INFORMATION TECHNOLOGY
ARCHITECTURE DESIGN TO AUTOMATE ENTERPRISE BUSINESS PROCESS USING TOGAF ADM

Muhammad Arif Abdul Hakim, Dian Nofita Saputri, Riha Rizanah Warang, Sfenrianto
Information Systems Management Department,
BINUS Graduate Program – Master of Information System Management
Jakarta, Indonesia 11480

ABSTRACT
The purpose of this study is to design information technology architectures to automate enterprise business processes. The company's IT architecture needs to be improved to support the vision and mission in accordance with the needs of the ongoing business process. Therefore, it is very important for companies to create IT blueprints to facilitate the development of information systems in the future. The IT architecture in this study was designed using TOGAF ADM, with SOA and ERP as a solution to existing problems. The results of this study are in the form of IT architecture design to support the company's strategic plan through the automation of enterprise business processes.

Key words: IT Strategic Planning, IT Architecture, Business Process Automation, TOGAF ADM, SOA, ERP


1. INTRODUCTION
In the current era of development of digital information systems, IT plays a role in business transformation, so that with IT organizations and management can adapt to information globalization [1]. Implementation of information technology systems in an organization will be able to increase competitiveness [2]. One strategy in the IT field, an organization needs to automate business processes. Automation of business processes is a method to support organizational business activities broadly with better work flow and communication between workers [3].

But at the development stage, it turns out that there are still many organizations that have not considered the IT architecture comprehensively. This is because the company implements information systems partially and is oriented towards the result, the condition is called
application silo stage [4]. The result is the emergence of different platforms between information systems, diversity of programming languages, differences in databases, and other fundamental differences in a company's IT architecture. The development of information systems that are individual in nature will cause problems when the system must communicate with each other or be integrated. This condition is certainly ineffective and inefficient for IT investments in an organization. In building an application system, it is necessary to go through an information system planning approach in terms of architecture that considers aspects of usability, scalability, and future development [5].

The research conducted refers to several previous studies relating to the design of IT architecture with a variety of case study backgrounds. Many IT architectural designs have been carried out using analytical methods Business System Planning (BSP) introduced by IBM [6] [7] [8], some are designed using Enterprise Architecture Planning (EAP) which is a development of the Zachman Framework [9] [10] and there is also the design of the IT architecture using the TOGAF ADM framework [11] [12] [13]. In automating enterprise business processes architectural planning needs to be considered [14] [15]. Automation of business processes can be done by implementing an application system by utilizing software applications based on Enterprise Resource Planning (ERP) [16] [17]. The use of Service Oriented Architecture (SOA) concepts can also be used to support existing system integration [18]. SOA is not hard coded style but has autonomous character and supports reusability and resource sharing.

2. LITERATURE REVIEW

IT strategies need to be aligned with the organization's business strategy. IT strategic planning is not only about the technology that will be used, but also must include the relationship between the choice of technology that will be used and the business strategy to be implemented [19]. IT strategic planning is part of the information engineering methodology used to identify strategies for achieving information system vision and mission through the management and development of information systems [20]. The objectives of IT strategic planning include achieving economies of scale [21], achieving service excellence [22], achieving supply chain integration [23] and achieving Key Performance Indicators (KPI) in each division in the organization [24].

Automation of business processes is the incorporation and application of technology to the process of implementing work on companies that can facilitate communication and collaboration as well as increase company productivity to achieve business objectives effectively [25]. The hallmark of business process automation is not changing basic operations and automating multiple operations [26].

Designing an IT architecture can be done using the Enterprise Architecture Framework (EAF). With EAF, the techniques for describing architecture become more structured. Some of the EAFs currently in use include the Open Group Architecture Framework (TOGAF), the Zachman Framework and Federated Enterprise Architecture (FEA) framework.

The TOGAF framework has a complete process and reference-model guide compared to other frameworks. So that TOGAF is recommended to be used if the design process is used to be complete and structured [27]. Therefore, this study uses TOGAF as a framework for designing IT architecture. The TOGAF consists of three main parts [28]: 1) TOGAF Architecture Development Method (ADM), 2) Enterprise Continuum and 3) TOGAF Resource Base. ADM can be said to be a core part of the TOGAF in which there are steps in the form of cycles and cover the whole part of the development of the IT architecture. ADM steps can be seen in Figure 1.
The design of IT architecture is aimed at building an adaptive IT infrastructure to adapt to the rapidly changing business world [30] and forming Enterprise Application Integration (EAI) [31]. To achieve these two things, there are several IT solutions that can be applied, among others, with SOA and ERP.

SOA is an approach to building an IT system in the form of parts of a software module called service. The purpose of developing SOA-based systems is for organizations to develop systems from simpler modules [28]. Whereas ERP is a system that integrates between design, management, and all organizational resources which aims to integrate all functional areas of the organization and get the right flow of information between one functional area and another functional area [32].

This study took a case study of one IT provider company with the aim of creating a blueprint for the design of IT architectures to automate business processes at the enterprise level. Current conditions of the company's architecture include; non-adaptive infrastructure, applications that are currently silo and do not support the needs of overall business processes and some of the existing business processes are still done manually so that the process takes a long time. The application of business process automation is an effort to improve the competitiveness and excellence of the company through information system strategic planning.

3. THEORETICAL FRAMEWORK

Theoretical framework built in this study relates to the design of IT architectures to automate enterprise-level business processes that are part of the company's IT strategic plan. The design of the IT architecture in this study used the TOGAF ADM framework as a guide to work steps in making a blueprint. The results of this study are in the form of an IT architecture design summarized in the target IT architecture to answer the need of automating business processes at the enterprise level. An overview of the theoretical framework can be seen in Figure 2.
Information Technology Architecture Design to Automate Enterprise Business Process Using TOGAF ADM

Figure 2 Theoretical Framework

The preliminary phase of TOGAF ADM in designing the IT architecture is to determine the architecture principles and requirements of the company to achieve the organization's vision and mission which is then followed by steps in TOGAF ADM. The SOA approach applied at the architectural design stage is one of the IT solutions for application integration. This will affect the design of IT architecture both in terms of information systems, technology and infrastructure used. SOA designs that are made are influenced by services created to support application integration that is formed from the legacy system or from solutions to application systems by implementing an ERP module that is open source.

4. METHODOLOGY

This study uses TOGAF ADM as a framework for designing IT architectures. Research is limited to the design stage, not to the implementation stage. The step in designing the IT architecture with the TOGAF ADM framework is done through an iterative approach that defines baseline architecture first, then continues with designing the target architecture. The presentation of the TOGAF ADM steps used in the study is more easily divided into 5 sections of the discussion, with illustrations of the flow from the design in Figure 3.

Figure 3 TOGAF ADM Activity in this study
In the TOGAF ADM framework, each phase will obtain artifacts in the form of output produced during the process of developing enterprise architecture. The output can be text or table, diagram, matrix or catalog. Figure 4 presents the TOGAF ADM artifact used in the study.

5. RESULTS AND DISCUSSIONS

In this study the design of IT architecture follows the steps set out in the methodology. The preliminary stage is the initial stage of designing the IT architecture on TOGAF ADM, which consists of requirements management and architectural principles. Requirements management, describing the underlying objectives, needs to be done in the enterprise business process automation, including: 1) Achieving economies of scale; 2) Achieving excel service; 3) Achieving digital collaboration; 4) Improving company wide monitoring; 5) Achievement of predetermined KPIs. The business needs to achieve these objectives include: 1) Having an adaptive IT infrastructure; 2) Integrated application system; 3) Automation of business processes; 4) Data sources can be synchronized and used together; 5) Having a robust IT architecture design using standard best practices. While the architectural principles set out in the design of the IT architecture to create the concept of business process automation consist of: 1) Design for Change; 2) Agility and Flexibility; 3) Business Continuity; 4) Integrated Process; 5) Corporate Data Model; 6) Secure Information; 7) Meet Business Needs; 8) Ease of Use; 9) Service Orientation; 10) Reusability; 11) Identity and Access Management; and 12) Interoperability. The architectural principles that have been defined above are supporters of what is the goal in designing this IT architecture.

Furthermore, at the stage of architecture vision, the solution to the IT architecture to be achieved in a high-level and comprehensive manner is illustrated through solution concept diagrams by displaying current conditions with the conditions to be achieved. Based on the case study, an illustration of the high-level architecture of the baseline is obtained as illustrated in Figure 5:
Figure 5 Current High-Level IT Architecture Conditions

The solution concept diagram illustrates the target IT architecture developed based on the current condition of the IT architecture with a pattern of solutions to achieve the architectural vision to achieve enterprise business process automation as expected. The solution concept diagram in Figure 6 explains that the IT architecture that will be built must be able to overcome current problems consisting of adaptive IT infrastructure, infrastructure resource sharing, integrated applications, automated business processes, data resource sharing, digital collaboration and company wide monitoring. The concept of the solution will be discussed further at the stage of identifying the problem solution.

Figure 6 The High-level Conditions of IT Architecture Expected

Based on current high-level conditions, the company's business processes consist of four primary activities and three supporting activities. Primary activities consist of research & development, sales, solution development and manages service. While supporting activities consist of human resources management, financial management and business support. Each of these activities has derivative functions from the domain unit, or specific business processes. The problems of IT architecture at enterprise level are generally described as consisting of silo infrastructure, silo application, business process manuals and redundant data. These problems will be identified further in this study by using PIECES analysis by considering the condition of the information system on each issue based on indicators of performance, information, economy, control, efficiency and service. SWOT analysis needs to be done to see strengths, weaknesses, opportunities and threats in developing enterprise business process automation.
before further development of the IT architecture. The results of this SWOT analysis will encourage awareness and attention of all stakeholders involved in the importance of designing this IT architecture. From the problems that exist, then a solution is needed to overcome them. Problems that have been identified are diverse, therefore need solutions that are specific to each type of problem. Table 1 below is a solution pattern of the problems that have been identified.

**Table 1 Solution Pattern Problems**

<table>
<thead>
<tr>
<th>No</th>
<th>Problem</th>
<th>Target Solution</th>
<th>Pattern Solution</th>
<th>SI/IT Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Business activities are currently processed manually and require a long time</td>
<td>All existing business processes need to be automated</td>
<td>OpenERP-based application system development</td>
<td>OpenERP</td>
</tr>
<tr>
<td>2</td>
<td>Data resource sharing has not been implemented</td>
<td>Resource sharing data needs to be applied to the application system</td>
<td>SOA-based application development with the use of shared services</td>
<td>ESB and Cloud</td>
</tr>
<tr>
<td>3</td>
<td>IT infrastructure has not been adaptive to change</td>
<td>IT infrastructure is made flexible to change</td>
<td>Development of SOA-based infrastructure by interconnecting through middleware</td>
<td>ESB</td>
</tr>
<tr>
<td>4</td>
<td>Resource sharing infrastructure has not been implemented</td>
<td>Resource sharing infrastructure needs to be implemented</td>
<td>SOA-based infrastructure development</td>
<td>Server, storage and network infrastructure</td>
</tr>
<tr>
<td>5</td>
<td>Current applications are silo and not integrated</td>
<td>Need to have an integrated application system</td>
<td>Integration and development of SOA-based application systems</td>
<td>ESB</td>
</tr>
<tr>
<td>6</td>
<td>The function of monitoring business processes at the enterprise level is not optimal</td>
<td>Need to have a system that supports company wide monitoring</td>
<td>Development of enterprise dashboard system applications combined with business intelligence</td>
<td>Development Application, Data Warehouse and BI</td>
</tr>
<tr>
<td>7</td>
<td>The monitoring function of IT operations is inadequate</td>
<td>Have a predictive implementation of ITSM analytic</td>
<td>Development of the ITSM Predictive Analytic application system by utilizing data warehouse and machine intelligence</td>
<td>Development Application, Data Warehouse, AI and Machine Learning</td>
</tr>
<tr>
<td>8</td>
<td>HR performance is less productive because the utilization is not optimal</td>
<td>Have a system for optimizing and calculating resource requirements efficiently</td>
<td>Application development for the workforce management system and employee portal was updated</td>
<td>Self Development Application and Artificial Intelligence</td>
</tr>
<tr>
<td>9</td>
<td>The application has not fully supported the needs of business processes</td>
<td>Having an application system that is in accordance with needs and integrated</td>
<td>OpenERP-based application system development</td>
<td>OpenERP</td>
</tr>
</tbody>
</table>

Furthermore, the solution that has been determined in its implementation must follow the established architectural principles. In general, IT architecture consists of business architecture, data architecture, application architecture and technology architecture. The design of the proposed IT architecture solution can be seen through the solution concept diagram in Figure 7.
After obtaining the IT architecture design based on the solution provided, the next step is to evaluate the suitability of the target architecture that has been designed as a consideration of implementation by stakeholders. The evaluation was carried out at the opportunity and solution stages of the TOGAF ADM step, to identify opportunities for implementing the designed IT architecture and the resulting gap analysis. Opportunity identification is done using the benefits diagram by showing what opportunities are obtained from the application of the IT architecture design made. While the gap analysis is carried out on information system architecture and technology using a model on TOGAF by forming the Architecture Building Block (ABB) matrix from baseline architecture and target architecture.

6. CONCLUSIONS

Based on the results of the research that has been done, some conclusions can be drawn including:

1. The IT architecture design obtained along with the results of the gap analysis has been able to answer the research problem formulation, namely, “How to design an IT architecture to automate enterprise business processes using the TOGAF ADM framework that focuses on identifying baseline architecture and implementing solutions on the target architecture to answer the problems faced”
2. The targeted condition, which is to automate enterprise business processes as an IT strategy, is expected to be achieved with the IT architecture produced in accordance with established architectural needs and principles. This is supported by verification of stakeholders that the design of the IT architecture produced has accommodated most of the business processes currently in the organization.

3. The blueprint of the IT architecture produced will be used for several purposes as follows:
   a) Integrated Guidelines, become a consistent and integrated guideline in developing and selecting information technology solutions that can be used to automate business processes in the company more effectively and efficiently
   b) Comprehensive Overview, describe the complete and comprehensive corporate architecture, from business, data, applications and technology, which can be easily understood by all stakeholders
   c) Collaboration Enhancement, collaboration between divisions that have been hampered due to lack of understanding of global business processes can be overcome by this architectural design
   d) Performance Improvement, improving company performance in each business line based on the KPI that has been determined to carry out the organization's vision and mission by maximizing the use of information technology
   e) Economies of Scale, increases revenue and reduces the company's operating costs
   f) Business Process Standards, a robust IT architecture design using technology standards that are best practice that meet good corporate governance standards in accordance with the provisions of Good Corporate Governance (GCG) that have been implemented.

REFERENCES

Information Technology Architecture Design to Automate Enterprise Business Process Using TOGAF ADM


