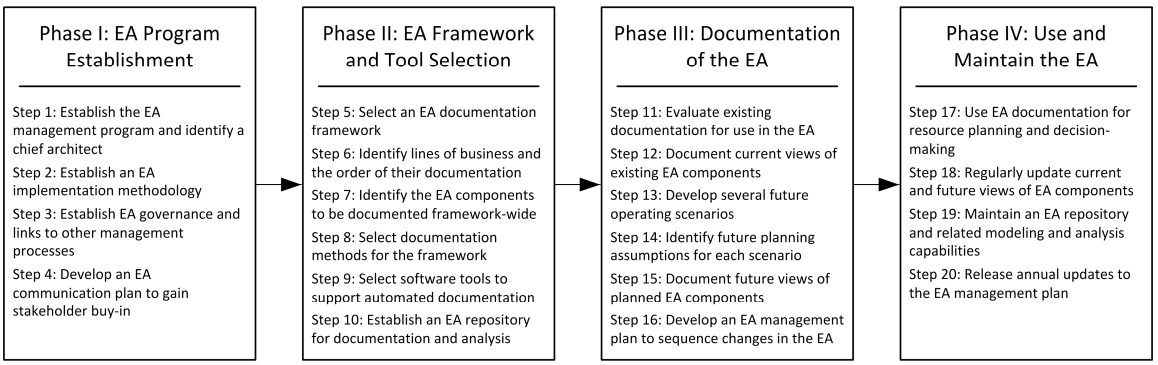

Figure A.16. The EA implementation methodology proposed by Bernard (2004)[85]

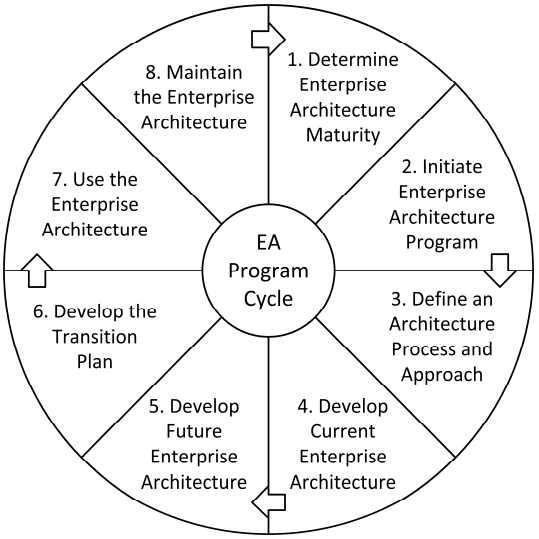

Figure A.17. The EA implementation approach proposed by Schekkerman (2008)[86]

On the other hand, the newer stream of planning approaches also embraced various EA methodologies and frameworks promoted by major consultancies including, among others, Gartner[87], IBM[88], Oracle[89] and Capgemini[90], and even the Department of Defense Architecture Framework (DoDAF) superseding the previous C4ISR framework in the U.S. Department of Defense[91]. For example, the step-wise approaches to organizing EA consulting engagements of IBM and Oracle are shown in Figure A.18 and Figure A.19 respectively.

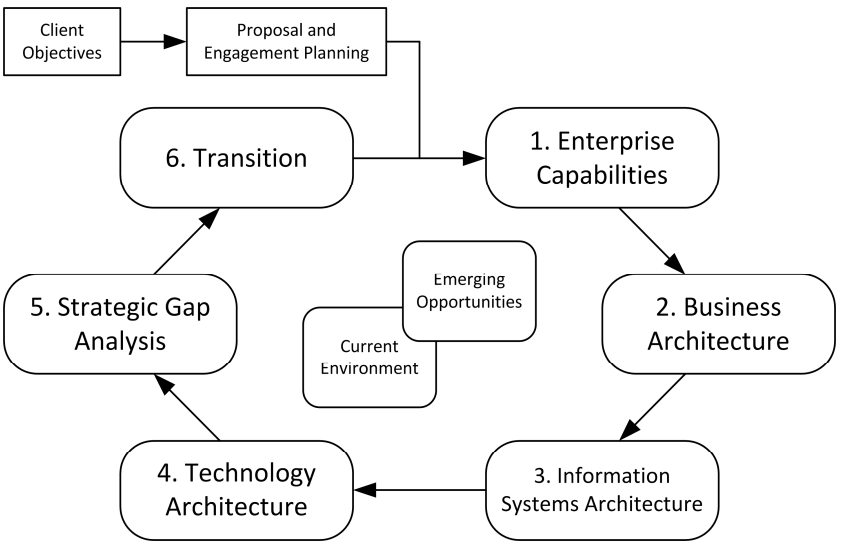

Figure A.18. IBM enterprise architecture consulting method (2006)[92]

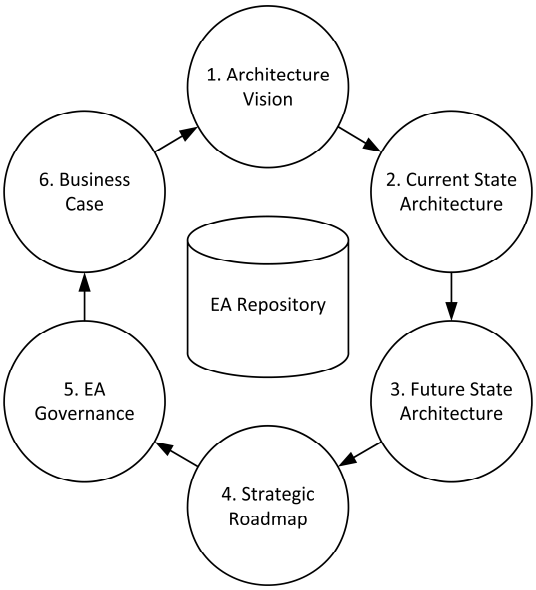

Figure A.19. Oracle enterprise architecture development process (2009)[93]

Finally, in the 2010s The Open Group Architecture Framework (TOGAF) gained widespread popularity in the EA community[94]. Originally based on TAFIM (see Figure A.11), TOGAF has evolved through a series of incremental improvements from the initial version 1.0 introduced in 1995 to the current version 9.2 published in April 2018. Recently TOGAF reached the status of the most popular EA framework[95] and is now positioned by The Open Group as a definitive global standard in enterprise architecture[96]. The step-wise architecture development method (ADM) recommended by TOGAF is shown in Figure A.20.

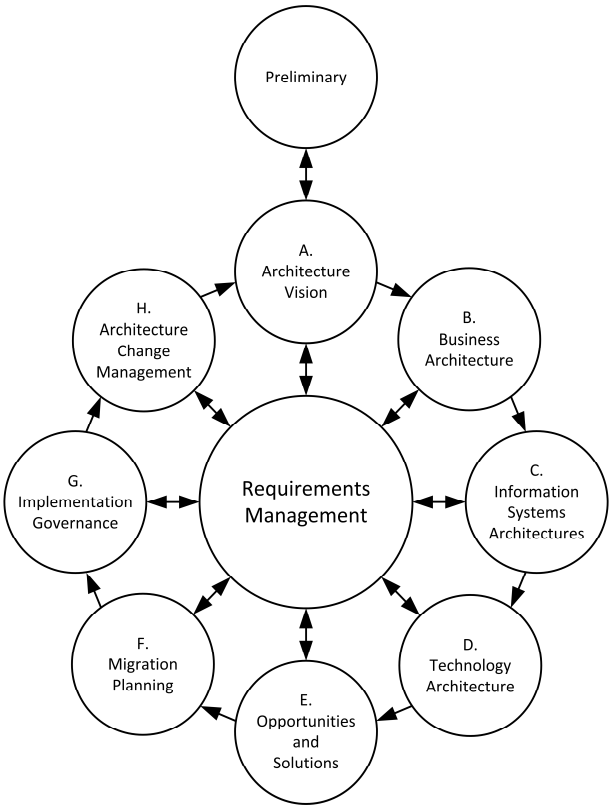

Figure A.20. TOGAF architecture development method (ADM) (2018)[97]

Conclusions of the Historical Analysis

The analysis of the long historical evolution of architecture-based planning methodologies from the early days of computing to the present days provided above (see Figure A.1 to Figure A.20) clearly shows that the latest EA methodologies and frameworks cannot be considered as new planning approaches in any real sense. Instead, the historical analysis demonstrates an undeniable connection of TOGAF and other modern EA methodologies to the earliest five-decades-old information systems planning approaches (see Figure A.1 to Figure A.3), and especially to BSP (see Figure A.4 and Figure A.6). Essentially, current EA methodologies and frameworks embody the high-level planning approach initially proposed by Marshall K. Evans and Lou R. Hague in 1962 and borrow many lower-level details from the BSP methodology.

Moreover, this lineage is evident and can be clearly traced at the level of general ideas, involved companies and even at the level of specific personalities. From the perspective of general ideas, all architecture-based planning methodologies, whether referring to information systems plans, information systems architecture or enterprise architecture, were based on the same basic principles. Namely, all these methodologies prescribed a formal, top-down and step-wise planning approach starting with the analysis of an organization and its business strategy and ending with some organization-wide plans, or architectures, describing the structure of required information systems[98]. Certainly, various architecture-based planning methodologies offered a

multitude of different "flavors" (e.g. process, system or data emphasis), different sequences of steps (e.g. the future state is described before the current state or vice versa), different attitudes (e.g. one-shot projects or iterative processes) and different terminology better aligned with the popular buzzwords of respective historical periods (e.g. Information Engineering appealed to the then-popular ideas of data normalization and computer-aided software engineering (CASE)). However, in spite of their continuous restyling and rewording, fundamentally all these methodologies represented only slightly different variations of the same analysis-synthesis documentation-oriented core planning paradigm inspired by traditional industrial engineering methods. All these methodologies from the 1960s to the present days inherited the same pivotal ideas, e.g. first developing comprehensive plans for information systems in some or the other form and then implementing these plans. Furthermore, in some cases this "genealogy" was openly admitted by the authors of corresponding methodologies. For instance, it was explicitly acknowledged that FEAF is based on EAP which, in its turn, is based on BSP[99], thereby directly confirming the existing connection between modern EA frameworks and the 50-years-old BSP methodology. Likewise, it is officially declared that TOGAF was derived from the earlier materials of TAFIM[100].

From the perspective of involved companies, many or even most architecture-based planning methodologies introduced to the market since the 1970s were products of the same narrow group of competing consulting companies, e.g. various predecessors of current "Big Four" consultancies (Deloitte, EY, KPMG and PwC) and most importantly IBM, or their former employees. For example, IBM alumni Clive Finkelstein, James Martin and John Zachman were among the most prominent individual contributors to the stream of formal architecture-based planning methodologies. Similarly, Edwin E. Tozer started his consulting career at Arthur Andersen and then worked for James Martin's consulting company James Martin Associates, while William H. Inmon worked for Coopers & Lybrand.

Lastly, the strong link between the latest EA methodologies and the earliest information systems planning approaches of the 1960s-1970s is easily traceable even at the level of specific personalities involved in their promotion. Most importantly, John Zachman joined IBM as a marketing specialist in the 1960s, successfully promoted BSP in the 1970s-1980s[101], published his famous framework for information systems architecture in 1987, then became the "father" of enterprise architecture in the 1990s and recently acquired the Federal Enterprise Architecture Certification (FEAC) Institute to sell FEAF and DoDAF trainings[102]. Similarly, Clive Finkelstein began his career at IBM in the 1960s, founded his own consultancy during the early BSP period in the 1970s, "fathered" Information Engineering in the 1980s, then started mentioning "enterprise information engineering" in the early 1990s[103] and finally also switched to promoting enterprise architecture[104].

The comprehensive historical analysis of architecture-based planning methodologies proposed by various companies and information systems experts since the 1960s allows making two curious conclusions important for the entire EA discipline. First, the historical analysis provided above clearly debunks the popular myth that the discipline of enterprise architecture originates from the Zachman Framework. As the analysis unambiguously demonstrates, current EA methodologies and frameworks are evident descendants of the earliest information systems planning approaches of the 1960s. In fact, the Zachman Framework neither influenced architecture-based planning methodologies in any real sense, nor even was the first published

architecture framework[105]. However, John Zachman himself still was among the most active promoters of architecture-based planning methodologies and specifically BSP.

Second, the historical analysis provided above allows grouping all the discussed architecture-based planning methodologies into a single family, or pedigree, of conceptually similar planning approaches. Basically, all formal, top-down and step-wise planning methodologies promoted by various consultancies and gurus over the last half of a century from BSP to TOGAF can be viewed merely as different elements of a single long-lasting and persistent global effort to "sell" the same planning approach under various titles. Although these methodologies significantly differed in their presentation style and terminology (e.g. initially referred to information systems plans, then to information systems architecture and finally to enterprise architecture), their real essence and fundamental meaning stayed unchanged and always implied the same analysis-synthesis documentation-oriented plan-then-implement mechanistic attitude towards information systems planning. The historical analysis of the family of formal architecture-based planning methodologies provided above is summarized in Figure A.21.

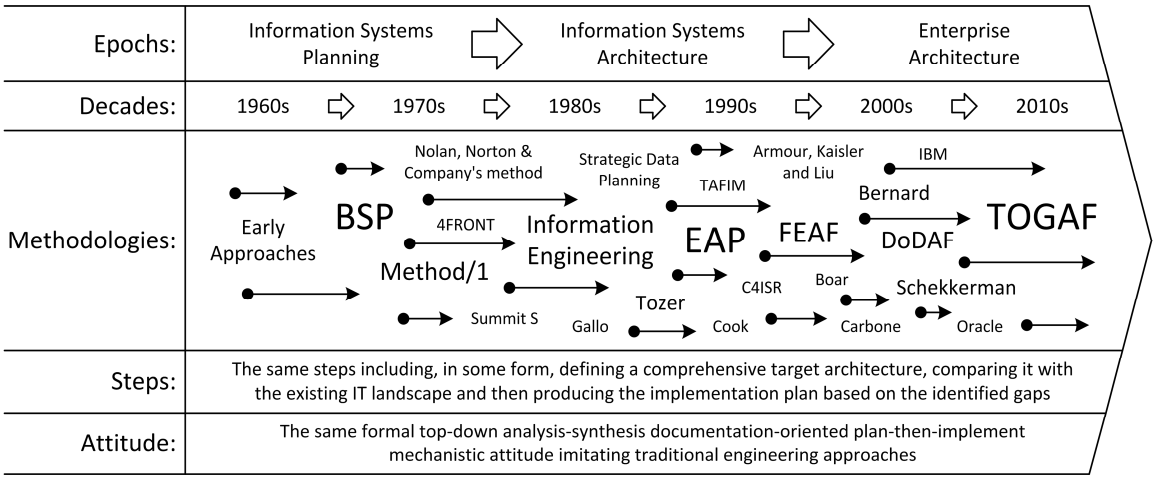

Figure A.21. The family of formal architecture-based planning methodologies

In spite of the evident conceptual similarity of all the proposed architecture-based planning methodologies from BSP to TOGAF, some general trends in the historical evolution of these methodologies can still be noticed. First, architecture-based methodologies evolved from one-shot planning projects often called architecture studies (e.g. BSP and Method/1) to continuous iterative processes where the next planning iteration, or project, starts as soon as the previous iteration is completed (e.g. TAFIM and TOGAF).

Second, architecture-based methodologies evolved from rather conceptual planning focused mostly on the logical aspects of architecture (e.g. processes, data and systems) to "deeper" planning also encompassing the underlying physical aspects of architecture (e.g. hardware, infrastructure and technology). For example, BSP and Information Engineering were largely abstracted from the technical details of architecture, while EAP and TOGAF explicitly cover the technology domain as well.

Third, architecture-based methodologies evolved from using relationship matrices as a means to capture and represent architecture to using more conventional graphical notations for this purpose. For example, BSP, Strategic Data/Information Planning and even EAP extensively relied on process/data class (CRUD), process/organization, organization/system and other types of matrices to describe the relationship between various elements of architecture, while TOGAF and other modern EA methodologies rely primarily on graphical diagrams and models to depict architecture.

Fourth, architecture-based methodologies evolved from producing loosely structured architectural documents to organizing their deliverables into neat taxonomies (or frameworks, in the original meaning of this word)[106]. For example, BSP, Method/1 and Information Engineering implied little or no specific structure for their products, while EAP, TOGAF and other modern EA methodologies clearly classify the resulting EA artifacts either according to different EA domains (e.g. business, applications, data and technology), or into some more sophisticated logical structures (e.g. the Zachman Framework, PRISM or other taxonomies)[107].

Lastly, architecture-based methodologies evolved from the planning approaches with a certain sophisticated theoretical basis to conceptually simple, largely atheoretical approaches. In other words, the historical evolution of architecture-based methodologies went towards the simplification of their theoretical foundations. For instance, BSP implied a set of rigorous, sequential and conceptually justified analytical procedures (essentially, an optimization algorithm) that allowed deriving an ideal architecture almost automatically from the information collected during the interviews with senior business stakeholders via grouping closely related business processes and data classes into cohesive IT systems. Likewise, Information Engineering leveraged the data normalization theory developed by Edgar F. Codd as a conceptual foundation to derive normalized, "mathematically" optimal, non-redundant architectures. However, all modern EA methodologies, including TOGAF, only suggest that the desired target architecture should be defined, but without specifying exactly how this architecture should be derived from the input information and how to ensure the optimality of the resulting architecture. Put it simply, early architecture-based planning methodologies tended to have some "ideological" underpinning and sound theoretical justifications for their procedures and outcomes, while modern methodologies are more theoretically shallow.

The Application of Architecture-Based Planning Methodologies

Despite being positioned as "best practices" in information systems planning and aggressively promoted by commercially motivated consultancies and gurus, formal architecture-based planning methodologies rarely fulfilled their promise and usually did not meet the expectations of organizations. Moreover, these methodologies were consistently found to be impractical, much less effective and popular than pragmatic and flexible homegrown architecture-based approaches to information systems planning.

Problems of Architecture-Based Planning Methodologies

The first attempts to investigate the practical effectiveness of formal architecture-based planning methodologies seemingly date back to the end of the 1980s[108]. The analogous efforts had also been undertaken later in the 1990s[109]. Then, during the following enterprise architecture epoch, similar studies and reports appeared in the late 2000s[110] and more recently in the 2010s[111]. All

these studies and field reports unanimously conclude that the practical implementation of architecture-based planning methodologies is associated with a number of considerable problems. Although these problems are rather diverse and multifaceted, they can be grouped into three core issues raised in some or the other form by most empirical studies of formal architecture-based methodologies: enormous planning efforts, low quality of the resulting plans and disconnection from the rest of the organization. These three issues are largely independent of each other, "orthogonal" in nature and can be clearly attributed specifically to the very essence of corresponding planning methodologies, rather than to some other more general factors, e.g. lack of management commitment and support, inadequate leadership, unclear business direction or shortage of skilled personnel.

First, the proper execution of architecture-based planning methodologies requires substantial investments of time, effort and managerial attention[112]. The creation of comprehensive plans, or architectures, formally describing an organization and its desired future state as recommended by architecture-based planning methodologies may take several months of full-time work for a dedicated team of people or even longer[113]. The corresponding development process often is further complicated by a broad organizational scope, dynamic context, high complexity and a large number of stakeholders involved in the process. Moreover, comparable efforts are also required later to maintain the existing plans or architectures up to date in order to accommodate the ongoing changes in an organization and its environment.

Second, the planning documents or EA artifacts resulting from the execution of architecture-based planning methodologies are often found incomprehensible to their stakeholders and unable to support decision-making. Common reasons for this problem include irrelevant informational contents, inconvenient presentation formats and inappropriate levels of abstraction and granularity of architectural plans. Furthermore, strict architectural plans recommended by most architecture-based methodologies are often considered too complex and technical by senior business stakeholders, especially by stakeholders unfamiliar with formal modeling notations and techniques. Another factor contributing to this problem and undermining the usefulness of architectural plans is their constant obsolescence. Frequent shifts in business priorities quickly render comprehensive architectures outdated and make them virtually irrelevant to decision-makers.

Third, architecture-based planning methodologies imply a separate standalone planning lifecycle essentially isolated from the surrounding organizational context. These methodologies are executed in a step-by-step manner in their own "time zone" and guided by their own internal logic, but do not enable adequate integration between the respective architecture planning activities and normal organizational activities, e.g. strategic planning, portfolio management, initiative funding and project delivery. As a result, existing architectures are not leveraged during regular decision-making processes and the architectural input is simply ignored. In fact, none of the architecture-based planning methodologies clearly explains when exactly resulting architectures should be used. The most common natural outcome of this disconnection between methodology-driven architecture planning processes and the rest of the organization is disbanded architecture teams and shelved architectural plans.

The three inherent problems with formal architecture-based planning methodologies described above represent permanent problems. The very same problems in some or the other form have been consistently identified by different observers at different historical periods

regarding all generations of architecture-based planning methodologies from BSP to TOGAF[114], which is unsurprising taking into account conceptual similarity or even equivalency of these methodologies, as demonstrated earlier. The problems associated with these methodologies are natural, rather than accidental, and result from their flawed design, rather than from their poor execution. These problems stem directly from the very essence of corresponding methodologies, i.e. top-down, step-wise, documentation-oriented, plan-then-implement mechanistic approach imitating classical engineering.

Unsurprisingly, over a long period of time many researchers, observers and analysts unanimously concluded that formal architecture-based planning methodologies are deficient and ineffective[115]. Problems with these methodologies were so evident and undeniable that their low success rate was acknowledged even by some of their own authors[116]. Moreover, independent observers at different time periods also concluded that the problems with formal planning methodologies are *fundamental* in nature and called for rethinking the very approach to information systems planning[117]. As opposed to "heavyweight", rigid and mechanistic architecture-based methodologies executed mostly by specialized planners or architects on behalf of an organization, many authors consistently argued for more pragmatic, flexible, participative and organic approaches to information systems planning[118].

Interestingly, the actual direction of the historical evolution of architecture-based planning methodologies discussed earlier (i.e. the evolution from more conceptual and theoretically substantiated planning projects creating relationship matrices to more technical and atheoretical iterative processes producing graphical diagrams organized into logical taxonomies) was essentially orthogonal to the empirically suggested development direction towards greater flexibility, pragmatism and stakeholder involvement. As a result, decades of this misdirected evolution driven seemingly only by chaotic commercial interests of competing consultancies and gurus, rather than by objective analysis and common sense, did not solve any of the three core practical problems associated with these methodologies described above[119]. Even the latest versions of EA methodologies still prescribe developing tens of EA artifacts (which are prohibitively expensive and time-consuming to create and maintain) predominantly of arcane technical nature (which will be incomprehensible to any business managers) via following sequential step-by-step processes (which cannot be integrated into regular decision-making procedures) in the total disregard of empirical realities, as if the respective problems have never been identified[120].

Prevalence of Architecture-Based Planning Methodologies

Aside from branded information systems planning methodologies widely promoted by global consultancies (e.g. BSP and Method/1), another family of planning approaches also "quietly" existed since the early days of computing and had been actively used in organizations. Specifically, many companies developed their own internal, homegrown approaches to information systems planning[121]. These approaches were established in-house, customized for the needs of particular organizations, never promoted publicly and had no specific well-known "loud" titles.

Historically, homegrown approaches to information systems planning prevailed in organizations, while BSP and similar architecture-based methodologies, despite being very widely discussed, were actually used only in about one-fifth of all companies[122]. Moreover, many

of these homegrown approaches proved much more effective in practice than formal architecture-based planning methodologies[123]. At the same time, the very idea of using some form of architecture to describe the relationship between business and IT was found helpful and promising by information systems planners, though with substantial deviations from the original prescriptions of popular architecture-based methodologies[124]. Taking into account the significant problems with formal architecture-based planning methodologies discussed above, it would be fair to say that genuine best practices in information systems planning, and even in architecture-based planning, historically were outside of the conspicuous zone of commercial architecture-based planning methodologies (e.g. BSP and Information Engineering), but instead were embodied in effective homegrown planning approaches developed in-house. However, these best practices stayed nearly invisible to the outer world, i.e. worked in leading organizations without being formally described, studied, conceptualized or widely promoted[125].

During the current enterprise architecture epoch, the actual prevalence of formal architecture-based planning methodologies, which are promoted today mostly as popular EA frameworks including TOGAF, is much harder to estimate since the very concept of enterprise architecture for many people became inextricably associated with EA frameworks essentially blurring the boundary between practicing enterprise architecture and using EA frameworks. At first glance, most companies practicing enterprise architecture indeed report on using some EA frameworks, though about one-third of all organizations still do not use any of them[126]. However, closer scrutiny immediately reveals the curious fact that, in most cases, the usage of EA frameworks is only formally declared, but their original prescriptions are not followed in any real sense[127].

In other words, at the present moment many successful EA practices operate under the "signboards" of EA frameworks without even trying to implement any of their actual recommendations, but instead carrying out some homegrown EA-based planning approaches unrelated to frameworks that proved helpful in practice. Taking into account the abundant and sharp criticism of EA frameworks[128], it would be arguably fair to say that the general impracticality of EA frameworks is now commonly acknowledged in the EA community and most architects do not treat their recommendations seriously any longer[129], while the overwhelming majority of organizations "using" EA frameworks simply ignore their essential prescriptions and rely on proven EA-based planning practices spreading across the industry. Analogously to the similar situation observed earlier during the previous pre-EA epoch described above, the current situation in the enterprise architecture epoch again clearly indicates that genuine EA best practices actually lay outside of the conspicuous zone of popular EA frameworks (e.g. TOGAF, FEAF and DoDAF), but instead are embodied in effective homegrown EA-based planning approaches quickly disseminating from organizations to organizations. These EA best practices are analyzed in this and some other earlier evidence-based books on enterprise architecture[130].

Conclusions of the Application Analysis

The analysis of the practical application of architecture-based planning methodologies provided above clearly shows that these methodologies never represented mainstream best practices in information systems planning. On the one hand, the entire family of formal architecture-based planning methodologies from BSP to TOGAF (see Figure A.21) proved impractical and much

less effective than pragmatic homegrown architecture-based approaches to information systems planning developed in many organizations and then spread across the industry. All these step-by-step methodologies never worked particularly well and were always associated with the three major practical problems described earlier. From this perspective, formal architecture-based methodologies can only be regarded as *proven worst practices* in information systems planning.

On the other hand, formal architecture-based planning methodologies never represented even mainstream planning practices. As discussed above, during the previous pre-EA epoch these methodologies were used only in the minority of organizations, while during the current enterprise architecture epoch the usage of these methodologies in the overwhelming majority of cases is purely declarative, i.e. the use of EA frameworks is proclaimed, but their actual recommendations are simply ignored or in the most extreme cases are not even studied. Essentially, all architecture-based planning methodologies were only widely promoted and briskly discussed in the literature, but rarely practiced and never represented "average" mainstream planning approaches actually adopted in real companies. In other words, these methodologies, as well as their successes, always existed mostly on paper rather than in practice[131].

The comprehensive analysis of the practical application of formal architecture-based planning methodologies allows making two curious conclusions important for the entire EA discipline[132]. The first conclusion is that all well-known architecture-based planning methodologies from BSP to TOGAF essentially reflect only a small visible tip of the huge planning "iceberg". All these methodologies represent evident management fads aggressively promoted by commercially motivated consultancies and widely discussed in the literature, but rarely actually used in practice and even more rarely with successful results for organizations. Although these methodologies always attracted considerable attention, created significant hype and essentially defined the discourse around information systems planning, information systems architecture and then enterprise architecture over the last half of a century, they never worked well in practice, never were widely used in organizations and never represented real best practices in information systems planning. Seeking best practices in these intentionally promoted but inherently ineffective architecture-based planning methodologies can be ironically compared to searching for keys under the lamppost because this is where the light is, even though the keys had been definitely lost somewhere else.

At the same time, genuine best practices in architecture-based planning belong to an invisible underwater part of the planning "iceberg". These best practices seemingly emerged as rudimentary homegrown planning approaches developed in-house, evolved in leading organizations over decades (arguably according to the approximate historical path discussed earlier, see Figure 19.2), gradually disseminated across the industry without being formally described or actively promoted on a commercial basis and currently matured to their present form analyzed in this book[133]. Unlike conspicuous but faddish and flawed architecture-based planning methodologies (e.g. BSP, Information Engineering, FEAF and TOGAF), real best practices worked "silently" in organizations and never were widely discussed, but constituted the actual body of knowledge on information systems planning stored mostly in the heads of practicing architects. The persistent disparity between widely promoted architecture-based planning methodologies and actual architecture-based planning best practices expressly demonstrates the

existence of a dramatic gap between what is superficially discussed and what actually works in organizations[134].

The second conclusion is that genuine EA best practices described in this book have no relationship to EA frameworks. Moreover, the lack of any connection between actual EA best practices and EA frameworks is evident from both conceptual and practical points of view. From a conceptual perspective, the development of genuine EA best practices and EA frameworks was motivated by different and essentially unrelated goals. While real EA best practices were obviously sought by organizations interested in improving the quality of their information systems planning, EA frameworks were seemingly motivated only by the commercial interests of consultancies and gurus eager to continuously resell the same "old wine in new bottles", i.e. promote new and new fresh-looking methodologies via replicating the same 50-years-old flawed ideas of BSP and other early planning approaches regardless of the well-known problems of these methodologies and a common understanding that more pragmatic, flexible and participative approaches are required[135].

From a practical perspective, the recommendations of EA frameworks do not overlap with proven EA best practices beyond very high-level common-sense generalities, e.g. some form of architectural planning is desirable, some diagrams and models can be useful, both the present situation and future goals should be taken into account, business, applications, data and technology aspects should be addressed, etc. At the same time, none of the frameworks-specific prescriptions proved useful in practice[136]. For instance, recommended taxonomies for organizing EA artifacts, long lists of specific EA artifacts, sequences of steps in which these artifacts should be created and even the general plan-then-implement approach advocated by EA frameworks all proved either impractical or harmful. Instead, successful EA practices are based on different sets of EA artifacts (see Figure 15.6), require diverse and continuous communication processes (see Figure 6.1), avoid detailed planning of the future state (see Figure 5.6) and even imply no strict separation of EA artifacts into different EA domains (see Figure 2.2) as suggested by EA frameworks. Furthermore, the vast majority of useful EA artifacts and planning techniques constituting successful EA practices cannot be traced to any EA frameworks that proposed them. Most notably, ubiquitously used Business Capability Models (see Figure 11.1 to Figure 11.3) are not even mentioned in any existing EA frameworks or methodologies. Even when useful EA artifacts are included in EA frameworks (e.g. Principles (see Figure 9.1) and some other helpful EA artifacts are listed in TOGAF), these frameworks only mention them among numerous useless EA artifacts and do not explain exactly how these artifacts should be used, when and why.

Historically, formal architecture-based planning methodologies and actual architecture-based planning best practices essentially form two different streams that evolved in parallel independently of each other, driven by entirely different forces. These streams are disparate in nature and should not be confused. On the one hand, the stream of formal architecture-based planning methodologies (see Figure A.1 to Figure A.20) was driven by consultancies and gurus. The corresponding prescriptive methodologies, and now EA frameworks, were created artificially simply by repacking the same ideas in different packages and "reselling" them again and again without taking into account their evident practical problems. These methodologies were always widely promoted and discussed in the literature, but rarely worked successfully in practice and, therefore, represent only classical management fads of little or no practical value. On the other

hand, the stream of real architecture-based planning best practices described in its current form in this book was driven by information systems planners in organizations. These planning approaches naturally evolved from simple to more sophisticated practices and spread across the industry. Although never deliberately promoted and seldom discussed in the literature, these planning approaches work successfully in numerous companies and, thus, represent the genuine body of knowledge on information systems planning. The comparison between the two streams of architecture-based planning approaches described above is summarized in Table A.1.

Stream	Formal architecture-based planning methodologies (see Figure A.21)	Real architecture-based planning best practices (this book)
Origin	Consulting companies and gurus	Information systems planners in organizations
Nature	Artificial, prescribed and imposed	Natural, industry-born and spontaneous
Evolution	The same approach replicated many times under different titles with insignificant modifications	Gradual evolution from simple to more complex practices
Approaches of the information systems planning epoch	BSP, Method/1 and earlier approaches (see Figure A.1 to Figure A.5)	Proven planning practices of these epochs are poorly studied and documented, no reliable sources or sound conceptualizations available, but seemingly loosely aligned with the historical evolutionary path discussed earlier (see Figure 19.2)
Approaches of the information systems architecture epoch	BSP, Information Engineering, TAFIM and other methodologies (see Figure A.6 to Figure A.13)	
Approaches of the current enterprise architecture epoch	EAP, FEAF, TOGAF and many other frameworks and methodologies (see Figure A.14 to Figure A.20)	Proven planning practices described in this book and earlier evidence-based books on enterprise architecture
Core ideas	Analysis-synthesis approach based on sequential steps and formal descriptions	Effective communication and continuous decision-making at different levels
Key features	Heavyweight, rigid, mechanistic and arcane	Pragmatic, flexible, organic and participative
Practicality	Impractical, associated with significant fundamental problems	Practical, work more or less successfully in numerous diverse organizations
Prevalence	Widely promoted and discussed in the literature, but rarely used in practice	Rarely promoted and discussed in the literature, but widely adopted in the industry
Metaphor	Visible tip of the iceberg	Invisible body of the iceberg
Essence	Classical management fads of little or no practical value	Genuine body of knowledge on information systems planning
Role	Provided the initial inspiration for real best practices, but never actually defined them	Actual best practices defining the discipline of enterprise architecture in its current form

Table A.1. Two streams of architecture-based planning approaches

Because of their incessant and irresponsible promotion by commercially motivated consultancies and gurus, EA frameworks became a prominent phenomenon of the modern EA

discipline that cannot be simply ignored in spite of their irrationality, practical uselessness and evident faddish nature. Essentially, EA frameworks now are a curious fact of life that undeservingly attracts significant attention in the EA discourse and occupies a considerable part of the entire information field. For this reason, this appendix will finish with the following brief advice for dealing with EA frameworks:

- Do not believe that EA frameworks are important, they are not
- Do not think that EA frameworks reflect best practices, they do not
- Do not try to implement EA frameworks, it cannot be done
- Ignore gurus promoting EA frameworks, they are bluffing
- Avoid discussing EA frameworks, think in a frameworks-free manner

Although framework certifications can improve the CVs of EA practitioners and comparisons of frameworks can enrich the publication records of EA academics, EA frameworks are not related to the current discipline of enterprise architecture in any real sense and represent enormously harmful management fads that should be eradicated[137].

Appendix Summary

This appendix analyzed the long history of the EA discipline, the evolution of formal architecture-based planning methodologies, the origination of modern EA best practices described in this book and their relationship to widely discussed EA frameworks. The core message of this appendix can be summarized in the following essential points:

- The roots of the current step-wise planning methodology recommended by TOGAF and other modern EA frameworks can be traced back to the early information systems planning approaches introduced in the 1960s and especially to the BSP methodology promoted by IBM
- After being introduced in a rudimentary form in the 1960s, formal architecture-based planning methodologies slowly evolved over the last half of a century through three different epochs initially positioned as information systems planning, then as information systems architecture and now as enterprise architecture
- In spite of their apparent stylistic differences, all architecture-based planning methodologies from BSP to TOGAF are based on the same core ideas, advocate a very similar analysis-synthesis plan-then-implement attitude imitating traditional engineering and essentially represent a single family of planning approaches
- The entire family of formal architecture-based planning methodologies proved impractical and even fundamentally flawed due to their common tendency to require significant investments of time and effort and producing only the heaps of cryptic documents nearly useless for decision-making purposes
- Despite being highly conspicuous and widely promoted, formal architecture-based planning methodologies were actually used only in the minority of organizations, while most companies developed their own homegrown architecture-based planning approaches and many of these homegrown approaches proved much more efficacious than branded methodologies

- Current EA best practices described in this book seemingly descend from the homegrown architecture-based planning approaches that emerged in leading companies, proved their practical effectiveness, gradually spread across the industry and matured over time, but have no real relationship to widely discussed faddish EA frameworks

Notes

Preface

[1] As Mintzberg (2009, p. 162) wittily notices, "a technique is something you can use in place of a brain"

[2] See, for example, Cardoza (2020) as a specimen of a typical mainstream article on enterprise architecture full of strange claims, sweeping statements, vague terms, frivolous buzzword-laden language and marketing rhetoric

[3] See, for example, Andriole (2020)

[4] For example, some recent industry publications (CompTIA, 2017; White, 2018b; White, 2020a) still claim that enterprise architecture has something to do with exactly the same set of four leading EA frameworks (Zachman, TOGAF, FEAF and Gartner) as ten years ago (Sessions, 2007). Other articles still discuss the virtues of TOGAF (White, 2018c) and Zachman (White, 2020b) or even try to equate enterprise architecture and TOGAF (Lewis, 2018)

[5] Arguably the most egregious cases of irresponsible promotion are the cases of FEAF and DoDAF. For example, the Federal Enterprise Architecture Certification (FEAC) Institute owned by John Zachman claims that "each of these Enterprise Architecture Frameworks [FEAF and DoDAF] has proven to have immediate applicability and impact in the private sector as well as the Federal space. FEAF and DoDAF are very powerful Frameworks and you don't have to be in Government to derive immediate EA impact from either of them!" (FEAC Institute, 2020a; FEAC Institute, 2020b). Another, less famous EA training provider asserts that DoDAF "is ideal for any commercial or private sector application, International organizations as well as Federal agencies" (EA Principals, 2020, p. 1). In reality, however, FEAF and DoDAF represent well-documented and spectacular failures: both have failed even in the organizations for which they were initially developed (i.e. in the U.S. Federal Government and Department of Defense respectively) with impressive financial losses measured in hundreds of millions of dollars (GAO, 2002; GAO, 2003b; GAO, 2004; GAO, 2005; GAO, 2006; GAO, 2007; GAO, 2011a; GAO, 2013; GAO, 2015; Gaver, 2010; Kotusev, 2016c). Even though these EA frameworks proved impractical and can be considered ideal only for wasting time and money, they are still promoted as "best practices" by those capitalizing on their promotion

[6] For example, Stevens (2018, p. 1) argues that "TOGAF replaces the need to organically grow your own enterprise architecture practice" and recommends to "encourage your organization to not reinvent the wheel if caught creating a custom EA practice", when even the most passionate TOGAF salesmen readily acknowledge that it cannot be used "out of the box", but instead needs to be customized in organization-specific ways (Viswanathan, 2015)

[7] See, for example, some of the recent articles in the most prestigious academic journals (Ahlemann et al., 2020; Dale and Scheepers, 2020; Hylving and Bygstad, 2019) and try to imagine what practical sense they can make

[8] See, for example, the latest standard from The Open Group (O-AA, 2020)

[9] The citation analysis of Simon et al. (2013) demonstrates that popular EA frameworks (i.e. TOGAF, Zachman, FEAF and DoDAF) are indeed the most highly cited and influential EA publications

[10] Most authors, for instance Sessions (2007), Simon et al. (2013) and Lohe and Legner (2014), to name a few among many others, argue that the entire EA discipline emerged from the seminal work of Zachman (1987)

[11] Specifically, I mean the approaches to enterprise architecture recommended by Wagter et al. (2005) (DYA) and Ross et al. (2006) (MIT). These two approaches propose significantly different ways of practicing

[42] These EA consulting engagements might still be better than having no rational information systems planning whatsoever and can arguably be beneficial to some very special types of organizations, e.g. small, simple and static companies with lagging IT departments and underdeveloped IT management practices. For instance, this view was expressed earlier regarding BSP studies by Gunton (1989). However, these types of consulting engagements are very inefficient, unfit for the vast majority of modern organizations and cannot be considered as mainstream EA "best practice"

[43] This suggestion is consistent with the earlier recommendation of Gartner to "use an [EA consultancy] to supplement your EA initiative, but never outsource your EA effort completely" (Lapkin and Allega, 2010, p. 1)

[44] For instance, Lapkin and Allega (2010, p. 3) describe this attitude in the following way: "Although many processes and functions of the enterprise can be outsourced, EA cannot be. Turning the responsibility and accountability for this critical strategic function over to a third party is tantamount to abdicating the responsibility for the realization of the business strategy. It is never advisable, because EA is so critical to business success"

[45] For instance, Lapkin and Allega (2010, p. 4) describe this situation in the following way: "Many software or hardware vendors have captive consultancies that represent themselves as having an EA framework and process that is independent and agnostic to final results. In truth, most of these frameworks offer predefined end states that presume your business needs are a perfect match for their offerings. Architecture engagement with this type of [EA consultancy] should be approached with extreme caution. [...] The process of EA is designed to discover the best fit of products given the desired target states, not the target state given a vendor's product portfolio. [...] Never abdicate the discovery of answers about your enterprise's future state to vendors that are selling products that may or may not be a fit to your changing needs"

Appendix A: The Origin of EA and Modern EA Best Practices

[1] The seminal nature of this publication for the EA discipline is claimed by countless authors, though without any rational argumentation. For instance, Simon et al. (2013, p. 2) formulate this belief in the most striking way: "The discipline of enterprise architecture (EA) has evolved enormously since John Zachman ignited its flame in 1987 (Zachman, 1987)". Similarly, Plessius et al. (2014, p. 2) describe the origin of enterprise architecture in the following way: "The concept of Enterprise Architecture (EA) was introduced in 1987 by Zachman with the words: "With increasing size and complexity of the implementations of information systems, it is necessary to use some logical construct (or architecture) for defining and controlling the interfaces and the integration of all of the components of the system." (Zachman, 1987, p. 276)"

[2] This popular version of the history of enterprise architecture is arguably best reflected in the "genealogical tree" of EA frameworks initially presented by Schekkerman (2004, p. 89) and then reproduced with some variations and updates in a number of other sources (Bernaert et al., 2016; Gong and Janssen, 2019; Khosroshahi et al., 2015; Matthes, 2011). This version can be viewed only as a naive "folk" history flawed at least by two major reasons. First, this version does not take into account, or even denies, the entire corpus of earlier literature on information systems planning existing before the Zachman Framework that actually includes hundreds of relevant publications, as if organizations never tried to plan their information systems before 1987. Unsurprisingly, this version suggests that all modern comprehensive EA methodologies have no historical predecessors and miraculously originated from a simple one-page taxonomy proposed by a lone genius. Second, and more important, this version completely ignores the practical reality around EA frameworks and empirical experience of numerous companies that clearly indicates that none of these frameworks actually proved useful. For this reason, the history of enterprise architecture promoted by Schekkerman (2004) and his followers (Bernaert et al., 2016; Gong and Janssen, 2019; Khosroshahi et al., 2015; Matthes, 2011) has almost nothing in common with what actually happened and cannot be treated seriously

[3] For instance, TOGAF is viewed as a de facto industry standard in enterprise architecture by many authors (Brown and Obitz, 2011; Dietz and Hoogervorst, 2011; Gosselt, 2012; Lankhorst et al., 2010; Sarno and Herdiyanti, 2010; Sobczak, 2013)

[4] In my previous publications discussing the history of enterprise architecture (Kotusev, 2016c; Kotusev, 2016e), I used a slightly different classification and articulated the following three periods of information systems planning methodologies: pre-EA (BSP), early enterprise architecture and modern enterprise architecture. A much earlier attempt to analyze the history and evolution of approaches to information systems planning has been presented by Stegwee and van Waes (1990)

[5] See Kriebel (1968) and Strategy Set Transformation (SST) (King, 1978; King, 1983; King, 1984)

[6] See DeFeo (1982)

[7] See Siegel (1975)

[8] See Blumenthal (1969) and Statland (1982)

[9] See Business Information Analysis and Integration Technique (BIAIT) (Carlson, 1979) and Business Information Characterization/Control Study (BICS) (Kerner, 1979; Kerner, 1982)

[10] See Wetherbe and Davis (1982)

[11] See Dearden (1965)

[12] See Rockart (1979) and Bullen and Rockart (1981)

[13] See Zani (1970) and Henderson and West (1979)

[14] See King and Cleland (1975) and Ghymn and King (1976)

[15] See Checkland (1981) and Le Fevre and Pattison (1986)

[16] See Evans and Hague (1962)

[17] As noted earlier, countless formal modeling techniques for processes and systems had been developed since the early 1900s (Couger, 1973), while the article of Evans and Hague (1962) is only the first identified application of these techniques to organization-wide information systems planning

[18] Based on Evans and Hague (1962)

[19] See Schwartz (1970)

[20] Based on Schwartz (1970)

[21] See Glans et al. (1968b), Glans et al. (1968a) and a series of earlier IBM manuals where the SOP methodology was originally described (SOP, 1961; SOP, 1963a; SOP, 1963b; SOP, 1963c; SOP, 1963d; SOP, 1963e), as well as some rudimentary works of IBM on total system studies (Ridgway, 1961)

[22] For example, see the ARDI (Analysis, Requirements determination, Design and development, Implementation and evaluation) end-to-end systems planning and development methodology with analogous steps and deliverables developed by Philips (Hartman et al., 1968), the BISAD (Business Information Systems Analysis and Design) methodology developed by Honeywell (Honeywell, 1968) and a similar high-level approach proposed by Thompson (1969)

[23] Based on Glans et al. (1968b)

[24] See BSP (1975), McNurlin (1979), Orsey (1982a), Orsey (1982b), Orsey (1982c), Vacca (1983), BSP (1984), Lederer and Putnam (1986) and Lederer and Putnam (1987)

[25] The origination of current EA frameworks and methodologies from BSP is acknowledged by some authors (Harrell and Sage, 2010; Hermans, 2015; Holcman, 2014; Reese, 2010; Sidorova and Kappelman, 2010; Spewak and Hill, 1992; Veryard, 2011) and even by John Zachman himself (Spewak and Hill, 1992; Zachman, 2015; Zachman and Ruby, 2004; Zachman and Sessions, 2007). For instance, John Zachman explicitly refers to Dewey Walker and BSP: “I acknowledge Dewey Walker, [...], as the “grandfather” of architecture methodologies. It was his internal IBM experience in Information Architecture that later became known as Business Systems Planning (BSP)” (Spewak and Hill, 1992, p. xv). Likewise, Samuel Holcman, a former long-time business partner of John Zachman and a co-founder of the now-defunct Zachman Institute for Framework Advancement (ZIFA), also acknowledges the seminal nature of BSP for the genesis of enterprise architecture (Holcman, 2014; Holcman, 2015a; Holcman, 2015b; Holcman, 2015c). Specifically, Holcman (2014, p. 4) describes the origin of enterprise architecture in the following way: “In 1970, [Dewey] Walker was commissioned to establish a national marketing approach for IBM. That assignment resulted in a highly

successful program called Business Systems Planning (BSP), for which Walker received IBM's Outstanding Contribution Award in 1973". Nevertheless, for some reason, the lineage of popular EA frameworks from BSP is still largely ignored by the EA community

[26] Later BSP was also supported by specialized software tools and databases for capturing the data collected as part of BSP studies and then reporting on this data (Sakamoto, 1982; Sakamoto and Ball, 1982). These tools and databases can be regarded as a prototype of modern EA tools and architectural repositories discussed earlier in Chapter 18

[27] Based on BSP (1975)

[28] As noted earlier, insatiable market demand for improving business and IT alignment in organizations is demonstrated by countless yearly surveys of IT executives starting from 1980 (Ball and Harris, 1982)

[29] The fact that most subsequent information systems planning methodologies had been spawned and derived from BSP is widely acknowledged in the literature (Adriaans and Hoogakker, 1989; Davenport, 1994; Lederer and Putnam, 1986; Lederer and Putnam, 1987; Stegwee and van Waes, 1990; Sullivan, 1985; Sullivan, 1987; Vacca, 1983; Wiseman, 1988; Zachman, 1982). As Vacca (1983, p. 11) puts it, "while BSP, developed in 1970, is not the only strategic planning methodology around today, it is the root from which the others have evolved"

[30] See Vacca (1984) and Vacca (1985)

[31] For example, see the Corporate Data Plan (CDP) methodology proposed by Cohn (1981) and the Business Information Systems Planning (BISP) methodology proposed by Levy (1982), which even mimicked BSP's title

[32] See Arthur Andersen (1979), Arthur Andersen (1987), Lederer and Gardiner (1992a) and Lederer and Gardiner (1992b)

[33] Based on Arthur Andersen (1987)

[34] The first use of the word "architecture" in relation to organization-wide information systems planning seemingly can be traced back to the article of Walker and Catalano (1969). Wardle (1984, p. 206) argues that "the term "architecture" is clearly attractive because of its association with structure and integration"

[35] Originally, the word "framework" in relation to architecture was virtually synonymous with the word "taxonomy". For instance, the chief evangelist of EA frameworks John Zachman initially defined an EA framework as "a logical structure for classifying and organizing the descriptive representations of an Enterprise that are significant to the management of the Enterprise as well as to the development of the Enterprise's systems" (Zachman, 1996, p. 2). Accordingly, most early EA publications (Bernard, 2004; Boar, 1999b; Carbone, 2004; Spewak and Hill, 1992) very clearly distinguished frameworks, as taxonomies for organizing EA artifacts, and methodologies, as the sequences of actions necessary to create EA artifacts, i.e. to fill the cells of frameworks. However, later the term "EA framework" has been blurred to the extent of full vagueness and now essentially lost any definite meaning altogether. For example, one of the recent definitions suggests that EA frameworks "offer principles, models, and guidance to help one establish an EA program. They elaborate what to include in architectural documents and provide instructions on how to operationalize EA" (Bui, 2017). Likewise, another definition suggests that an EA framework "comprises a set of models, principles, and methods that are used to implement EA. The framework provides a means to communicate information about architectural artifacts, their relationships to each other, and to their stakeholders using a common vocabulary. An [EA framework] may also help in the architectural planning process and provide guidelines and measures to help conduct a maturity assessment of EA methodology within the organization" (Cameron and McMillan, 2013, p. 61). Unsurprisingly, numerous very diverse entities have been recently considered as "EA frameworks" by different authors including, among others, the Enterprise Architecture Planning methodology of Spewak and Hill (1992) (Matthes, 2011), the book of Ross et al. (2006) (Bui, 2012; Bui, 2017), ArchiMate and ARIS modeling languages (Kallgren et al., 2009; Matthes, 2011), various EA maturity models (Matthes, 2011), the POSIX open-system environment reference model (Matthes, 2011) and even ITIL and COBIT (Aziz and Obitz, 2007; Gall, 2012; Obitz and Babu, 2009). All these entities have no real relationship to the original meaning of the term "EA framework" and some of them even have no relationship to enterprise architecture. From this perspective, the

term “EA framework” now can be formally defined only as “any arbitrary set of EA-related or non-EA-related recommendations”, or even recursively as “anything that can be considered by someone to be an EA framework”. See Appendix F in Kotusev (2017e) for a more detailed discussion of the confusion around the term “EA framework”. In this book, “EA frameworks” in most contexts refer specifically to the limited set of popular EA-related publications explicitly titled as “frameworks”, primarily to TOGAF, Zachman, FEAF and DoDAF

[36] The architectural model proposed by Wardle (1984) classifies constituents of architecture into twelve distinct categories according to four domains (data, applications, communications and technology) and three levels (conceptual, logical and design guidelines & boundaries). The study of Wardle (1984) was supported financially and organizationally by Nolan, Norton & Company

[37] The PRISM (Partnership for Research in Information Systems Management) framework classifies components of architecture into sixteen distinct categories according to four domains (infrastructure, data, application and organization) and four types (inventory, principles, models and standards) (PRISM, 1986). The corresponding PRISM research project was organized collaboratively by CSC Index Systems and Hammer and Company and sponsored by a group of companies including IBM (Davenport, 1986). For this reason, it is also known in the literature as the Index framework (Boar, 1999b; Carbone, 2004)

[38] See Zachman (1987), Zachman (1988), Zachman (1989), Sowa and Zachman (1992a) and Sowa and Zachman (1992b). Interestingly, John Zachman explicitly acknowledged that the framework was actually conceived only as an addition to the BSP methodology: “At the outset, my intention in describing the Framework was merely to improve on the planning methodologies to follow BSP. [...] For me, at least initially, the Framework was simply the logical structure that connected the products of planning [resulting from BSP studies] with the products of the more technical implementation” (Spewak and Hill, 1992, p. xvi). The historical and practical role of the Zachman Framework (or the lack of thereof, to be precise) is discussed in great detail in Kotusev (2019b)

[39] The PRISM framework seemingly fairly deserves to be acknowledged as the first full-fledged EA framework but, for a number of reasons explained by Rivera (2013), this framework remained in shadow for a long time. On the one hand, “PRISM research was privately funded, and the result of the research was to be solely used by the research firms themselves and the funding sponsor companies. [...] None of the sponsor companies were authorized to publish or share the results of the research externally – so only the handful of 50+ sponsor companies knew about this new architecture framework” (Rivera, 2013, pp. 14-15). On the other hand, “Dr. Hammer and Dr. Davenport [who were the primary authors of the PRISM framework] did not pursue or actively promote the PRISM Architecture Framework any further as at the time they were focused on the BPR [business process reengineering] frenzy, which took all of their time [...]. When BPR took off, PRISM was disbanded (around 1990)” (Rivera, 2013, p. 15). Unsurprisingly, Carbone (2004, p. 46) reports that the information on the PRISM framework could not have been found anywhere: “We believe that our framework is an adaptation of a CSC/Index Institute [i.e. PRISM] framework, but were never able to find any information about it”. By contrast, “the Zachman framework has been presented at countless IT conferences” (Carbone, 2004, p. 11)

[40] Based on BSP (1984)

[41] See Remenyi (1991) (Appendices 4-11)

[42] See Parker et al. (1989) (Part 3) and Atkinson and Montgomery (1990)

[43] See Nolan and Mulryan (1987)

[44] Based on Atkinson and Montgomery (1990)

[45] Based on Nolan and Mulryan (1987)

[46] See Tozer (1986b), Tozer (1986a), Tozer (1988) and Tozer (1996)

[47] See Gallo (1988)

[48] See Connor (1988). This architecture planning methodology was seemingly the first methodology that used an architecture framework, namely the so-called STRIPE matrix, to organize its outputs. The STRIPE matrix classifies architecture deliverables into fifteen distinct categories according to five domains (business,

data, application, technical environment and type of plan) and three planning levels (strategic, tactical and operational)

[49] See Parker (1990)

[50] See Inmon (1986) and Inmon and Caplan (1992)

[51] See the planning methodology developed at the University of Minnesota (Vogel and Wetherbe, 1984; Vogel and Wetherbe, 1991; Wetherbe and Davis, 1983) and the similar "belated" approaches proposed by Rowley (1994), Mentzas (1997), Min et al. (1999) and Li and Chen (2001)

[52] Based on Tozer (1988)

[53] Based on Gallo (1988)

[54] See GAO (1992) and GAO (1994)

[55] See TAFIM (1996a) and TAFIM (1996b)

[56] Based on TAFIM (1996b)

[57] See Finkelstein (1981) and Martin and Finkelstein (1981). Interestingly, the very term "information engineering" initially appeared in the literature on information systems planning around the late 1950s (Canning, 1957; Haigh, 2001; Levin, 1957)

[58] See Arthur Young (1987), Inmon (1988), Finkelstein (1989), Martin (1989), Davids (1992), Finkelstein (1992), Finkelstein (2006b) and a similar high-level planning approach proposed by Spencer (1985)

[59] See Martin (1982b) and Martin and Leben (1989)

[60] For instance, Finkelstein (1981, p. 2) explained that "Information Engineering identifies and models the data that is the organization. And that data generally changes less frequently than the procedures that utilize the data". Analogously, Martin (1982a, p. 29) argued that "the procedures change rapidly (or should); the computer programs, processes, networks and the hardware change; but the basic types of data are relatively stable. [...] Because the basic data types are stable, whereas procedures tend to change, data-oriented techniques succeed if correctly applied where procedure-oriented techniques have failed"

[61] Based on Arthur Young (1987)

[62] Based on Finkelstein (1989)

[63] The NIST (National Institute of Standards and Technology) model of enterprise architecture defines five different levels of architecture: business unit, information, information system, data and delivery system (Rigdon, 1989). This model seemingly represents the first published source where the term "enterprise architecture" was consistently used, though without any specific definition of its meaning. However, the phrase "enterprise architecture" was once mentioned earlier, arguably accidentally, by Zachman (1982, p. 32). See Kotusev (2016e) for a more detailed discussion of the origin of the term "enterprise architecture"

[64] The second identified published source using the term "enterprise architecture", now with a formal definition of its meaning, is the article of Richardson et al. (1990). Specifically, Richardson et al. (1990, p. 386) understand enterprise architecture as an architecture that "defines and interrelates data, hardware, software, and communications resources, as well as the supporting organization required to maintain the overall physical structure required by the architecture". Interestingly, in their article Richardson et al. (1990) describe the application of the PRISM framework in one of the sponsor companies that funded the PRISM research project (Texaco)

[65] The original version of EAP is described by Spewak and Hill (1992), while its updated version is presented by Spewak and Tiemann (2006)

[66] Spewak and Hill (1992, p. 53) explicitly admit that "EAP has its roots in IBM's BSP". Moreover, "Strategic Data Planning, Information Engineering, [...] have also contributed techniques and ideas to EAP" (Spewak and Hill, 1992, p. 53)

[67] Based on Spewak and Hill (1992)

[68] See Boar (1999b)

[69] See Cook (1996)

[70] As noted earlier, in their original narrow meaning, architecture frameworks represented only logical structures, or taxonomies, for organizing architectural descriptions (PRISM, 1986; Wardle, 1984; Zachman, 1987). However, later the meaning of the term "EA framework" had been significantly broadened to represent, among other things, even full-fledged EA methodologies. While some of the "new" EA frameworks, e.g. E2AF (Schekkerman, 2006a) and EA Grid (Pulkkinen, 2006), still conform to the original definition of architecture frameworks (i.e. provide only taxonomies for architectural descriptions), most of the current EA frameworks including TOGAF, FEAF and DoDAF provide comprehensive EA methodologies with recommended steps, deliverables and other aspects of an EA practice. Interestingly, Simon et al. (2013) argues that even some works that were never explicitly labeled by their own authors as frameworks (Boar, 1999b; Perks and Beveridge, 2003; Ross, 2003; Spewak and Hill, 1992) may need to also be regarded as EA frameworks

[71] See TEAF (2000)

[72] See C4ISR (1997) and Sowell (2000)

[73] See FEAF (1999), FEA (2001), FEA (2007), FEA (2012) and FEAF (2013)

[74] See FEAF (1999, pp. 20-22)

[75] See Armour et al. (1999a), Armour et al. (1999b) and Armour and Kaisler (2001)

[76] Based on Armour et al. (1999b)

[77] See Longepe (2003)

[78] See Carbone (2004)

[79] See Bernard (2004)

[80] See Theuerkorn (2004)

[81] See Niemann (2006)

[82] See Schekkerman (2008)

[83] See Holcman (2013)

[84] See Pham et al. (2013)

[85] Based on Bernard (2004)

[86] Based on Schekkerman (2008)

[87] See Bittler and Kreizman (2005)

[88] See IBM (2006)

[89] See Covington and Jahangir (2009)

[90] See van't Wout et al. (2010)

[91] See Wisnosky and Vogel (2004), DoDAF (2007a), DoDAF (2007b), DoDAF (2007c), DoDAF (2009) and Dam (2015)

[92] Based on IBM (2006)

[93] Based on Covington and Jahangir (2009)

[94] See Perks and Beveridge (2003) and TOGAF (2018)

[95] As noted earlier, TOGAF is often viewed as a de facto industry standard in enterprise architecture (Brown and Obitz, 2011; Dietz and Hoogervorst, 2011; Gosselt, 2012; Lankhorst et al., 2010; Sarno and Herdiyanti, 2010; Sobczak, 2013)

[96] For instance, The Open Group claims that TOGAF is "a proven Enterprise Architecture methodology and framework" as well as "the most prominent and reliable Enterprise Architecture standard in the world" which is used in 80% of companies from the Global 50 list and in 60% of companies from the Fortune 500 list (The Open Group, 2016b, p. 1)

[97] Based on TOGAF (2018)

[98] The strong conceptual similarity between all early architecture-based planning methodologies has been noticed previously by Stegwee and van Waes (1990, pp. 11-12): "There exist many methodologies for

[information systems planning] which stem from BSP [...], like Information Engineering [...]. In essence they all follow the [same] main lines [...]. First, the business strategy is determined by means of mission statements, organizational goals, and critical success factors. Next, the trends and opportunities in the field of information technology are analyzed in order to identify new application areas and alternative technical architectures. Then, an overview is given of the current information system support [...]. The information architecture is specified by means of a process model, developed for the organization, an entity model, summarizing the data to be stored, and a matrix showing which data is created, retrieved, updated, or deleted by which processes. The logical information architecture is then manipulated to form the systems architecture, specifying individual information systems to be discerned [...]. A transition path has to be provided in order to indicate how to reach the new situation, as described by the architectures [...]. From these results a project portfolio and plan can be developed for the short to mid-range period". Similarly, Wiseman (1988, p. 82) also noticed that "most of the other general-purpose approaches to information systems planning (e.g., [...] James Martin's information engineering, and those offered by large accounting firms [e.g. 4FRONT by Deloitte & Touche and Summit S by Coopers & Lybrand]) are lineal descendants of BSP"

[99] See FEAF (1999, pp. 20-22) and Spewak and Hill (1992, p. 53)

[100] For instance, TOGAF (2018, p. 3) states that "the original development of TOGAF Version 1 in 1995 was based on the Technical Architecture Framework for Information Management (TAFIM), developed by the US Department of Defense (DoD). The DoD gave The Open Group explicit permission and encouragement to create Version 1 of the TOGAF standard by building on the TAFIM, which itself was the result of many years of development effort and many millions of dollars of US Government investment". In its turn, TAFIM was based on some earlier models initiated in 1986 (Golden, 1994)

[101] See Zachman (1977), Zachman (1982) and Marenghi and Zachman (1982). Moreover, John Zachman explicitly acknowledged his involvement with BSP: "As one of [Dewey Walker's] early disciples, I had the opportunity to make substantial contributions to BSP, both conceptually and literally. I wrote and/or reviewed significant portions of the BSP documentation as it evolved over the years" (Spewak and Hill, 1992, p. xv)

[102] See Zachman International (2012)

[103] See Finkelstein (1991)

[104] See Finkelstein (2006a)

[105] As noted earlier, the architectural taxonomy proposed by Wardle (1984) and the PRISM framework (PRISM, 1986) had been published before the Zachman Framework (Zachman, 1987)

[106] This is arguably a consequence of the wave of intense hype generated by the Zachman Framework

[107] For example, the EA methodology proposed by Cook (1996) organizes its deliverables into the top rows of the Zachman Framework, the EA methodology described by Carbone (2004) into the cells of the PRISM framework, the methodology of Bernard (2004) into the EA^3 Cube framework, Capgemini's EA methodology (van't Wout et al., 2010) into its own Integrated Architecture Framework (IAF), Gartner's EA methodology (Bittler and Kreizman, 2005) also into its own proprietary framework (James et al., 2005), while Boar (1999b) allows the choice between the Zachman Framework, Gartner framework and PRISM (preferable). Interestingly, some EA methodologies (Carbone, 2004; FEAF, 1999; Holcman, 2013; Spewak and Hill, 1992) pay lip service to the Zachman Framework, but actually ignore its suggestions. Most strikingly, Carbone (2004) praises the Zachman Framework, but actually uses PRISM to structure the deliverables

[108] See Goodhue et al. (1986), Goodhue et al. (1988), Lederer and Sethi (1988) and Lederer and Sethi (1989)

[109] See Goodhue et al. (1992), Lederer and Sethi (1992), Beynon-Davies (1994), Davenport (1994), Kim and Everest (1994), Periasamy (1994), Segars and Grover (1996), Shanks (1997), Shanks and Swatman (1997) and Hamilton (1999)

[110] See Kemp and McManus (2009), Seppanen et al. (2009) and Gaver (2010)

[111] See Holst and Steensen (2011), Tucci (2011), Lohe and Legner (2012), Bloomberg (2014), Lohe and Legner (2014), GAO (2015) and Trionfi (2016)

[112] For instance, McNurlin (1979, p. 3) provides the following description of one BSP study: "To get the [BSP] project underway, a team was formed of executives from [one] division and the corporate office. [...] Over a four month period, these [at least six] executives devoted about 40% of their time to the project, at afternoon sessions lasting three to four hours each". Similarly, Mariotti (1988, p. 13) provides the following description of an architecture project by Nolan, Norton & Company: "The team consisted of senior executives from finance, sales, marketing, and operations from the British, German, and other divisions. There was also one information systems manager from Britain and three of us from Nolan, Norton. [...] All of the team members worked on the project full time for seven months"

[113] For instance, Collins (1983, p. 27) reported that "the elapsed time for Phase II [of the BSP study undertaken in our company] took overall approximately 1 year". The survey of 26 U.K. consultancies by Meiklejohn (1986) showed that information systems planning consulting engagements usually lasted from three weeks to one year, several months on average, and typically implied interviewing 20 to 30 people from client organizations as part of the engagement. Likewise, the survey of 131 U.K. companies by Galliers (1988) demonstrated that these information systems planning "studies" more often took 3-5 months to complete. Later, the survey of 105 IT planners who participated in information systems planning studies by Lederer and Sethi (1996, p. 48) found that "the average duration of each study was 6.9 months"

[114] For example, exactly the same problems had been reported earlier specifically regarding TAFIM, the direct and officially acknowledged predecessor of TOGAF, and eventually lead to its retirement due to impracticality of the proposed approach: "TAFIM most certainly required a large investment of both time and money", "the elapsed time required to produce the architecture makes it close to obsolete before completion", "the end result is normally incomprehensible to a business-oriented audience and is harder to trace to the business strategy" and "due to some of these flaws, the TAFIM was abruptly cancelled" (Perks and Beveridge, 2003, p. 79)

[115] The adequacy of formal architecture-based planning methodologies was consistently questioned by many authors including Goodhue et al. (1988), Lederer and Sethi (1988), Goodhue et al. (1992), Davenport (1994), Kim and Everest (1994), Periasamy (1994), Shanks (1997), Hamilton (1999), Kemp and McManus (2009), Gaver (2010), Holst and Steensen (2011), Tucci (2011), Bloomberg (2014), Lohe and Legner (2014) and Trionfi (2016). For instance, significant doubts regarding the efficacy of the earliest formal information systems planning methodology, Study Organization Plan (SOP), were expressed long ago by Head (1971, p. 23): "It is interesting to speculate why SOP was not widely accepted. Its methodology was somewhat cumbersome, and its full implementation in many cases required documentation efforts of questionable value". Later, Vitale et al. (1986, p. 271) concluded that "high levels of environmental turbulence cast shadows on the utility of the top down planning process as an instrument for [information systems planning]". Lederer and Mendelow (1988, p. 75) reported that "many systems managers say [formal architecture-based] planning methodologies require too much time and thought by both line and systems managers. In addition, the systems-planning cycle takes too long, and major business changes can make the final plan irrelevant". Bock et al. (1992, p. 14) expressed a similar opinion: "Numerous methodologies have been proposed for implementing enterprisewide modeling, including IBM's business systems planning method, [...] and Martin's strategic data planning approach. In each case, these methods require extensive planning exercises. In reality, however, most organizations do not construct enterprisewide models. One IS director [...] stated that he knew of no corporation in [his industry] that could claim significant success in enterprisewide modeling". Davenport (1994, p. 121) argued that "information architecture [advocated by BSP] has never achieved its promise. Enterprise models of information types, uses, and responsibilities are too broad and arcane for nontechnical people to comprehend – and they can take years to build". Periasamy (1994, p. 162) reported the following story: "A group was set up in 1989 to build Thames Water's [data architecture]. The effort expended was considerable ([...] Information Engineering methodology, and human resource and time); a senior IT manager estimates the total cost to be about £0.25 million. The resulting [data architecture] was however found to be dysfunctional. Thames Water's IT department sought information from the IT departments of the other nine large UK water-sewage companies on their corporate data modelling experience. A situation similar to that of Thames Water was revealed across the companies. The companies were in the process of developing or had [data architectures] but none of them reported deriving any

major value from their data models". Earl (1996, p. 55) concluded that "the general verdict on this [formal architectural] approach [...] was negative. It typically takes large amounts of resources, including management time, and in one company user managers found it hard to grasp the meaning of the blueprint generated or to see which elements mattered most. As a result, though some elements can be useful, the overall blueprint is often axed or aborted". As Ross et al. (2006, p. vii) put it, "the historic ineffectiveness of IT architecture efforts in large organizations has troubled us for years. In presentations we have railed against traditional IT architecture efforts for their remoteness from the reality of the business and their 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". Gunton (1989, pp. 137-138) provided a fair summary of the typical problems and outcomes of formal architecture-based planning methodologies: "The traditional approach [to information systems planning] is exemplified by [formal architecture-based] planning techniques such as IBM's Business Systems Planning (BSP) and updated variants such as James Martin's Strategic Data Planning. [...] They produce a blueprint or map of the systems and/or the information that the business needs, based on a methodical process of analysis. The drawbacks of this approach are that the analysis process is very expensive and difficult to organize. It demands the commitment of senior managers who really understand the business, which is often difficult to obtain. Even where this difficulty can be overcome, the blueprint that is produced can easily prove so complex and unwieldy that its value as a strategic corporate overview is obscured by a mass of detail. And, since analysis invariably focuses on today's operations, it is always vulnerable to unanticipated changes in markets or in organization. I know of far more organizations that have developed a strategic data model, then shelved it or adopted only a small part of it, than have successfully carried a substantial part of the model through to implementation in the form of databases and applications"

[116] For example, Spewak and Hill (1992, p. 19) explicitly acknowledged that "the vast majority of enterprises that undertake Enterprise Architecture Planning are not successful". Similarly, Cook (1996, p. xviii) also openly acknowledged that "most enterprise information architecture design projects have failed. They rarely get completed or, if completed, rarely get implemented"

[117] For instance, Stegwee and van Waes (1990, p. 16) argued that "looking back to the developments concerning ISP [information systems planning] we can conclude that [...] the time has arrived to change our attitudes towards ISP fundamentally". Likewise, Goodhue et al. (1992, p. 28) concluded that "the evidence of the nine [organizations that tried BSP and similar planning methodologies] presented here strongly supports the need for a fundamental rethinking of IS planning methodologies". Hamilton (1999, p. 81) concluded that "findings from the study suggest strongly that the prescriptive approach to architecture-driven planning at the portfolio level is fundamentally flawed". Finally, Gaver (2010, p. 10) concluded that "EA often doesn't work well anywhere because the problems with Enterprise Architecture [frameworks] are fundamental in nature"

[118] Calls for more pragmatic, flexible, collaborative and evolutionary planning approaches were consistently incoming from many authors including Goodhue et al. (1988), Stegwee and van Waes (1990), Goodhue et al. (1992), Beynon-Davies (1994), Kim and Everest (1994), Earl (1996), Shanks (1997), Holst and Steensen (2011), Lohe and Legner (2012) and Lohe and Legner (2014)

[119] By analogy with the "garbage can" model of organizational choice, i.e. the model describing decision-making in organizations as a semi-anarchic process characterized by almost random interactions between problems, solutions and decision-makers (Cohen et al., 1972), the historical evolution of architecture-based planning methodologies can be described as a "garbage can" of chaotic mutations

[120] For example, Capgemini's EA methodology (van't Wout et al., 2010) lists around 80 different EA artifacts to be created, of tens of EA artifacts prescribed by Bernard (2012) only a few can be meaningful to the business audience, while TOGAF (2018) defines eight sequential phases each with its own inputs, outputs and 6-18 concrete sub-steps to be followed, or 78 steps in total

[121] Descriptions of some early homegrown approaches to information systems planning of the 1970s are provided, for instance, by McFarlan (1971), McLean and Soden (1977), Sporn (1978), Rush (1979) and van Rensselaer (1979). Some homegrown planning approaches of the 1980s are described, for instance, by van Rensselaer (1985), Davies and Hale (1986), Corbin (1988) and Penrod and Douglas (1988). Descriptions of

some later homegrown planning approaches of the 1990s are provided, for instance, by Carter et al. (1990), Carter et al. (1991), Martinsons and Hosley (1993), Palmer (1993), Reponen (1993), Flynn and Hepburn (1994), Periasamy (1994) and Cerpa and Verner (1998)

[122] In the late 1980s and the 1990s, systematic information systems planning had been practiced seemingly in about a half of all medium and large organizations in developed countries (Ang and Teo, 1997; Conrath et al., 1992; Falconer and Hodgett, 1997; Falconer and Hodgett, 1998; Galliers, 1987b; Galliers, 1987c; Galliers, 1988; Pavri and Ang, 1995; Teo et al., 1997). However, the vast majority of these companies used some homegrown planning approaches and only around 15-25% of them used formal architecture-based planning methodologies. For instance, the survey of 334 U.S. organizations by Cresap, McCormick and Paget (Hoffman and Martino, 1983) showed that only 23% of these organizations used BSP-like planning methodologies, while 78% used their own homegrown planning approaches (answers were not mutually exclusive). Out of the sixteen "random" U.S. CIOs surveyed by Vitale et al. (1986) who had, or planned to have, systematic information systems planning processes, only four reported that they used BSP-like planning approaches. The survey of 209 U.K. and Australian companies by Galliers (1987b) demonstrated the predominance of in-house planning approaches over the well-known architecture-based methodologies, and in the United Kingdom "in-house approaches outnumber the well-known, proprietary methodologies by over 3:1" (Galliers, 1986, p. 36). The study of 31 information systems planning efforts in different U.S. companies by Goodhue et al. (1988, p. 380) showed that only five of the examined efforts used BSP or similar planning methodologies and "none of these firms saw the kind of success envisioned in the literature". The survey of 245 U.S. organizations by Premkumar and King (1991, p. 46) concluded that "only 22 per cent of the respondents use a commercial [information systems] planning methodology, while the rest use an in-house developed methodology". Concretely, only 12% of the surveyed organizations used Information Engineering and only 8% used BSP. The study of 27 U.K. companies by Earl (1993) demonstrated that only four of them used formal architecture-based planning methodologies. The survey of eighteen U.K. organizations by Flynn and Goleniewska (1993) indicated that only one of them used Information Engineering. The survey of 105 Irish companies by Finnegan and Fahy (1993, p. 132) demonstrated that only 21% of these companies used BSP and only 11% used Information Engineering, but "over 78% of respondents had the IS planning methodology developed or adapted internally". The survey of 76 U.K. organizations by Fidler et al. (1993) showed that only 18% of these organizations used BSP. Finally, the survey of 294 U.K. companies by Periasamy (1994), of which 194 practiced information systems planning, demonstrated that only 12% of these companies used Information Engineering, only 3% used BSP and only 3% used Method/1, while 73% used homegrown planning approaches. At the same time, the available detailed case studies of organizations using formal architecture-based methodologies, e.g. BSP (Collins, 1983; Gill, 1981; McNurlin, 1979; Wahi et al., 1983), Method/1 (Mainelli and Miller, 1988), Information Engineering (Adriaans and Hoogakker, 1989; Brown et al., 1990) and other methodologies (Mariotti, 1988; McNurlin, 1988), show that the prescriptions of these methodologies were actually followed in practice to develop comprehensive architectures, which sharply contrasts with the purely declarative use of EA frameworks prevalent in the industry today, as discussed later in this appendix

[123] For instance, the qualitative comparative studies of information systems planning approaches by Goodhue et al. (1988), Earl (1990), Earl (1993), Periasamy (1994) and Earl (1996) unanimously demonstrated the superiority of pragmatic, flexible and participative homegrown planning approaches over formal architecture-based planning methodologies promoted by consultancies. In particular, Periasamy (1994, p. 264) reports that "the [six] case studies provide support for the "organizational approach" [identified previously by Earl (1993)] as the form of IS planning appropriate for integrated strategy development and business planning [...]. No formal IS planning methodology is used and there is emphasis on management processes and cooperation. In this IS planning arrangement, IT and other functional level planning activities are ongoing". The subsequent quantitative surveys by Falconer and Hodgett (1998), Doherty et al. (1999) and Segars and Grover (1999) also confirmed that the clusters of planning approaches highly correlating with the "organizational" approach (characterized by the continuous dialog between business and IT) are most effective, while the clusters correlating with the "method-driven" and "technological" approaches identified by Earl (1993) (characterized by the focus on formal methodologies and architectures respectively) are among least effective. Interestingly, it was

explicitly acknowledged that TOGAF represents specifically the "technological" approach considered by Earl (1993) as one of the least promising: "The architectural approach to planning described in this book [TOGAF version 6.0] has its roots in Earl's Technical Approach" (Perks and Beveridge, 2003, p. 51)

[124] For example, the survey of 294 U.K. organizations by Periasamy (1994, p. 69) demonstrated that "72% of those who practiced in-house [information systems planning] methodologies had [architecture], and 69% of [architecture] utilizers had adopted in-house methodologies". The concept of architecture was considered promising and useful, but in a form significantly different from the one advocated by formal architecture-based planning methodologies (Hamilton, 1999; Periasamy, 1993; Periasamy, 1994; Periasamy and Feeny, 1997). Most importantly, the studies of Periasamy (1994) and Periasamy and Feeny (1997) demonstrate that comprehensive architectural models and relationship matrices recommended by architecture-based planning methodologies were found largely useless in practice, while simpler, higher-level and easier-to-understand architectures depicting the relationship between business and IT in an intuitive graphical form "invented" in-house proved very useful for facilitating communication between business and IT stakeholders. "Involvement and participation by senior management and functional management were viewed as being more important than usage of an [architecture-based planning] methodology. Though formal methodology was considered to be of only marginal relevance to the planning process, IT architecture and IS models were perceived to be of some value" (Periasamy, 1994, p. 225). Many companies went through numerous unsuccessful attempts, failures and disappointments with architecture before establishing successful homegrown architecture-based planning practices (Burton and Bittler, 2011; Earl, 1996; Hobbs, 2012; Holst and Steensen, 2011; Wierda, 2015; Zink, 2009). As noted earlier, branded architecture-based methodologies proposed by consultancies and gurus might have provided only the initial inspiration for using architecture, but did not define the actual best practices in this area (Birkinshaw and Mol, 2006)

[125] Arguably the most comprehensive available description of homegrown architecture-based planning approaches and best practices of the early 1990s is offered by Periasamy (1994)

[126] Around 2010 enterprise architecture had been practiced seemingly in about two-thirds of all medium and large companies in developed countries (Ambler, 2010) and numerous industry surveys (Ambler, 2010; Aziz and Obitz, 2007; Buckl et al., 2009; Cameron and McMillan, 2013; Carr and Else, 2018; Gall, 2012; Obitz and Babu, 2009; Schekkerman, 2005b; Schneider et al., 2015a) reported varying statistics regarding the usage of EA frameworks, but a significant portion of organizations in every survey still either explicitly acknowledged that no EA frameworks were used, or provided some other elusive answers, e.g. used homemade, blended or hybrid EA frameworks

[127] This curious fact was noticed previously by other researchers and then completely supported by the field research underpinning this book. For example, the study of eighteen German organizations by Buckl et al. (2009) shows that 64% of these companies used some EA frameworks, but only in a "simplified" form or even only as idea contributors. The case study of Chubb Insurance by Smith et al. (2012) also shows that even though TOGAF was used as the basis for its EA practice, no TOGAF-specific recommendations could actually be observed in the resulting EA practice. Likewise, many organizations studied as part of this research nominally used some EA frameworks and five of these companies were even included in the official list of TOGAF users (The Open Group, 2016a). However, none of the studied organizations followed the prescriptions of TOGAF or other EA frameworks in any real sense (Kotusev, 2016a; Kotusev, 2016d; Kotusev, 2018). Interestingly, many of the interviewed architects reported that they used EA frameworks, but at the same time were unable to explain clearly how exactly these frameworks were used. Even more interesting, some of the interviewed architects never read the original TOGAF text, but were still convinced that their EA practices were TOGAF-based

[128] The impracticality of EA frameworks is very widely acknowledged (Andriole, 2020; Bloomberg, 2014; Gerber et al., 2007; Holst and Steensen, 2011; Lewis, 2018; Lohe and Legner, 2014; Trionfi, 2016). For instance, Buckl et al. (2009, p. 15) argue that "the frameworks appear theoretical and impossible to implement". Vivek Kundra, the former federal CIO of the United States, reportedly argued that "enterprise architecture frameworks are worse than useless" (Tucci, 2011, p. 1)

[129] For instance, Evernden (2015, p. 29) fairly argues that "many practitioners see frameworks as theoretical or conceptual rather than a highly practical everyday device for managing and thinking about architectures"

[130] Primarily I mean the previous books of Wagter et al. (2005), Ross et al. (2006), Murer et al. (2011) and Ahlemann et al. (2012c)

[131] For example, the study of six large companies considered as rather advanced IT users by Periasamy (1994) arguably presents a fair historical snapshot of architecture-based planning practices in different organizations, which clearly illustrates both the prevalence of respective planning approaches and their contrasting outcomes: five of these companies successfully used pragmatic homegrown architecture-based planning approaches, while the sixth company tried to use Information Engineering and failed

[132] Similar conclusions on the absence of any real connection between, on the one hand, superficial rhetoric and faddish ideas and, on the other hand, actual situation and genuine best practices are arguably valid for many, if not most, management-related disciplines

[133] This process very highly correlates with the research-based model of management innovations developed by Birkinshaw and Mol (2006): the innovation typically starts from the dissatisfaction with the "status quo" (persistent problems with business and IT alignment) and the inspiration from external sources (architecture-based planning methodologies and later EA frameworks proposed by consultancies and gurus), then the innovation is actually "invented" within organizations (emergence of homegrown architecture-based planning approaches), acknowledged as effective by internal and external actors (in-house IT planners and architecture consultants) and finally diffuses to other companies (currently EA best practices quickly disseminate across the industry by countless migrating architects)

[134] The evident disparity between popular EA frameworks and genuine EA best practices is discussed in more detail in Kotusev (2016h)

[135] For instance, Earl (1996, p. 58) even reports that in many companies more or less successful homegrown approaches to information systems planning had been replaced with flawed approaches imposed by consultancies: "We usually find that much of the organizational approach [which worked successfully] was then already in place, but it was thrown out as firms listened to the prescriptions of the IT and consulting industries"

[136] Interestingly, exactly the same conclusion had been made previously by Earl (1996, p. 56) regarding approaches to information systems planning: "Paradoxically, the organizational approach [which proved to be most successful] does not closely match the usual prescriptions for IS planning. The literature recommends, for example: basing IS plans on established business goals; using strategy analysis techniques to discover IT applications that will yield a competitive advantage; using formal planning methods and information engineering techniques; and assiduously following resource-planning and project-control procedures"

[137] As Donaldson and Hilmer (1998, p. 7) put it, "many techniques truly deserve the pejorative label, "fad", and deserve to be strenuously combated"

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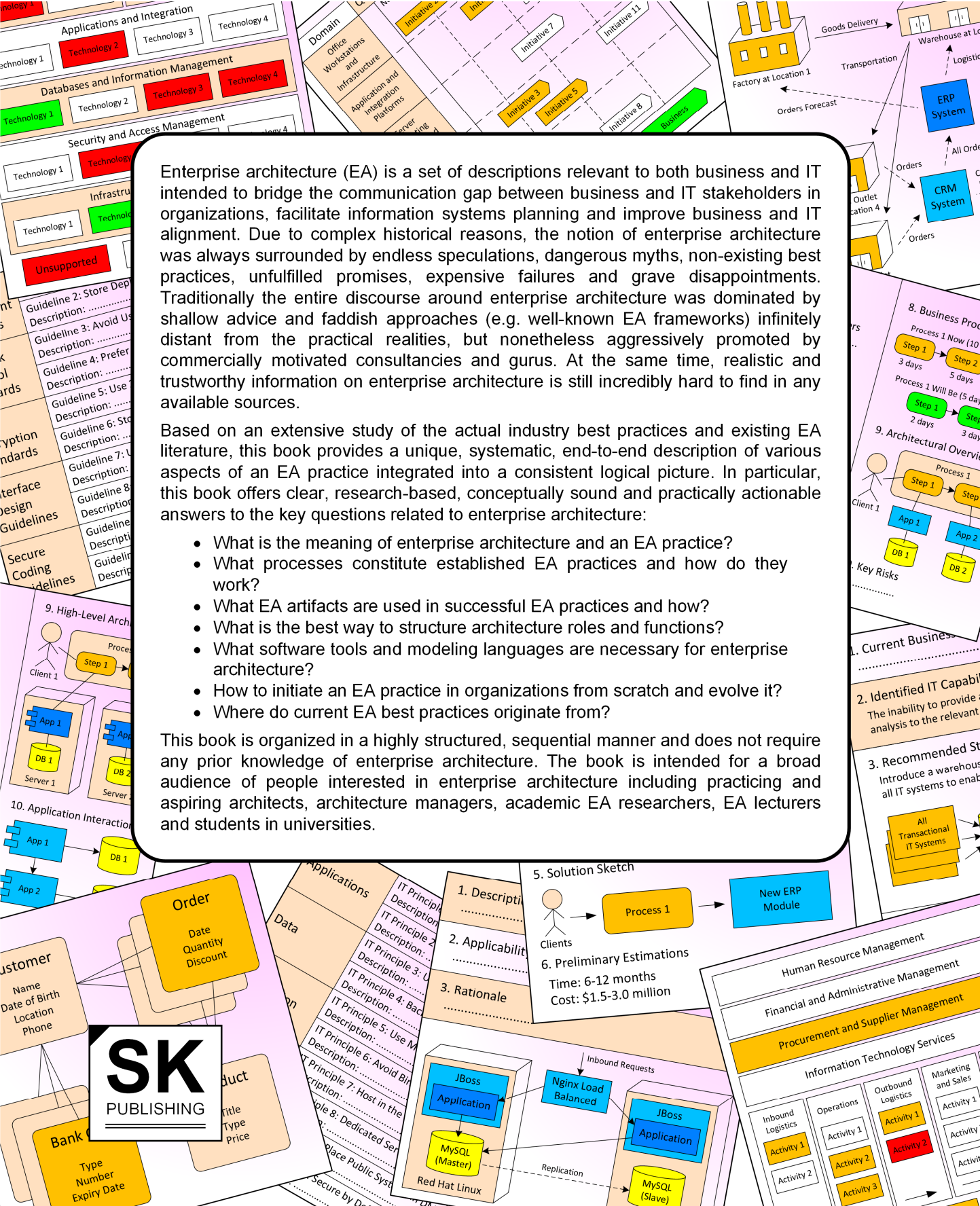
Svyatoslav Kotusev is an independent researcher, educator and consultant. Since 2013 he focuses on studying enterprise architecture practices in organizations. Besides this book, he is an author of many articles and other materials on enterprise architecture that appeared in various academic journals and conferences, industry magazines and online outlets (visit http://kotusev.com for more information). Svyatoslav received his PhD in information systems from RMIT University, Melbourne, Australia. Prior to his research career, he held various software development and architecture positions in the industry. He can be reached at kotusev@kotusev.com.



Enterprise architecture (EA) is a set of descriptions relevant to both business and IT intended to bridge the communication gap between business and IT stakeholders in organizations, facilitate information systems planning and improve business and IT alignment. Due to complex historical reasons, the notion of enterprise architecture was always surrounded by endless speculations, dangerous myths, non-existing best practices, unfulfilled promises, expensive failures and grave disappointments. Traditionally the entire discourse around enterprise architecture was dominated by shallow advice and faddish approaches (e.g. well-known EA frameworks) infinitely distant from the practical realities, but nonetheless aggressively promoted by commercially motivated consultancies and gurus. At the same time, realistic and trustworthy information on enterprise architecture is still incredibly hard to find in any available sources.

Based on an extensive study of the actual industry best practices and existing EA literature, this book provides a unique, systematic, end-to-end description of various aspects of an EA practice integrated into a consistent logical picture. In particular, this book offers clear, research-based, conceptually sound and practically actionable answers to the key questions related to enterprise architecture:

- What is the meaning of enterprise architecture and an EA practice?
- What processes constitute established EA practices and how do they work?
- What EA artifacts are used in successful EA practices and how?
- What is the best way to structure architecture roles and functions?
- What software tools and modeling languages are necessary for enterprise architecture?
- How to initiate an EA practice in organizations from scratch and evolve it?
- Where do current EA best practices originate from?

This book is organized in a highly structured, sequential manner and does not require any prior knowledge of enterprise architecture. The book is intended for a broad audience of people interested in enterprise architecture including practicing and aspiring architects, architecture managers, academic EA researchers, EA lecturers and students in universities.

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