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Modeling of Strategic Alignment to Modify TOGAF Architecture Development Method Based on Business Strategy Model

Yoppy Mirza Maulana [a,b,*], Zafril Rizal M Azmi [b], Ruzaini Abdullah Arshah [b]

[a] *Department of Information System, Universitas Dinamika, Raya Kedung Baruk 98, Surabaya, 60298, Indonesia*
[b] *Department of Computing, Universiti Malaysia Pahang, 26600 Pekan, Pahang, 26660, Malaysia*
Corresponding author: [*]yoppy@dinamika.ac.id

***Abstract*— Strategic alignment is generally seen as an important driver for optimizing business performance. Strategic alignment is aligning internal resource capabilities and external opportunities for superior performance. To realize the suitability of Business and IT strategies, a framework is needed, namely Enterprise Architecture (EA). One of the frameworks for EA is The Open Group Architecture Framework (TOGAF). TOGAF is a method for developing and managing the Enterprise Architecture life cycle called Architectural Development Method (ADM). This ADM integrates elements of the TOGAF standard in responding to the organization's business, and IT needs. In this paper, researchers will contribute to formulating a strategic alignment model to modify the existing strategic alignment in TOGAF ADM based on the business strategy model. In this business model strategy, there are two things: the analysis of business strategy choices and the Balanced Score Card (BSC) strategy map. Analysis of business strategy choices uses SWOT analysis as a business strategy determination based on internal and external business environment analysis. Second, the BSC strategy map is a process of mapping business strategies into the BSC strategy map, which includes four perspectives: financial, customer, internal business processes, and learning and growth perspectives. This model was tested at the University Dinamika, and the results have a good alignment rate of 95%. For further research, this model can be tested in various organizations, such as universities and public and private organizations.**

***Keywords*— Enterprise architecture; strategic alignment; business strategy; TOGAF ADM.**

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I. INTRODUCTION

In general, business-IT alignment (BITA) is the application of IT support to businesses in the organization [1], [2]. BITA, or strategic alignment, is generally viewed as a desirable and important factor and driver for optimizing organization performance [1], maximizing IT investment [3], and ensuring IT services are aligned with business objectives and processes [4]. Strategic alignment is the alignment of internal resource capabilities and external opportunities for organizational performance [5], [6]. Strategic Alignment can be achieved and maintained through Enterprise Architecture (EA) [6], [7].

EA is a set of structured plans that integrate business and IT by analyzing conditions from the past, present, and future [7]–[10]. Several organizations propose EA frameworks to describe EA in a unified and compatible way [7] because EA represents the main enterprise elements of objectives, business strategy, business processes, information systems, and IT [11]. One of the frameworks for EA is The Open Group Architecture Framework (TOGAF) [7], [12].

TOGAF is a method used in developing and managing the EA life cycle [13], [14]. The method used by TOGAF is called the Architecture Development Method (ADM) or known as TOGAF ADM [15], [16]. TOGAF is a framework that has better concepts, processes, and models than others [17]. TOGAF is a standard that can be accepted by various types of companies because it is practical and precise [16]. According to Rouhani et al [17], TOGAF also provides better governance and repositories than others. However, TOGAF focuses more on IT development and lacks detail in terms of alignment between business and IT strategies [17].

Based on the lack of detail on TOGAF in business and IT alignment and in general, the problem of the EA framework is the integration between strategy and IT [18], the researcher conducted a literature study related to TOGAF modification, but there has been no research related to strategy alignment in TOGAF. Researchers focus more on implementing TOGAF ADM as IT governance or blueprints and modifying TOGAF ADM for the Application of technologies such as cloud computing and IoT. Therefore, the research question is how

to create a strategic alignment model to modify TOGAF ADM. In order to answer the research question, a strategic alignment model was made in TOGAF ADM based on a business strategy model known as EA modeling techniques [18]. Developing a strategic alignment model in TOGAF ADM based on a business strategy model is the contribution of researchers in modifying strategic alignment in TOGAF ADM.

According to Kitsios and Kamariotou [18], in the last five years related to EA modeling techniques, researchers have optimized business strategies using Archimate, which is an open and independent architectural modeling language. Kitsios and Kamariotou [18] suggested that EA modeling should be carried out by analyzing the business environment, value chains, SWOT analysis, and business strategy assessment, such as the Application of key performance indicator (KPI) and balanced scorecard (BSC) models [12]. In this study, the EA modeling techniques used were business environment analysis and BSC strategy maps.

II. Materials and Method

In this study, journals and proceedings were used as literature sources. This literature framework has several stages, namely; 1) Study of Business-IT Alignment through EA; 2) Comparative study of enterprise architecture framework; 3) ADM TOGAF Study; 4) Study of business strategy models; 5) Study of business and IT alignment assessment through EA

A. Business-IT Alignment through EA

EA is a useful approach for achieving and maintaining BITA. EA is a method that describes a complex organization. An EA is a structured and aligned set of plans representing the integration of the business and IT landscapes of past, present, and future conditions. EA represents the basic organization of an enterprise, consisting of its suppliers, customers, and partners, and it also contains the principles that guide its design and development. EA is a discipline whose goal is to more effectively align an organization's strategy with its resources and processes [7], [13].

B. EA framework comparison

The literature comparing EA frameworks includes concepts, models, and processes. The concept generally discusses the alignment between business and IT, the importance of repositories, and governance. The model is a design related to the concept, which includes notation, syntax, and semantics. The process is a series of processes from the EA life cycle [17]. Based on the comparison framework in these three aspects, TOGAF has the best value in all aspects, but TOGAF focuses more on IT development and cannot provide proper alignment between business and IT [17].

C. The Open Group Architecture Development Method (TOGAF ADM)

The Open Group first introduced TOGAF in 1995, one of the EA frameworks, and in 2018 it was updated to TOGAF version 9.2 [16]. TOGAF is a detailed framework and set of tools in EA development used to design, build and evaluate. TOGAF is the industry standard for architectural development methods and basic resources that can be freely used by organizations wishing to develop enterprise architectures for use within organizations. TOGAF is a method for developing and managing the Enterprise Architecture life cycle called the Architectural Development Method (ADM) and is the core of the TOGAF standard [16]. This ADM integrates elements of the TOGAF standard in responding to the organization's business, and IT needs.

ADM consists of the steps needed to build enterprise architecture. In this research, the modifications are at the vision, business, and information system architecture stages. Architecture Vision defines the organization's scope, business strategy, and goals, identifies stakeholders and creates an architecture vision. The Business Architecture describes how the company operates to achieve business objectives and responds to the strategic drivers defined in the architecture vision. Information System Architecture explains how the company's Information System Architecture enables the Business Architecture and Architecture Vision [15].

D. Business Strategy Model

In this business model strategy, there are two things: the business environment analysis and the BSC strategy map. First, this business environment analysis includes internal and external analysis. The internal analysis implemented value chain theory and a resource-based view. The value chain emphasizes adding value to the company from the extraction of raw materials to the final product [19]. Resource-Based View (RBV) theory is about the heterogeneity of company resources [20]. The external analysis uses porter's five forces theory, which is used to factor opportunities and threats [21]. SWOT analysis (strengths, weaknesses, opportunities, and threats) is a strategic planning tool to assess the internal capabilities (strengths and weaknesses) of the organization and the external situation facing the organization (threats and opportunities) [22]. Second, the BSC strategy map is used to present its strategic objectives and evaluate the company's characteristics [23]. The process is by putting business strategy into four perspectives from the company's strategic objectives, including financial, customer, internal business processes, and learning and growth perspectives [18].

E. Business and IT alignment assessment through EA

Based on Bakar, Harihodin, and Kama [24], 17 EA assessment models focus on Business-Alignment, namely Information System Architecture (ISA) Evaluation and IS/Business Alignment Assessment. The IS/Business Alignment Assessment is based on three dimensions derived from the Enterprise Architecture component: Business Architecture, Information Architecture, and Application Architecture. Information Architecture or Data Architecture is the main data in supporting the business. Application Architecture defines the applications required for data management and business support [25].

In this approach, the way to measure the alignment is as follows; 1) Alignment between Business Process (BP) (part of Business Architecture) and Information (part of Information Architecture); 2) Alignment between BP (part of Business Architecture) and Application (part of Application Architecture); 3) Alignment between Application (part of Application Architecture) and information (part of Information Architecture) [25].

The alignment formula between Business Architecture and Information Architecture is as follows:

AlinAN_AI = (nEcP/ ntE + nPE/ntP + nErP/ ntE)/3 with the following explanation; 1) nEcP represents the number of entities created by only one business process (Rule 1.1); 2) nPE represents the number of processes that create, update and/or delete (CUD) at least one entity (Rule 1.2); 3) nErP represents the number of entities that are read (R) by at least one process (Rule 1.3); 4) ntE, number of total entities; 5) ntP, number of total processes [25].

The following is Alignment between Business Architecture and Application Architecture as follows;

AlinAN_AA = ((1- (nASwBP/ntS))+(1-(nBPwAS/ntP))/2) with the following explanation; 1) nASwBP represents the number of application systems without any business process associated (Rule 2.2 negation); 2) nBPwAS represents the number of business process without any support by an application system (Rule 2.1 negation); 3) ntS, number of total application systems; 4) ntP, number of total processes [25].

The following Alignment between Application Architecture and Information Architecture as follows;

AlinAA_AI = ((1-(nEMA/ntE))+(1-(nGM/nGM+nGA))/2) with the following explanation; 1) nEMA represents the number of entities managed by more than one application system (Rule 3.1 negation); 2) nGM represents the number of cases managed manually (Rule 3.2 negation); 3) nGA represents the number of cases managed automatically among application systems; 4) ntE, number of total entities.

F. Research method

A research method is a science that studies how research is carried out scientifically and systematically in solving research problems. The stages of the research methodology on modeling strategic alignment to modify TOGAF ADM based on the business strategy model, as shown in Figure 1.

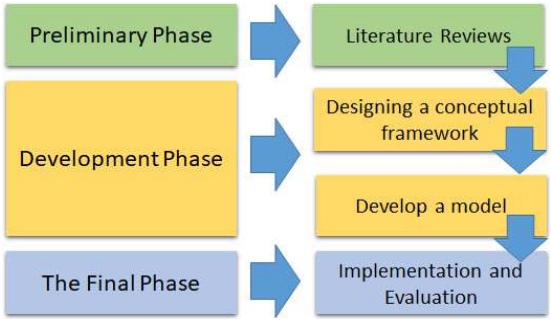

Fig. 1 Research Method

1) Preliminary Phase: In this phase, there are two processes were conducted; first, conducting a literature review related to the modification or use of TOGAF ADM, and second, determining research problems and research gaps regarding the modification of TOGAF ADM

2) Development Phase: In this phase, two processes were conducted; first, designing a conceptual framework on strategic alignment modeling to modify TOGAF based on the business strategy model [18]. Second, develop a model of strategic alignment to modify TOGAF ADM based on the business strategy model [18].

3) Final Phase: At this stage, testing and assessment of the strategic alignment model on TOGAF ADM are carried out with the following steps; 1) This model was piloted at University Dinamika as a case study; 2). This model was evaluated using IS/Business Alignment Assessment [25].

III. Result and Discussion

A. Preliminary Phase

At this stage, the authors are conducting a literature study related to the modification or use of TOGAF ADM research. There are 13 types of relevant literature from 2019 to 2021. This literature study resulted in two classifications of using EA as governance planning and IT Blueprints based on TOGAF ADM [13], [26]–[31] and modifications of TOGAF ADM related to technologies such as cloud computing, IoT [32]–[36]. Based on the literature study, none focused on researching strategic alignment, and this paper aims to create a strategic alignment model to modify TOGAF ADM.

Based on the literature study, none of them focused on researching strategic alignment. At the same time, strategic alignment objectives are important in optimizing business performance [5]. Problems arise when strategic alignment is not right and the organization cannot maximize the return on IT investment [1]. Therefore, this paper aims to create a strategic alignment model to modify TOGAF ADM.

B. Development Phase

The first step is to design a conceptual framework as proposed in Figure 2 and is the basis for developing a strategic alignment model to modify TOGAF ADM.

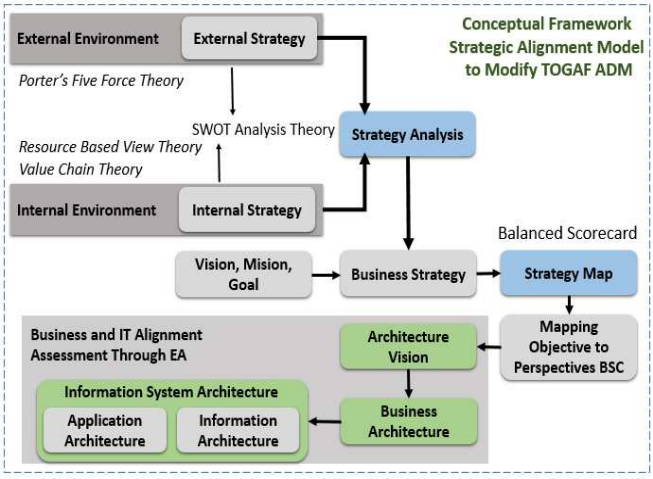

Fig. 2 Conceptual Framework Strategic Alignment Model to Modify TOGAF ADM

The second step in the strategic analysis phase is carried out based on internal and external analysis. Strategic analysis is the process of formulating internal and external analysis to determine the organization's proper business strategy. The theory used in the strategic analysis is SWOT [22]. The stages of strategy analysis are as follows; (1) Formulate the results of Strengths and Weaknesses based on the Resource-Based Display and Value Chain in the IFAS column, (2) Formulate the results of Opportunities and Threats based on the Five Porter Strengths, in the EFAS column, (3) Give weights to the IFAS and EFAS columns, (4) Calculate the IFAS and EFAS

ratings, (5) Multiply the weights and ratings of each IFAS and EFAS, (6) Calculate the total score from the multiplication of weights and ratings on IFAS and EFAS, (7) Determine the X and Y points as business strategy coordinates, (8) Develop a SWOT matrix, to determine the right business strategy for the organization.

The organizational goal-setting stage is based on the business strategy. Furthermore, strategy mapping is prepared by grouping organizational goals in 4 BSC perspectives and mapping them into business services and business functions and processes. The strategic analysis step to the preparation of organizational goals is the stage in modifying the components of the existing business strategy in the vision architecture and mapping it to the business architecture, as shown in Figure 2, namely the strategic alignment model.

C. Final Phase

In this final stage, the implementation and evaluation of the strategic alignment model in TOGAF are carried out. This model is then implemented with a case study at the University Dinamika. The first step is to conduct a strategic analysis phase based on the internal and external analysis used to determine the right business strategy for the organization, the results of which can be seen in Figure 3.

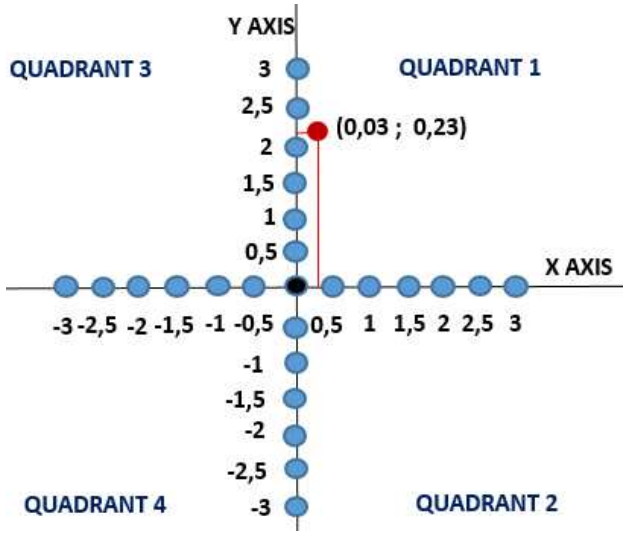

Fig. 3 Business Strategy Coordinates

After it is stated that the University Dinamika strategy is aggressive, the next step is to describe the strategy through the SWOT Matrix so that a strategy can be produced for the University Dinamika, as shown in Table 1.

TABLE I
SWOT MATRIX

	Strength	Weaknesses
Opportunities	Increase the professionalism of lecturers, SNPT-based curriculum, KKNI-based Graduate Competencies, quality lecture processes, paperless education management, and automation in dealing with existing threats.	Increase educational efficiency, institutional quality, number of collaborations, qualifications, and competencies of human resources and laboratories for lectures in the face of existing threats.
Threats	Increase lecturer professionalism, SNPT-based curriculum, KKNI-based Graduate Competence, quality lecture processes, Paperless education management, and automation in responding to opportunities such as the AEC, Globalization, Grants and collaboration, creative industries, smart and green campus, and CSR.	Increase educational efficiency, institutional quality, number of collaborations, qualifications and competencies of human resources and laboratories for lectures in response to opportunities such as the AEC, Globalization, Grants and cooperation, creative industries, smart and green campus, and CSR.

The next stage is strategic mapping, which maps business goals into four balanced scorecard perspectives, as shown in Figure 4. Next is the mapping of business goals and business processes, as in Table 2. Strategic mapping is a part of the architecture vision and business architecture in scope enterprise architecture. Furthermore, business process mapping with information and application architecture is carried out, as shown in Table 3.

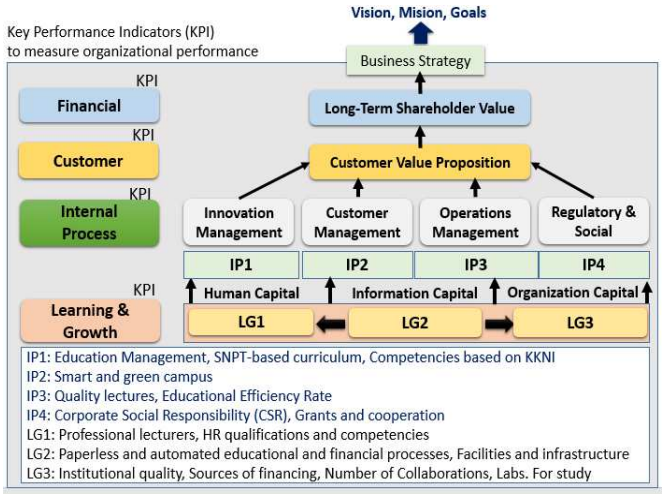

Fig. 4 Strategy Map

TABLE II
MAPPING OF OBJECTIVE AND BUSINESS FUNCTION/PROCESS

Objective	Business Function/Process
Education Management SNPT-based curriculum Competencies based on KKNI	Education Management System
Educational Efficiency Rate	Education efficiency evaluation process
Quality lectures	Lecturer performance evaluation
HR qualifications and competencies	HR Administration
Smart and green campus	Customer Innovation Management

Objective	Business Function/Process
Corporate Social Responsibility (CSR)	Administration CSR
Paperless and automated Educational and Financial processes	Administration and New Student Registration Study Planning Administration Lecture Administration Examination and Assessment Administration Judiciary Administration Administration of Academic Activity Announcements Student Scholarship Letter Issuance Academic Letter Request
Facilities and infrastructure	Administration for Facilities and Infrastructure
Institutional quality, Grants, and cooperation	Institutional Administration
Sources of financing	Strategic and Operational Financial
Laboratory for study	Laboratory administration

TABLE III
MAPPING OF BUSINESS PROCESSES AND INFORMATION ARCHITECTURE, AND APPLICATION ARCHITECTURE

Business Function/Process	Information Architecture	Application Architecture
Education Management System	Education Management System and Academic Information	e-Education Management
Education efficiency evaluation process	Academic Information	
Lecturer performance evaluation	Lecturer Information and Academic Information	
HR Administration	HR Information Management	e-HR
Customer Innovation Management	Customer Innovation Information	e-CRM
Administration CSR	Community information	e-CSR
Administration and New Student Registration	Academic Information	e-Academic Management
Study Planning Administration	Academic Information	
Lecturer Administration	Academic Information	
Examination and Assessment Administration	Academic Information	
Judiciary Administration	Academic Information	
Administration of Academic Activity Announcements	Academic Information Academic Information	
Student Scholarship Letter Issuance	Academic Services	e-Academic Services
Academic Letter Request	Academic Services	
Administration for Facilities and Infrastructure	Facilities and Infrastructure Information	e- Facilities and Infrastructure
Laboratory administration	Facilities and Infrastructure Information	
Institutional Administration	Memorandum of Understanding	-
Strategic and Operational Financial	Financial Information	e-Financial

The final stage after implementation is the evaluation of the strategic alignment model. This evaluation uses IS/Business Alignment [25]. There are three stages in determining business and IT alignment, namely:

1) Formulating alignment between Business Architecture and Information Architecture:

$$AlinAN\_AI = (nEcP/ntE + nPE/ntP + nErP/ ntE)/3 \quad (1)$$

The calculation is as follows ((7/12)+(19/12)+(10/12))/3 = 1 = 100%, so the alignment of Business Architecture and Information Architecture is 100%, which are represented in Table 3.

2) Formulating alignment between Business Architecture and Application Architecture:

$$AlinAN\_AA=((1-(nASwBP/ntS))+(1-(nBPwAS/ntP))/2)(2)$$

The calculation is as follows (1-(0/8)+1-(1/19))/2 = 0.97 = 97%, so the alignment of Business Architecture and Application Architecture is 97%, which is represented in Table 3.

3) Formulating alignment between Application Architecture and Information Architecture:

$$AlinAA\_AI =(1-(nEMA/ntE)+1-(nGM/nGM +nGA)))/2)(3)$$

The calculation is as follows (1-(2/12)+ 1-(1/(1+9)))/2 = 0,87 = 87%, so the alignment of Application Architecture and Information Architecture is 87%, which is represented in Table 3. Based on the IS/Business Alignment evaluation of the TOGAF ADM strategic alignment model with the University Dinamika case study, it yielded an average of 95%.

IV. CONCLUSION

This paper presents a new model of strategic alignment to modify the TOGAF ADM business strategy, which is at the vision and business architecture stages. The level of alignment in the strategic alignment model reaches an average of 95%, so it can be used as an additional TOGAF ADM to achieve business alignment and IT strategy. In the future, the strategic alignment model in TOGAF ADM can be used to develop enterprise architecture in organizations or companies.

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