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Enterprise Architecture Best Practices in Large Corporations

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Abstract: Enterprise architecture (EA) is an integrated strategy, business, and information systems approach for analysis, governance, and information technology (IT) alignment. It is a comprehensive blueprint that requires the careful planning, documentation, and analysis of all the operations of an organization. Employing EA helps companies achieve strategic goals with the support of business activities and information systems. However, some large corporations avoid EA frameworks and methodologies owing to their implementation difficulties or the presence of conflicting frameworks and business needs. The goal of this paper is to increase large organizations' awareness of enterprise architecture best practices (EABPs) and methods of EA framework implementation. Thus, this research has developed an EABP capability matrix to measure companies' capacities to implement EABPs and provided lessons based on how 17 organizations implemented EABPs. Based on an analytical literature review, the developed matrix includes eight critical EABPs categorized under four themes: EA framework and methodology, strategic practices, business activities, and information systems. As practical and theoretical contributions: (1) This inclusive approach was not found in the EA literature as most past research focuses on only one of these themes. (2) The EA matrix can be used as a measurement matrix research methodology to measure the extent to which cases adopt EABPs, making it beneficial to EA researchers and practitioners. (3) EA practitioners can also use it to practically determine and rectify the weak points of EABPs, thus taking advantage of EA frameworks. The findings indicate that many large organizations implement EABPs as business-as-usual practices without EA frameworks and methodologies. However, those that adopt an EA framework use the open group architecture framework and rely heavily on enterprise resource planning in the implementation of EABPs.

Keywords: enterprise architecture; large organizations; business process management; enterprise resource planning; best practices; the open group architecture framework (TOGAF); governance; IT alignment

1. Introduction

Enterprise architecture (EA) promises great benefits to organizations that seek to improve their strategies, optimize their business activities, and better utilize information technology (IT). Through EA's guiding principles, organizations can more easily achieve their goals and initiatives and implement critical information systems [1,2]. EA-based business activities can work coherently toward strategic aims and lead to better organizational outcomes [3]. IT resources can be tracked using EA repositories and subsequently aligned with business activities to steer a business towards its goals [4]. EA frameworks thus integrate strategies, business activities, and information systems by providing a representation of current organizational capabilities and enabling desirable results.

Although EA is widely praised in the relevant literature, its implementation success rate remains low [1,5–7]. EA's difficult implementation is attributable to its need for complex maintenance and its

comprehensive coverage of all organizational areas. For successful implementation, EA requires the continuous documentation and analysis of all activities and resources throughout the organization while leading a given business to its desired strategic state [8,9].

　　Understanding organizations' technological practices that are analogous to enterprise architecture best practices (EABPs) is critical; this is the starting point at which organizations can begin successfully implementing EA. Large organizations with greater EABP capabilities are more likely to incorporate EA frameworks and methodologies [1,10–12]. EABPs are a set of activities that are conducted to enhance an organization's strategic fulfillment through business tactics and information analysis. Although many technology-based business organizational practices (e.g., modeling business processes using a software) could be placed under the umbrella of EA because it is a comprehensive blueprint for organizations, certain horizontal (cross-sectional organizational practices) EABPs are essential in the adequate functioning of EA frameworks and methodologies [13]; this paper focuses on those EABPs. Horizontal EABPs serve an entire organization and have a strong impact on organizational success rates in EA implementation. In this research, "EABP capability" is defined as the effectiveness with which an organization can successfully apply the best practices of EA. Here, large private organizations are focused on because their commercial nature and complexity demand a greater need to enact EA frameworks and methodologies. In addition, this study emphasizes on horizontal EABPs, which are significant in the complete implementation of EA because they are conducted throughout an enterprise. In contrast, vertical practices (practices applied in one managerial unit or line of business) are outside the scope of this study [6,8]. Various studies focusing on best practices in EA research, including EA methodologies, strategic practices, business activities, and information systems practices, have been conducted. However, little research has combined these aspects, particularly for horizontal practices within large organizations. Implementing EABPs has many advantages, including directing organizational efforts toward achieving specific strategic goals, unifying employees' way of work, creating the organizational backbone for integrating the use of business processes, and integrating the organization using horizontal information systems [1,7,9,14,15]. Grounded on previous EA research, a matrix has been developed and tested in this study to measure an organization's capacity to utilize horizontal EABPs. Using this EABP matrix, organizations would be able to determine the shortcomings in their EABP implementation, leading to better decision-making for top and middle management. Through multi-case study analysis, the EABPs within 17 large corporations have been examined. This study investigates the following research questions: (1) What are the critical EABPs that are needed for the successful implementation of EA? (2) How can EABP capabilities within organizations be measured? (3) How are EABPs currently implemented in large organizations? Thus, this study will contribute to the EA literature as follows:

1.　Identify the critical horizontal EABPs for the successful implementation of EA.
2.　Provide a matrix that can be used to measure the EA capabilities within an organization.
3.　Provide insight into how organizations actually implement EABPs.

　　This paper will proceed as follows. First, an analytical literature review will be conducted to determine the common horizontal EA practices found in past research. Second, the methodology and its results will be described. Finally, this study's findings and conclusions will be discussed.

2. Analytical Literature Review

EA is "an approach for managing the complexity of an organization's structures, business environments, and different information systems, and for facilitating the integration of strategy, personnel, business, data, and IT" [5] (p. 131).

EA research has indicated that EABPs can be categorized as follows [1,7,9]:

1.　EA frameworks and methodologies
2.　Strategic practices
3.　Business activities
4.　IT capabilities

The studies sourced to create the above categories were sought using the following search terms: ("Enterprise Architecture") and (("Capabilities," "Best Practices," or "Practices"), ("Framework"), ("Methodology"), ("Maturity"), ("Modeling"), ("Horizontal"), or ("Crosscutting")). These terms were applied to several database search engines: ScienceDirect, ProQuest, Taylor & Francis, Web of Science, Scopus, Google Scholar, Emeralds, IEEE, and ACM. The selected search terms were based on the title, research keywords, abstract, and research questions. The inclusion criteria were as follows: English peer-reviewed articles including conference book chapters and journal articles, studies presenting relevance to the focus and research questions of this paper, repeated papers in different databases by title or content, non-accessible papers within databases or other search engines, papers published after 2004 (to focus only on recent developments), and short papers or posters. Thirty-seven papers were considered after excluding non-matching studies. These papers were reviewed and analyzed thoroughly for EABPs and the results are discussed in the following sections.

2.1. EA Framework and Methodology

An EA framework is the core horizontal component of an architectural practice. It can be defined as an instrument that aligns different resources, including IT, with the organization's current and future needs [14]. Known EA frameworks, such as Zackman, the open group architecture framework (TOGAF), federal enterprise architecture (FEA), Gartner, Department of Defense architecture framework (DoDAF), and treasury enterprise architecture framework (TEAF), were created from various sources and have been applied to different contexts [16]. An organization's workflow may change depending on the adopted EA framework because EA frameworks are like a master plan of business strategies consisting of various processes and information technologies [17,18]. EA frameworks are beneficial to organizations because they (1) "[are] well-established solutions to architectural problems of organizations; (2) Help in documenting architectural design and implementation decisions; and (3) [facilitate] collaboration and communication between users" [19] (p. 45).

Documentation and implementation in the EA framework is conducted through an EA methodology [20]. An EA methodology is a horizontal practice that an entire organization implements for effective decision-making and resource management [21]. It offers the tools required to guide an organization in documenting and modeling its current state using EA artifacts (shared organizational documents) and identifying the necessary documents that assist in making business and technology-related decisions, including resource management [22]. The EA methodology "prepares a set of methods and practices for developing, managing, and maintaining an EA implementation project" [23] (p. 927). As an EA framework implementation guide, EA methodologies outline how an organization transitions from its current (as-is) state to its planned (to-be) state. Some EA frameworks present a clear and detailed EA methodology, such as TOGAF architecture development method (ADM), FEA, and DoDAF. Other EA frameworks (e.g., Zachman and TEAF) provide general guides for the entrepreneurial transition from current to future states [23,24].

Early EA research focused on understanding EA frameworks and methodologies. Nevertheless, recent studies have considered managing and using technological advancement for the better application of EA frameworks and methodologies [25]. More emphasis on the horizontal approach of EA has been

found in recent literature. However, this discussion is theoretical, with no clear consideration of the practical underpinnings within organizations [15]. The additional current organizational advancement that affected EA research is the evolved business models that now rely more on social media for marketing, e-commerce for sales, big data analysis for information, and shared economy (industry 4.0) for infrastructure. According to previous studies [26–28], organizations using these technologies can lose track of information and resources and require higher levels of control, particularly the horizontal views and control, provided by EA [26,27]. Other studies [15,26] found that with the availability of advanced information systems and enterprise resource planning (ERP), EA frameworks and methodologies had a stronger impact on organizations. In the last five years, the number of publications discussing TOGAF EA frameworks and their organizational adoption, as well as the decline in the adoption of other frameworks, has increased [25]. This is attributable to the continuous support and improvements received by this framework from the Open Group, which keeps up with the current dynamic market and industry changes [29]. In addition, TOGAF is supported by many commercial off-the-shelf software such as SAP (Systems, Applications and Products in data processing) ERP, which simplifies its implementation for larger organizations [30]. The discussed publications in this section focus mostly on the EA frameworks or methodologies and do not seek a rounded approach to EA practices [6,30–32].

2.2. Strategic Practices

Strategic practices entail any methods, procedures, and tools used to plan and implement strategies [33]. These practices can range from making strategic plans, formulating strategic statements, monitoring strategic initiatives, and using strategic tools such as strengths, weaknesses, opportunities, and threats (SWOT) analysis and balanced scorecards [34]. However, the EA literature has demonstrated that a shared strategy and effective governance are the most essential factors in EA framework and methodology implementation.

A strategic statement defines the purpose and future competitive direction of an organization [35]. An organizational strategy is a generic EA practice [36]. An organizational strategy is finalized through the organizational synergy created by EA integration [37]. The purpose of an EA framework is to effectively work toward an organizational strategy [32]. Moreover, implementing EA usually starts with a strategic statement [38], and the EA framework's purpose and necessary resources are derived from this statement. However, without a shared and communicated strategy, an EA framework can have no clear direction [15,39]. As such, a shared strategy is defined here as a purposeful statement that must be communicated throughout an organization. It is among the most important EABPs.

As an EABP, effective governance is the process of potent self-interorganizational management. It entails the control of EA frameworks and methodologies as well as major corporate decisions and resources. Governance is conducted through a board of directors or a governance board; these bodies guide a corporation toward fulfilling its strategies [23,40,41]. EA is a mechanism of governance that enables governance boards to view their company's key as-is performance indicators and resource deployment in detail, thereby allowing governance board members to determine whether the firm is working toward its to-be state [2]. Since EA enables holistic as-is views, governance boards can effectively formulate policies and regulations in accordance with organizational requirements using EA. Furthermore, EA empowers adopted standards and polices throughout an organization via structuring and sharing documents with an online repository. By referring to EA-based as-is views, governance boards can monitor the enforcement of policies and regulations supporting the governance process [42–44].

EA can affect how a strategy is formulated, analyzed, and executed within an organization [39]. Moreover, the EA framework can shape organizations' collective thinking, thus affecting how strategy is created. The EA methodology creates the backbone of organizational governance that enables systemized analysis and execution of strategic goals [32,37,39]. A recent study discusses the development in large organizational governance by involving IT as a component requiring its own

strategy [27]. In the study, an increasing need for large organizations to have their own core traditional strategy that is supported by an IT strategy is observed. EA comes into the picture here, as the authors discuss [27], by supporting organizations to govern their IT by traditional and IT strategies. A gap exists in the EA literature because strategy and governance are usually considered individually, without a deeper understanding of other related EA practices [9,32,37,39,45]. A growing trend in the EA literature is the discussion on the usage of strategic and governance practices such as strategic auditing, SWOT analysis, balanced score cards, and competitive advantage [13,39]. This shows that EA research is streamlining from being a computer and information systems discussion-engrossed discipline to only a more organizational and strategy-based approach [45]. All of these business tools were suggested in conjunction with an EA framework for planning as well as an EA methodology as an arm for the governance and implementation of strategic goals [13,23]. The author [6] discusses that a strategy can be integrated into an organization's planning via an EA framework and applied through information systems and business processes.

2.3. Business Activities

Business functions, operations, procedures, and activities that support the achievement of core organizational goals are called business activities [46]. Business activities include service provision, product development, and/or trade [47]. These business activities can be governed and managed through an EA. The literature defines two essential business activities for the EA to function adequately: business processes and architectural modeling.

Business processes are the key organizational activities that are corroborated by, integrated with, and directed toward an enterprise's strategy. Business processes and EA enhance one another [8,48,49], and business processes can provide organizational cross-sectional integration that enhances information interoperability as required by EA documentation [50,51]. A study suggests that one of EA's major goals is to integrate and standardize business processes within an organization [52]. EA's as-is views support improved business processes by identifying bottlenecks and duplicate processes, which can help reduce performance issues and financial waste [3,52]. EA frameworks also provide the organizational blueprint needed to maintain and control business processes according to strategic needs [13,50,53]. Moreover, EA can provide better IT and strategic alignment at the operational level by prioritizing the use of key resources [13].

Another critical business activity to be conducted throughout an organization is modeling. Architectural modeling is a significant EABP that depicts cross-sectional representations of an organization [25]. Multiple tools are usually used for architectural modeling, including the unified modeling language (UML) 2.0, integrated definition (IDEF), Microsoft Visio, business process management notation (BPMN) 2.0, ArchiMate, and organizational information charts or graphical representations of the EA framework [26,54,55]. Through the lens of EA, architectural modeling provides viewpoints for strategic IT alignment, thereby steering an organization toward its to-be state while reducing IT costs [56]. Using dashboards, these architectural models provide real-time insights into an organization's leadership and governance [51,57,58].

The integration of EA, business processes, and/or architectural modeling is an outlook that has received only little attention in EA research [25,52]. A recent review [52] of EA and BPM integration studies found that the literature still lacks a perspective that combines these practices. This study seeks to fill this gap by creating an EABP matrix and analyzing case studies that combine EA, BPM, architectural modeling, and other related practices. Löhe and Legner [51] suggest that BPM models can be implanted into EA to create better documentation for decision-makers only using horizontal architectural modeling tools such as architecture of integrated information systems (ARIS). Their study focused on the documentation of BPM models and EA artifacts without considering other related EABPs [51]. The advancement in horizontal organizational technologies using architectural modeling (such as ARIS and ArchiMate) enabled stronger organizational mappings [26,59]. Large organizations have additional need for architectural modeling to be able to view and control various complexities

of processes [3,11]. Yet, architectural modeling using tools, such as ArchiMate, would be misguided without the structure of an EA and organizational direction guided by a strategy [45,60].

2.4. Information Systems

An information system is "an organized collection of IT, data and information, processes, and people" [61] (p. 2). EA requires information systems, particularly documentation and resource usage data. The EA literature analysis has revealed that cloud repositories and resource tracking are the two critical functions of information systems.

Large organizations often face information overload that can be rectified by knowledge or resource centers using a centralized cloud repository [62]. This is particularly true for large organizations wherein information and documentation are in greater demand. Thus, using an online central data warehouse or cloud repository to store and share documentation across different divisions is necessary for larger organizations. An online repository can share documentation (including standards and policies), strengthen collaboration, enable the visualization of information, and enrich data analysis [62,63]. As an EABP, cloud repository documentation (artifacts) is organized based on EA frameworks [64]. Cataloging EA artifacts depends on the given EA framework, which acts as a schema to classify documents and information to simplify retrieval [51]. Cloud repositories must be continuously maintained to keep EA artifacts and related information updated, and cloud updates are necessary to meet both current and future business needs [9,23].

Resource tracking is one of the most critically required technological competencies in larger organizations. It is defined as the use of information systems (e.g., ERP) for the effective employment of resources and competencies [65–67]. As an EABP, resource tracking is required to prioritize resource allocation according to a strategic EA goal. In addition, resource tracking is needed to foresee EA implementation within different organizational initiatives and projects [68]. An EA sets the rules and standards for resource tracking and use within an organization; this can reduce expenditures and avoid wasted efforts [69]. EA frameworks such as Gartner, TOGAF, and FEA have introduced the resource planning and tracking methods needed for organizational transformation [59,70].

Various tools and techniques have been recently discussed in EA literature for the documentation of EA artifacts and resource tracking. These include horizontal EA documentation and resource tracking information systems such as ERP (e.g., SAP) and advanced horizontal modeling tools (e.g., ArchiMate and ARIS) [56,59,65–67]. A semi-automated documentation process using a business process management system (BPMS) has been suggested by Farwick et al. [71]. In their study, they created a model wherein a BPMS surveys the processes using predefined criteria and then aggregates the documentation and key performance indicators (KPIs) to be presented on the dashboards for decision-makers. Regardless of the different advancements of documentation technologies and resource tracking tools, Banaeianjahromi and Smolander [72] have discussed that the commitment of top management toward EA documentation processes is a key factor for the continuous successful and beneficial utilization of the EA repository and resource tracking. However, neither Banaeianjahromi and Smolander [72] nor other studies in this theme [56,59,71] discuss the role of strategy or governance for effective resource and documentation utilization.

Table 1 presents distinct EABP categories based on the organizational themes described in the EA literature. The following section describes the research methodology.

Table 1. Critical enterprise architecture best practices (EABPs) found in the literature.

Theme	Practice	Supporting Reference
1. Enterprise Architecture (EA)	-Adopting an EA framework: using an EA framework to guide the organization's planning and operations.	[14,15,19,25,26]
	-Using an EA methodology: documenting and implementing an EA framework.	[20–24]
2. Strategic Practices	-Employing a shared strategy: strategic statements, goals, and practices used to guide the EA, leaders, and employees of the organization towards a specific direction.	[6,32,36–39,45]
	-Effective governance: using EA to utilize resources and the workforce towards achieving the organization's strategies and goals.	[2,27,43,44]
3. Business Activities	-Implementing business processes: integrating and directing key business processes using EA framework.	[13,48–51]
	-Architectural modeling: using EA framework to model horizontal representations of the organization.	[25,54,56,58,60]
4. Information Systems	-Documenting material using cloud repositories: using a centralized online repository that is organized based on an EA framework to store and share documentation and key information.	[9,23,63,64,72]
	-Using technological competencies to track and utilize resources: adopting horizontal information systems to optimize the usage of organizational resources in order to reach predefined EA strategic goals.	[56,59,68,70]

3. Methodology

The research methodology was conducted in two phases. Phase 1 entailed the testing of the EABP matrix and exploration of the practices within large organizations. The EABP matrix is grounded on EA literature, which highlights eight practices; these practices were weighted (Appendix B) and each organization was evaluated based on these weights. In phase 2, the organizations most capable of implementing EABPs were considered for a multi-case study analysis. This analysis allowed a detailed investigation of established EABPs in one of the largest and most important corporations in the region. Figure 1 outlines the research methodology.
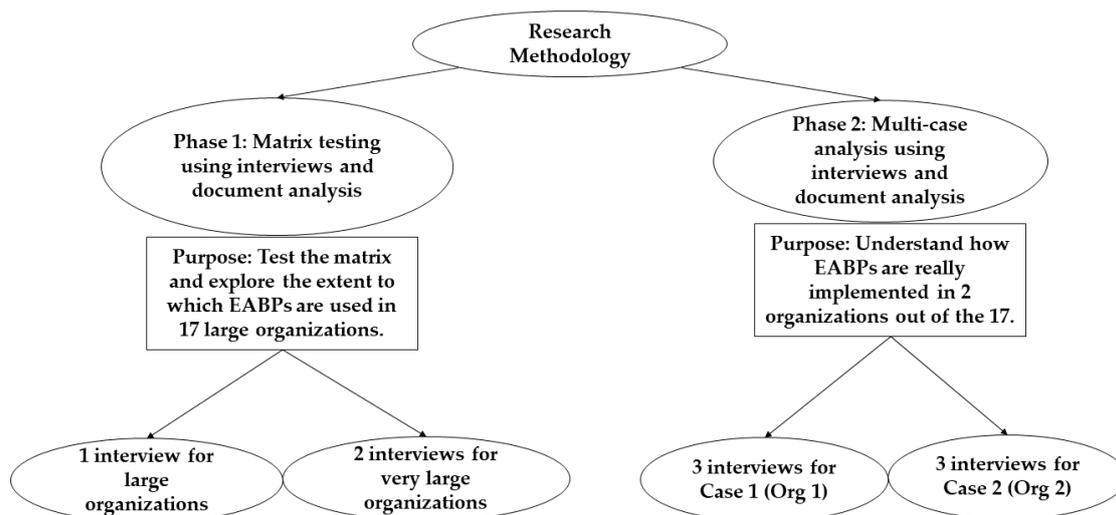

Figure 1. Outline of the research methodology.

3.1. Phase 1: Testing of EABP Matrix

Forbes lists the top 100 largest publicly traded corporations in different countries by assessing them based on profits, assets, annual revenue, and market value [73]. To enable adequate sampling in this study, the Forbes' list of the top 100 largest companies in a country was acquired. The country and organization names are kept confidential for the sake of privacy of the examined organizations. Since this study focuses on large organizations, the largest corporations on the list were first considered for sampling. These organizations were contacted through their shared email or phone number on their websites. Those who did not respond or were not cooperative were excluded from the sample. The final sample contained 17 organizations from 12 different industries; this satisfies the criteria of the convenient sampling technique [74]. Snowball sampling is a technique that can pinpoint information-rich consultants within organizations. In some cases, informants within one organization would lead to other key participants in other organizations. Thus, snowball sampling was deemed a suitable sampling method for this paper [75].

Table 2 presents the 17 organizations' industries and approximate number of employees. Some organizations specialized in several fields, including education, technology, health, and finance. Conglomerate companies are those with various lines of businesses in diverse fields (e.g., technology and finance) or those with different production lines. All the organizations had over 500 employees, which was a criterion used to confirm the size of the organization [76].

Table 2. Organizational profiles.

Organization	Field	Approximate Number of Employees	Interviewees
Org 1	Conglomerate	66,000	I14, I15
Org 2	Telecommunication	18,000	I2, I3
Org 3	Automobile	5000	I4
Org 4	Food sector	32,000	I5, I13
Org 5	Technology	2000	I6
Org 6	Conglomerate	44,000	I7, I8
Org 7	Financial services	3000	I9
Org 8	Consultancy	1800	I10
Org 9	Health	5000	I11
Org 10	Education	7000	I1
Org 11	Conglomerate	36,000	I12
Org 12	Health	6000	I16
Org 13	Conglomerate	8000	I17
Org 14	Telecommunications	4000	I18
Org 15	Transportation	2000	I19
Org 16	Infrastructure industry	2500	I20
Org 17	Education and consultancy	800	I21

A total of 21 semi-structured interviews were conducted for the 17 organizations. Interviews were conducted with CEOs (Chief Executive Officer), CIOs (Chief Information Officer), IT managers, and senior project managers. Only those informants having horizontal knowledge of the organization and detailed knowledge of their organization's functions in terms of EA frameworks and methodologies, strategic practices, internal business activities, and horizontal information systems were selected. Three approaches were employed to find out whether the informant possessed the relevant knowledge in the key research areas: snowball sampling (asking current participants about future subjects and their knowledge), reading about their position in the shared organization documents or professional social media (e.g., Linkedin), and asking them directly about their knowledge in these areas [75,77,78]. For the proper evaluation of horizontal EABPs, the largest firms in the sample—Organization (Org) 1, 2, 4, and 11—required two interviews, whereas the other firms required only one interview. Subsequent to the interviews, shared and online organizational documentation for each of the contacted corporations was used as secondary data to verify the information. Published reports found on the internet and

news articles about the companies were also useful in confirming the information obtained from the interviews.

Thus, the interviewees were asked about EABP details as they were conceptually discussed in the EA literature. The interviews sought to evaluate EABPs within all 17 organizations using the evaluation matrix in Appendix B; therefore, the questions generally pertained to the companies' current EABPs. The interviewer asked details about each EABP to assess the effectiveness of its implementation. First, interviewees were asked about their company's typical practices, e.g., "Does your company have a strategy?" Next, they were asked for details regarding EABPs such as "Has the strategy been announced?" If the interviewee answered "no" to the second question, EABP implementation was considered limited compared with the cases outlined in the literature. However, if an interviewee replied "no" to both questions, then it was determined that their organization employed no EABPs. Interviewees were also asked to explain more about their company's EABP usage; for instance, an interviewee would be asked "How is the strategy communicated to employees across the whole organization?" A senior project manager from Org 12 stated, "The strategy is announced on our website; employees receive information about the strategy in their email and we discuss the strategy with our employees in meetings." The purpose of such discussions was to evaluate the efficacy of EABP implementation within all sampled organizations. A few interviewees were unsure of certain EABP information, such as their firm's resource tracking practices. However, this information was found in the reports on the organizations' website or in published articles about the organization. The same procedure was followed for all EABPs in the 17 companies. All the data were collected through electronic notes because many interviewees declined recorded interviews.

The electronic notes from 21 interviews were thoroughly reviewed, analyzed, and summarized in a tabular form (see Table 6). This analysis aimed to evaluate each organization individually using the criteria in Appendix B. The outcome of these evaluations is presented in Table 4.

To understand the companies' EABP capabilities compared with the cases found in the literature, the interviewers' notes were thoroughly analyzed for details regarding each EABP. Documents were also used to verify information about each EABP when needed. The results are detailed in Section 4.

3.2. Phase 2: Multi-Case Study (Org 1 and 2)

A case study methodology enables the examination of a situation in its organic context [79]. Multi-case studies allow a deeper and more comprehensive insight into the phenomena being studied [80]. Thus, a multi-case study approach can broaden the perspectives on each case and compare the similarities and differences between organizations [81].

In phase 2, six semi-structured interviews were conducted for Org 1 and 2, with each interview lasting about 1.5 h. The interviews were recorded and then transcribed. Questions were developed to collect information regarding the two companies' EABPs and how they were implemented. The literature review assisted in developing open-ended questions, which motivated interviewees to describe EABPs and their applications within their organizational settings. To ensure that the questions in the interview protocol covered all of the EABPs, they were created based on the definition of EABPs derived from the literature. Thus, two questions were sometimes needed to cover all the EABPs. For example, two points were covered by the questions in Appendix A: "Which EA framework is used the organization?" and "How is it implemented?" These include identifying the used EA and examining the additional details of its implementation in the organization. All of the interview questions were influenced by the following studies: [9,13,14,21,37,82]. The interviews were based on a protocol (see Appendix A); thus, the interviewer followed a semi-structured approach and pre-selected questions were used as guidelines. This allowed participants to elaborate on topics they knew more about and removed restrictions during the interview [83]. In addition to interviews, many documents were used to triangulate and verify the information provided by the interviewees; this enabled more rigorous data collection [84]. Electronic notes were used as most interviewees refused to record the interviews. The data in the notes were coded to labels to condense the large volume of text in the data

and to find details about the EABPs within both organizations. The coding was guided by the eight EABP definitions synthesized from the literature in Section 2. The data was scanned for practices that are related to EABP definitions. These practices were highlighted and grouped into labels. The labels were then grouped according to their corresponding EABPs and used to organize thought and logic while discussing the case studies in phase 2. The labels were also useful to determine the location of the related quotes while writing the findings of the case study [81,85].

Table 3 shows the interviewees' managerial positions, which pertain to EA implementation and maintenance. The table also indicates the experience of each interviewee, including their specific experience in technology and EA. The interviews presented in Table 3 are in addition to those conducted in phase 1 (Table 2) for Org 1 and 2. Consequently, different participants were interviewed to acquire further information about EABPs in Org 1 and 2.

Table 3. Phase 2 participants.

Participants	Managerial Position	Experience (years)	Organization
Interviewee 1	General Manager of Computer Center	20	Org 1
Interviewee 2	Senior Enterprise Architect	17	Org 1
Interviewee 3	Strategic Transformation Officer	11	Org 1
Interviewee 4	ICT (Information Communication Technology) Solution Expert	15	Org 2
Interviewee 5	Enterprise Architect	7	Org 2
Interviewee 6	Enterprise Solution Architect	8	Org 2

Documents were collected internally from organizations' corresponding departments, online from their official websites, or from other websites. Table 4 describes the 18 collected documents and the organizations they are related to.

Table 4. Documents collected in phase 2.

Document	Description	Organization
D1	The human resources (HR) enterprise architect role document outlines what an EA framework is in the organization and how it should be implemented. The role of the enterprise architect is also described.	Org 1
D2	Report on the importance of enterprise architecture (EA) in achieving and formulating Org 1's strategy.	Org 1
D3	Internal article discussing Org 1's success in implementing EA and the awards received based on that.	Org 1
D4	Knowledge sharing report on EA implementation experiences.	Org 1
D5	Presentation slides describing the challenges Org 1 faced and how EA can assist in overcoming these challenges.	Org 1
D6	Report detailing organizational challenges and suggested solutions based on EA and enterprise resource planning (ERP).	Org 1
D7	Annual reports detailing the role of information technology (IT) and EA in strategic fulfillment, as well as governance and its relationship with EA.	Org 1
D8	Strategic planning document containing details on EA implementation and maintenance.	Org 1
D9	Technical document reporting SAP and EA use.	Org 1
D10	Document providing information on service-oriented architecture (SOA), the open group architecture framework (TOGAF), and SAP.	Org 1
D11	Job description of the enterprise architect role and the ICT skills required for it. It also describes the organization's current EA status and what the job will require.	Org 2

Table 4. *Cont.*

Document	Description	Organization
D12	Internal report discussing the organization's financial issues and growth challenges and how EA can assist in solving these problems.	Org 2
D13	Report discussing the implementation of business process management (BPM), EA, and related technologies.	Org 2
D14	Government report specifying the Org 2's success in implementing EA and state-of-the-art technologies.	Org 2
D15	Report on the EA documentation methodologies within the organization.	Org 2
D16	ICT internal report on Org 2's technological advances and EA use.	Org 2
D17	Technical document specifying the integration of customer relationship management (CRM) with TOGAF and BPM software	Org 2
D18	Internal report on best practices, such as information technology infrastructure library (ITIL), project management, and PRojects IN Controlled Environments (PRINCE2), and their roles within the enterprise architecture.	Org 2

4. Findings

4.1. Phase 1

The EABP capability matrices in Appendix B and Table 5 were developed and synthesized following the reviewed EA literature. This study created themes from the literature and EABP criteria to measure the organizations' capabilities by following an approach similar to the questionnaire design in organizational capability or maturity matrix development studies found in information systems research (see [86,87]). First, the assessment of EABPs is conducted via the EABP evaluation matrix (see Appendix B). In each of the 17 organizations, interviewees were asked about the practices that existed in their organization according to the evaluation criteria of the matrix in Appendix B. Literal exact wording for each criterion was not required as every organization was different in their adoption of the EABPs; thus, the questions differed according to the situation. The interviews however assured that all of the criteria were covered. Each score was recorded in the EABP capability outcome matrix in Table 5.

Based on the literature [13,14,21,25,37], the following EABPs counted for four evaluation points because they were identified as the most important EABPs: announced strategy, effective governance, EA methodology, and EA framework [14,21,37,82]. The remaining EABPs were allocated only two evaluation points because they were considered essential but not as imperative as the previous four EABPs [13,25,88]. Four levels and their corresponding scores (see the "Capability" column in the table below) were identified in the matrix: low = 1–6, average = 7–12, high = 13–18, and capable = 19–24. These four scoring levels were adapted from previously published articles [85,89,90].

The mean score for EABP capability between all organizations was 13.12, indicating that most large organizations in the sample have a high chance of successfully employing EABPs. This is a sensible outcome because most large organizations are in a greater need of practices that can increase the cohesion of strategy, business, and technology. However, only 1 of the 17 organizations (Org 1) fully adopted an EA framework and methodology, and only two organizations (Org 2 and 11) applied them in limited vertical parts of the organization. Organizations with a high capacity of using EABPs are more likely to adopt an EA framework and methodology because they already employ the most critical EABPs.

Table 5. The EABP capability matrix outcomes.

Org	EA Method (4)	EA Framework (4)	Strategy (4)	Governance (4)	Business Processes (2)	Modeling (2)	Cloud Repository (2)	Resources Tracking (2)	Score (24)	Capability
1	4	4	4	4	2	2	2	2	24	Capable
2	2	2	4	4	2	2	2	2	20	Capable
3	0	0	0	0	0	2	2	1	5	Low
4	0	0	4	4	2	0	2	2	14	High
5	0	0	4	4	2	2	2	2	16	High
6	2	2	2	4	2	2	2	2	18	High
7	0	0	4	4	0	2	2	2	14	High
8	0	0	4	0	2	2	2	2	12	Average
9	0	0	0	0	1	0	0	2	3	Low
10	0	0	4	4	2	2	2	2	16	High
11	2	4	2	2	2	2	2	2	18	High
12	0	0	0	4	0	2	0	2	8	Low
13	0	0	0	4	1	1	2	2	10	Average
14	0	0	4	4	2	1	0	2	13	High
15	0	0	2	4	2	2	0	1	11	Average
16	0	0	2	4	2	1	2	2	13	High
17	0	0	4	4	0	2	2	0	12	Average

Organizations that were evaluated as "high" in the EABP matrix are as follows: 4, 5, 6, 7, 10, 11, 14, and 16. These organizations had better levels of EABP implementation than those with "average" and "low" scores in the EABP matrix. The interview transcripts showed that the organizations with "high" scores had a vibrant strategic direction, had effective governance boards, and implemented an advanced horizontal information system. The strategic direction for these organizations was clear, and according to the interviewees (I1, I5, I6, I7, I8, I13, II8, and I17), the employees were aware of organizational strategic plans and the different objectives that can contribute to fulfilling them. This finding is consistent with the findings of [36–38,91] because a vibrant and well-communicated strategic direction can lead to better levels of focused change or a higher level of EABP implementation. Governance boards in these organizations focused on fulfilling organizational strategies and were data-driven. According to the interviewees, the governance boards facilitated EABP implementation by removing the barriers obstructing its adoption (I1, I5, I7, I8, I13, and I12). For instance, the governance boards of Org 4, 6, and 10 conducted a thorough assessment of the policies and technologies that can hinder the fulfillment of their strategy and implementation of business process management. A key finding of phase 1 is that all the organizations scoring "high" in the EABP matrix implemented a horizontal information system that assisted in the incorporation of EABPs within the organizations (I1, I13, I6, I7, I13, II8, and I17). For example, Org 6 and 11 implemented the SAP ERP information system, which assisted in resource and employee tracking and enabled better documentation throughout the organization. Both these organizations employed an EA framework (TOGAF) within the SAP ERP system for a few departments only (vertically), which in this case lowered the impact of the EA framework to only a limited number of departments. This finding is consistent with the findings of [9,23,63,64,88] as a successful implementation of horizontal information systems leading to higher levels of EABP implementation. Overall, these organizations adopted effective strategic practices and had advanced technological capabilities but lacked the usage of an EA framework and methodology.

Four organizations were evaluated as "average" in the EABP matrix: Org 8, 13, 15, and 17. These organizations adopted adequate levels of strategic practices and high levels of architectural modeling. The strategic direction of Org 8 and 17 was clear and well-communicated, which is considered an important EABP. Moreover, the governance boards managed the transition of their organizations toward achieving their strategy by providing the necessary resources (I10 and I21). Although the governance board of Org 15 was keen to fulfill their strategic objectives, the strategic statement and goals were not adequately communicated through different employee levels (I19). Org 13 adopted operational governance of resource policies but lacked strategic direction. Thus, Org 13 did not effectively adopt EABPs, leading to non-unified and scattered operational efforts. This finding is similar to previous research [38,82,91] as the lack of strategic practices can impact the successful implementation of EABPs.

The organizations evaluated as "low" on the EABP matrix were Org 3, 9, and 10. These organizations lacked strategic direction, organized business processes, and technological capabilities. In both Org 9 and 12, in providing health services to customers, it was noticed that the senior management were specialized in medical fields and lacked organizational technology and business training. This is a common practice in some health service organizations [92–94]. Since the senior management of both organizations were responsible for creating strategic direction and governance, EABP implementation in both organizations was affected (I11 and I16). Org 3 adopted fair information systems EABPs, which supported their sales and services. Nevertheless, it lacked many EABPs, particularly strategic practices and business activities (I4). Table 6 provides a summary of the eight EABPs for the organizations evaluated as "high," "average," and "low" in the EABP matrix. The two "Capable" organizations are discussed with additional details in the following section and are therefore not included in this table.

Table 6. Summary of the used EABPs for the organizations evaluated as "high," "average," and "low".

EABP	High Org: 4, 5, 6, 7, 10, 11, 14, 16 Interviewees: I5, I13, I6, I7, I8, I9, I12, I18, I20	Average Org: 8, 13, 15, 17 Interviewees: I10, I17, I19, I21	Low Org: 3, 9, 12 Interviewees: I4, I11, I16
1. Adopting an EA framework	The adoption of an EA framework horizontally is lacking, except the vertical implementation of TOGAF framework.	No EA architecture was adopted in any of these organizations.	No EA architecture was adopted in any of these organizations.
2. Using an EA methodology	EA methodology was implemented only vertically within a limited number of departments.	No EA methodology practices were implemented in these organizations.	No EA methodology practices were implemented in these organizations.
3. Employing a shared strategy	These organizations implemented many strategic EABPs, including a shared strategic statement and the fulfillment of a strategy through the implementation of balance score cards, usage of strengths, weaknesses, opportunities, and threats (SWOT) analysis, and detailed and shared strategic goals and objectives.	Strategic direction and statement were evident in these organizations. The strategic statement was shared publicly through their website or internally through the intranet and external systems. However, some organizations lacked other means of communication for these strategic directions, such as detailed goals or the implementation of balance score cards.	All of these organizations lacked the usage of a clear strategic direction, goals, or objectives.
4. Effective governance	Governance boards sought to fulfill the strategic direction through the following: 1. Support: provision of the needed resources and formulation of enabling regulations and policies. 2. Monitoring of performance: most of these organizations used key performance indicators (KPIs) mapped with the strategic objectives to track the progress toward the fulfillment of their strategies.	Most of these organizations had governance boards that supported the achievement of organizational goals through procuring the needed resources and monitoring organizational performance in achieving these goals.	Governance board and governance practices only existed in one organization.
5. Implementing business processes	Structured business processes existed in most of these organizations. These business processes were supported by a horizontal information system. The information system provided modeling and task distribution for the process owners and processes personnel.	Business processes were adopted as a form of structure for these corporations. Overall business process models and detailed specific models existed if a business process was adopted. Some of these organizations also provided business processes related to consultancy services to other organizations.	The organizations were lacking in terms of the adoption and awareness of business process. Only one organization adopted business processes at the operational levels only without an adequate awareness and support from senior management.
6. Architectural modeling	Architecture modeling existed in some organizations. The practices ranged from using dashboards for representing models of the organizational processes and departments to using modeling tools such as unified modeling language (UML) and business process management notation (BPMN) 2.0. Performance of different processes and departments were tracked using visual representations.	Most of these organizations adopted architectural modeling tools and techniques such as integrated definition (IDEF), BPMN, and UML 2.0. Overall, architectural modeling was used in these organizations to follow up with changes within the organizations.	Modeling was used in only two of these organizations. The functionality of architectural modeling was similar to that in "high" and "average" organizations. One organization did not adopt any form of architectural modeling.

Table 6. *Cont.*

EABP	High	Average	Low
	Org: 4, 5, 6, 7, 10, 11, 14, 16 Interviewees: I5, I13, I6, I7, I8, I9, I12, I18, I20	**Org: 8, 13, 15, 17 Interviewees: I10, I17, I19, I21**	**Org: 3, 9, 12 Interviewees: I4, I11, I16**
7. Documenting material using cloud repositories	Some of these organizations used cloud repositories to share documentation, policies, and regulations. These organizations adopted an "organizational chat" model to organize documentation.	All of these organizations stored their documentation on the cloud to be shared across geographically distant branches and departments.	Only one organization adopted the usage of cloud repositories, which was useful in delivering the sales and marketing statuses for this automobile organization.
8. Using technological competencies to track and utilize resources	Tracking the resources and employees using ERPs and horizontal information systems was necessary for these organizations. Resource tracking was conducted visually using dashboards or within drill-in detailed charts and sheets. Most of these organizations used commercial off-the-shelf ERP systems such as SAP or Microsoft Dynamics.	Two organizations used well-known ERP systems to track resources with the strategic prioritization of resource usage, whereas one organization used their own simple in-house system to track resources. Org 15 used their system to only book and track the usage of different resources without proper strategic prioritization.	Most of these organizations adopted resource allocation, tracking, and prioritization based on customer needs using different off-the-shelf software and ERPs.

To better understand current EABPs in large corporations, phase 2 focused on the "capable" organizations evaluated in Table 5 (Org 1 and 2).

4.2. Phase 2: Multi-Case Studies

4.2.1. Case 1 (Org 1)

Org 1 is the largest corporation both in the sample and in the continent. It boasts 66,000 employees and is an international leader in providing chemical and energy products as well as technology solutions. The corporation originally focused exclusively on chemicals and energy, but its strong investment in technological research and development enabled it to provide technology solutions to other public and private enterprises.

Org 1 faced many difficulties in managing its documentation and resources. It also struggled to achieve its strategies and meet its goals. Interviewee 1 said "There was no public model for classifying electronic records and every department did their own documentation procedure as an ad-hoc activity. This has created many inconsistencies and difficulties in sharing and archiving documents."

Files about documentation, software, hardware, and configuration management were unstructured and non-standardized, thereby creating many operational discrepancies between departments. Although physical records were structured, formal electronic documents were not uniformly organized. Moreover, departments operated as independent silos with many communication problems and had trouble completing interdepartmental tasks. Information about such tasks or about corporate governance lacked accuracy, integrity, and quality. Moreover, sometimes the information was duplicated because different departments worked on the same or similar tasks. Information re-creation and loss occurred throughout the corporation, making it difficult to manage and control departments.

Interviewee 2: "Resource apportionment was conducted on an on-demand basis, which did not allow enterprise-wide effectiveness and resource utilization."

Since there was no unified configuration management or resource standardization, the software and hardware resource development, procurement, support, and training costs were high. Different departments developed or obtained resources abruptly when the need arose, and each one applied a different setting to their software and hardware, thus acting independently of the firm's overall requirements, goals, or strategies.

Horizontal and vertical policies, standards, or guidelines were complex and not standardized; in other words, the corporation lacked global (horizontal) security policies and standards. Consequently, the corporation was vulnerable to cyberattacks, which was reported in the media.

To handle many of the previously discussed issues, Org 1's governance board decided that an EA was required. After researching the matter, the company's computer center implemented the SAP EA framework (SAPEAF). The firm had already horizontally implemented SAP as an ERP system to link different departments within the corporation, but several resource alignment and documentation structuring issues were still present. SAPEAF was thus a reasonable EA framework choice because it could integrate systems outside of the SAP environment under a well-established architecture. SAPEAF is a commercial extension of the TOGAF framework that also supports transitioning to service-oriented architecture (SOA) if required [95].

Many organizational entities within Org 1 implemented SAPEAF, but the firm's computer center had the most responsibility in doing so. The computer center received an international award in EA excellence in 2016 for its successful EA implementation. According to Interviewee 1, "The implementation of SAPEAF has enabled [Org 1] to go through a smoother digital transformation, which would have been a more lengthy and complex procedure for such a large body."

Org 1 divides its operations into "upstream," which includes development and production procedures, and "downstream," which includes distribution and merchandizing processes. After SAPEAF implementation, the turnaround time decreased for upstream partners who participated in the development and production supply chain. The quality of the firm's business services increased in the upstream, and according to Interviewee 2, more than 500 processes were modeled using ARIS and SAPEAF. The ARIS approach is used for holistic enterprise business process modeling, governance, and administration [96,97]. The computer center incorporated ARIS into SAPEAF to facilitate the modeling and governance of business processes. Applying EA enriched both upstream and downstream processes through EA practices, such as enterprise-wide technology standardization, enabling reusable services via SOA and software development lifecycle as part of the EA methodology planning, and documentation of software development projects. SAPEAF enabled Org 1 to focus its business processes and technological initiatives on serving its strategic goals and global organizational vision. Org 1 has shared its strategy on their website, and it is also visible through SAPEAF, reminding employees about it. The firm focuses on using technology, innovation, and business processes to become a global leader in energy and chemical products. Digital transformation is a crucial part of this strategy because Org 1 views technology as a catalyst for change and innovation. According to Interviewee 2 and the annual review reports, technological alignment with business processes and operations has driven Org 1 to achieve its financial and operational goals for 2018. The governance board includes more than 12 members with various backgrounds in technology, chemistry, economics, and finance. The board's purpose is to oversee the company's overall performance and monitor its operations. These activities are supported by EA initiatives, which enable the vigorous review of operations and open reporting channels. SAPEAF has placed different KPIs into perspective and under a common structure where they can be systematically tracked. This enables meaningful and structured data analyses in the context of relevant architectures or perspectives, such as production or procurement. SAPEAF has also based the firm's business process architecture on TOGAF and has led processes to focus on services and reusability according to SOA. The business process architecture was founded on TOGAF, which is used for highlighting key processes, defining best practices, and outlining methods of governance and structure for each process [98]. Influenced by SOA, Org 1 frames key processes as services through SAP NetWeaver after being integrated with ARIS. NetWeaver is a platform for integrating data, processes, and other systems within the SAP environment [99]. Architectural modeling is conducted through ARIS, which sends and receives information to and from the SAP ERP software; this enables mining, optimization, and automation of processes. ARIS work-handlers are used to distribute tasks to employees, while process models guide work and link different departments. For documentation and electronic resource tracking, SAP Ariba is used to further enable a company's digital transformation. Compounded with the SAPEAF architecture, documentation was organized into categories according to the TOGAF architecture, as shown in the Figure 2 below.
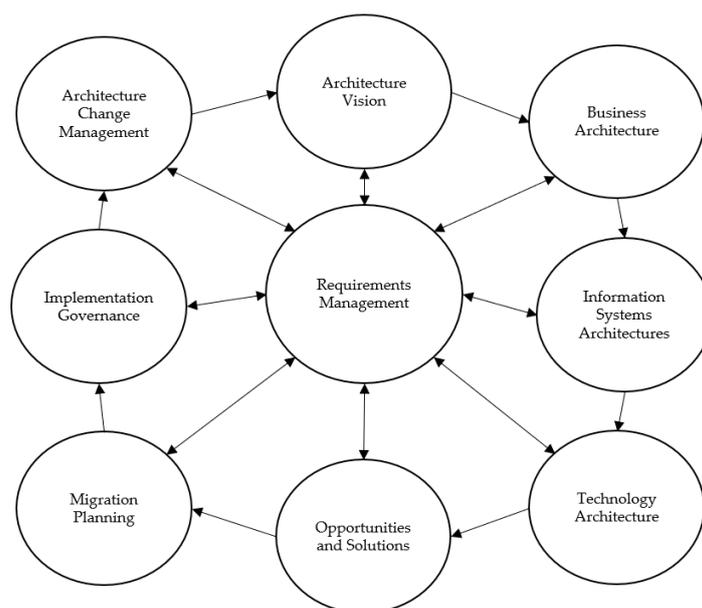
Figure 2. TOGAF framework implemented in Org 1, adapted from [29].

Supply chains are managed through e-contracts within the SAP Ariba environment, which is a form of electronic documentation that sets rules of conduct for Org 1's partners. Data is shared between supply chain partners through the Ariba cloud, described by Interviewee 3 as a "cost-efficient trading community". SAP Ariba is also used for e-sourcing, which is an electronic form of tracking resources on the cloud. This has led to better resource allocation, which accords with the EA framework, strategic requirements, and the firm's business needs. The electronic cloud hub within the SAP environment has created an effective organizational portfolio management system for resource allocation and governance.

4.2.2. Case 2 (Org 2)

Although not the largest organization in the sample, Org 2 is a telecommunications company focused on adopting state-of-the-art technologies to serve its customers. Similar to Org 1, Org 2 is an industry leader in the region; it seeks to provide not only customer-to-business solutions but also business-to-business and business-to-government ICT solutions using business intelligence (BI), big data, cloud technologies, the Internet of Things, cybersecurity, and other relevant techno-business solutions.

The corporation faced two key issues, one of which was its transition from being a government entity to a private sector corporation. Although this transition has been happening for the last 15 years, the company continually suffered from bureaucracy and legacy systems and infrastructures, which slowed business processes and customer request fulfillment. Moreover, its major expansion and internationalization into becoming an ICT solution provider for several countries in the region created many challenges in governing organizational performance and documentation. Intense competition also arose for Org 2; many local and international organizations entered the region to provide telecommunication, technology, and consultation solutions to customers, businesses, and governments. Org 2's expansion and the rise of its many competitors caused the company financial stress, which triggered a need for business optimization and greater strategic focus. However, the corporation possessed outdated systems and infrastructures, lacked standardization, had difficulty governing operations and resources, and experienced fierce international and national competition, all of which led to financial issues. Interviewee 5 stated "The local and international telecommunication market is very competitive, which increases the need for our company to grow returns on investment and market share."

The privatization, internalization, and robust competition pressured the company to adopt best practices that could lead to better governance and optimized operations, documentation, and resources. Consequently, the firm's governance board formulated an EA center of excellence. Other centers of excellence, including strategy execution and project management, existed before the EA center of excellence. This center decided to adopt TOGAF because it accorded with the corporation requirements. TOGAF was incorporated into an in-house software called telecom company enterprise architecture (TCEA). This software was integrated with the Siebel customer relationship management (CRM) system. Org 2 used Siebel to handle customer requests and increase loyalty management, which is a necessity in the firm's competitive industry. TCEA is used to document and track resources according to TOGAF repositories and methodologies. It is also used to ensure that processes and operations are strategized and optimized according to a corporation's goals. Therefore, using Siebel CRM and TCEA as an EA governance software aligns with a customer-satisfaction-oriented loyalty strategy and is applicable to the EA of an entire corporation.

As part of their EA methodology, Org 2 has adopted the information technology infrastructure library (ITIL), which is linked to TCEA and Siebel. ITIL is a library of best practices used in IT services and organizational business requirements alignment. It is used to standardize documentation about technology–business alignment practices, services, processes, and procedures within the company [100]. Customer requests, or "incidents" as they are called in Org 2, go through Siebel and get documented in the micro-view through ITIL. Next, the requests are placed in a macro perspective through TOGAF (or TCEA). Power BI is a Microsoft business analytics tool that creates aggregations, dashboards, and visualizations for an organization [101], and this tool receives feeds from Siebel, TCEA, and other processes. Its views are created according to TOGAF and the organization's strategy. Org 2's centers of excellence and EA center handle Power BI; however, the final yearly, monthly, and sometimes daily reports and dashboards are also viewed by upper management and the governance board. Interviewee 6 said "After applying the TOGAF framework via TCEA, we were able to structure our strategy and clearly determine responsibilities which fall under these structures. Additionally, TCEA allowed for upper management's higher levels of control over our processes; they are able to shape these processes and steer them towards the realization of our goals and strategy."

Org 2's strategy is divided into multiple clusters: (1) digitalization of internal operations and higher dependency on data; (2) improving overall performance and efficient resource use; (3) providing a leading customer experience; and 4) planning measured service expansion and market-penetration—this strategy is highlighted on their website. Their KPIs are also set within the TCEA environment and structured according to the strategy cluster. This has enabled top management to monitor the outcomes of each strategic goal periodically or, if necessary, in real time. The process architecture designed within ARIS classifies processes into three categories: core, management, and supporting. ARIS is integrated with TCEA to structure processes according to TOGAF. Moreover, information from these processes is retrofitted into their respective locations conferring to the TOGAF framework, which is helpful for governance and performance monitoring. Interviewee 4 said "ARIS is used in our organization as a business process management system, which conducts itself as an ERP system in terms of connecting the enterprise."

The firm initially conducts architectural modeling through a piece of software called Bizagi, while the storage of process architecture and all mature models is conducted through ARIS. Bizagi is an enterprise business process modeling tool with three versions: Modeler, Studio, and Engine [102]. However, Org 2 relies on Bizagi for BPMN modeling only while ARIS manages the storage of process models, development of process applications, monitoring, simulation, automation, and process mining. Furthermore, resource allocation and tracking are both conducted through ARIS, which guides the strategy and TOGAF framework. The project management office (PMO) conducts resource planning and performance tracking using the Power BI, ARIS, and TCEA dashboards. The PMO applies the PRojects IN Controlled Environments (PRINCE2) method for project and resource management. PRINCE2 is part of TCEA and structures projects for different TOGAF architectures.

5. Discussion and Conclusions

There is a gap in the EA literature identifying the most critical horizontal EABPs for the successful implementation of EA. This is of specific importance in large organizations with complex processes and difficulties in enacting change. Only two studies, [9] and [23], had a scope close to that of this study. However, both only focused on EA methodology practices concerning the documentation of an as-is organizational situation. This research has pursued a broader approach by considering the horizontal EABPs that the literature has identified as most critical: EA framework, EA methodology, shared strategy, effective governance, business processes, architectural modeling, cloud repository, and resource tracking. Based on the outcome of this research, it is recommended that large organizations adopt these EABPs; doing so would increase strategy, business, and technology alignment and eventually lead to EA framework and methodology implementation.

This research has significantly extended the EA literature. First, it identified the EABPs required for large organizations to successfully implement EA. Second, based on the reviewed literature, an EABP capability matrix was developed to help determine a firm's current EA capability status. Third, this research has shown in the first phase of the findings that most organizations have high EABP capability but do not adopt any known EA frameworks. Finally, a multi-case study (phase 2) approach was used to understand how EABPs are implemented within EA-capable organizations. Results showed that 2 of the 17 studied organizations (Org 1 and Org 2) were able to successfully implement an EA framework and methodology because they were also effective in applying EABPs.

Unlike Org 1, which focused on supply-chain efficiencies, Org 2 focused more on customer intimacy. According to [103], organizations should focus on one of three strategic directions: operational excellence, customer intimacy, or product leadership. Previous analysis demonstrated that Org 1 focused on production and supply-chain optimization and therefore adopted a strategy of operational excellence; meanwhile, Org 2 focused more on the customers and enforced a customer intimacy strategy.

Compared with Org 1, Org 2 lacks greater awareness of EA. Although EA awareness is not necessarily widespread throughout Org 1, its employees understand and utilize EA more than Org 2's employees. This can be attributed to the recent EA implementation in Org 2 in comparison with Org 1, which implemented EA four years before Org 2. It is also noted that Org 2's employees are more aware of EA's benefits, which stems from upper management. Org 1's understanding of EA's importance comes from employees specializing in technology, such as those working in the computer center. Org 1's computer center has a centralized and high-level impact on the organization because it is a chemicals production company and does not specialize in technology. Org 2 does not have a centralized unit implementing EA, but its EA center of excellence and other units, including the project management center of excellence, manage EA implementation and governance.

Note that both organizations use TOGAF as the core EA on which all their strategies, organizational structures, and operations rely. Org 2 has a stronger focus on technological standards, such as ITIL and PRINCE2. Org 1 uses expensive software like SAP with less in-house development. In contrast, Org 2 develops software internally and TOGAF is built into their TCEA software, which is used as a repository and performance management tool. Org 2 only uses Siebel as comprehensive CRM software, integrating and organizing it based on TOGAF. This approach is more customized to Org 2's needs because their TCEA is developed internally and TOGAF is tailored according to the firm's business requirements. Org 1 uses the built-in features of commercial software for EA.

It is recommended for large organizations to use the EA framework with customization and link it to technology, as the analysis of multi-case studies has shown. This finding is not widely discussed in the EA literature because, in reality, the findings show that EA framework implementation is linked with software systems. Note that when horizontal systems such as ERP and CRM are integrated with EA frameworks, they assist in monitoring the organizational performance and strategic-technology alignment. The usage of ERP and CRM did not significantly improve performance, as the case studies show. Usage of EA framework and methodology improved the performance of the two large organizations in terms of operations, production, and customer service. Technological standards and

practices such as ITIL and configuration management enable better unification of EA documentation practices and software development, which is especially important in large organizations. Moreover, EA methodology provides the model and standardized method of documentation for large organizations. Both aspects of EABPs (EA framework and methodology) are not broadly used in large organizations, with the only exceptions of the two analyzed organizations. On the contrary, the adoption of a shared strategy is found to be one of the most used practices in large organizations. Realization of a strategy is conducted through an EA framework, as the phase 2 findings indicate. However, it is noticeable that organizations divide and categorize their strategies with a strong focus on technology, which is an important component of EA. Adopting an EA framework is recommended because it enables better categorization of KPIs and different performance indicators. This categorization also facilitates the aggregation of different KPIs, which is necessary for governance within large organizations. Business processes, as a model of improvement, management, and control of processes, are not extensively adopted in large organizations, as shown by the matrix [104]. However, it is a highly recommended practice for large organizations because it assists in the standardization of business activities and documentation. Working under an EA framework, these business processes become more purposeful and reusable, as indicated by the findings of phase 2. Both organizations depended on a BPMS for the management and modeling of business processes, which is a successful practice in improving the quality of processes. According to the case studies, architectural modeling facilitated detecting bottlenecks and problematic processes. Modeling is not a common practice within large organizations, as shown by the matrix. However, it is important for the successful implementation of the EA framework and methodology because it provides transparency in overviewing the organizational structure and business processes. Although cloud repositories can be considered as a nonessential feature for large organizations, they are imperative for EA framework and methodology. It is a recommended EABP because large organizations use it for sharing the EA framework and methodology documentation. Moreover, cloud repositories assist large organizations in their digital transformation by being a common ground for electronic documentation and resource management. Project management in alignment with an EA framework is a recommended practice for resource management, which could lead to better strategic outcomes.

Theoretically, this study combined the strategic, business, and technological perspectives of EA that, to the best of the researcher's knowledge, has not been presented in EA research. This theoretical perspective is a synthesis of viewpoints focusing on distinct EA: methodological, strategic, or technological. The inclusive perspective is practical because organizations have to consider EA practices from all of these viewpoints. This practical study showed what the 15 large organizations lacked for the successful implementation of EABPs using the EABP matrix. Moreover, it discussed the successful EABP implementation in two large organizations using a multi-case methodology. The study also discussed how the two large organizations successfully integrated EABPs, reaping the benefits of EA.

This study only focused on horizontal practices and did not discuss vertical EABPs; therefore, EA research can be further extended by focusing on vertical EABPs. Another limitation of this study is that only large organizations were analyzed and the EABP matrix was designed to measure the capability of only large organizations. Future research could therefore test the matrix on small to medium-sized organizations to broaden its applicability to smaller organizations. However, studying EABP literature that is more relevant to small and medium-sized enterprises is recommended. Qualitative research has its limitation on generalizability; thus, this paper calls for upcoming research to adopt the EABP matrix to other large organizations. Other methods such as quantitative study might be used to create a questionnaire based on the analysis and outcomes of this study. The sample of the largest organizations in this study was limited to one only country, which is another limitation; future studies might consider organizations from multiple countries to obtain a more diverse perspective.

Conflicts of Interest: The author declares no conflict of interest.

Appendix A : Interview Protocol

- Purpose of the organization, size, and structure.
- Which EA framework is used in the organization? How is it implemented?
- How is the EA methodology implemented?
- What kind of software assists in EA implementation and methodology?
- What is your strategy and how does EA help in its fulfillment? *
- What is the role of governance boards with regard to EA?
- Do you implement BPM and how is this related to EA? *
- Do you use architectural modeling? What kinds of tools are used? How does this assist in the EA methodology? *
- Do you use a cloud repository for your documents? How is it used in the EA framework and methodology? *
- How do you track resources? How do you optimize the performance of resources? What is the contribution of EA to this? *

* During the interview "you" and "your" referred to the organization.

Appendix B : EABP Evaluation Matrix

EABP	Evaluation Criteria		
	High Level of EABP Adoption Weight: (4–3)	**Average Level of EABP Adoption Weight: (2–1)**	**Low Level of EABP Adoption Weight: (0)**
1. Adopting an EA framework [14,15,19,25,26]	The strategic adoption of an EA framework is evident, and it is horizontally implemented throughout the organization.	The EA framework operationally exists; however, it is only applied vertically in some departments.	No EA framework is adopted.
2. Using an EA methodology [20,21,23,24]	EA methodology tools and artifacts exist, and they are used horizontally to assist in planning, decision-making, and resource management.	EA methodology tools and artifacts are only used vertically or within a limited number of departments.	EA methodology practices are not conducted vertically or horizontally.
3. Employing a shared strategy [32,36–39]	A strategic statement exists, and it is adopted horizontally throughout the organization.	Although a strategic statement exists, it is not communicated well throughout the organization.	No strategic statement, goals, or objects exist.
4. Effective governance [2,27,43,44]	Governance boards directed the organization toward achieving their strategy. Moreover, they oversaw performance and managed regulation resources.	Governance boards existed but with weak or nonexistent involvement in directing the organizations through planning and resources.	No governance boards existed.
5. Implementing business processes [13,48–51]	Business process models exist and are used to identify areas of improvement in organizational operations. Business processes are used to horizontally integrate different functional departments.	Business process models exist but with vertical or limited cross-department integration.	No business process structure or integration exists.

EABP	Evaluation Criteria		
	High Level of EABP Adoption Weight: (4–3)	**Average Level of EABP Adoption Weight: (2–1)**	**Low Level of EABP Adoption Weight: (0)**
6. Architectural modeling [25,54,56,58]	Different tools, software, and methodologies exist to horizontally map organizational departments, processes, and operations.	Architectural modeling is conducted within only IT or other departments without the cross-cutting adoption of modeling tools and methodologies.	No architectural modeling methodologies or tools exist.
7. Documenting material using cloud repositories [9,23,63,64,72]	A documentation central cloud repository is horizontally adopted with visual representations, cataloging, or indexing for document retrieval.	Different departments have their own repositories and these repositories are not fully integrated with other organizational entities.	No documentation repositories exist, and documents are stored only on paper or other means such as email.
8. Using technological competencies to track and utilize resources [56,59,68,70]	Horizontal information systems or ERPs are used to track the performance and usage of resources. These information systems are used to prioritize resource allocation according to strategic needs of the organization.	Resource tracking is only used vertically or within a few linked departments without clear strategic prioritization.	No resource tracking or prioritization exists.

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