



Analysis of Microsoft Dynamics AX Implementation Based on TOGAF For Pharmaceutical Holding Company: A Case Study

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Abstract. XYZ is a holding company moving in pharmacy manufacturing with a primary objective of implementing an all-encompassing ERP system capable of integrating all entities within the enterprise. This strategic move is intended to facilitate streamlined control and effective management of the intricate components inherent in a substantial business venture. To attain this goal, an analysis becomes imperative. Its purpose is to evaluate the system's compatibility with the precise business requisites, focusing on the procurement unit of the enterprise. This analysis is grounded in the principles of TOGAF, a recognized framework renowned for its capacity to guide the development of IT architecture aligned with the business needs of an organization. The outcome of this analysis underscores a congruence between the ERP system and the company's stipulated requirements in several business and technological aspects, further affirming its suitability and relevance with some adjustments in business process and system adoption.

Keywords: ERP, TOGAF, Microsoft Dynamics AX, Procurement, Pharmacy Manufacture, Holding Company.

1 Introduction

Enterprise Resource Planning (ERP) is a comprehensive computer software solution designed to facilitate efficient control and management of business processes within an enterprise by enabling seamless information sharing across various functions of the company, such as transactional data, to empower informed decision-making within those functions, encompassing manufacturing, inventory, procurement, invoicing, distribution, and accounting [1]. Implementing an ERP system poses a significant challenge, particularly when replacing numerous applications and involving multiple processes. However, an integrated ERP solution is deemed essential for most large enterprises, especially within the finance and Human Resources (HR) areas [2]. Those statements align with the vision outlined in the strategic plan of The Ministry of State-Owned Companies (BUMN in Indonesian abbreviation), for 2020-2024 as written in Minister Regulation No. PER-8/MBU/08/2020. The Ministry of BUMN has engaged

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institutional transformation to enhance organizational, information system, and infrastructure development through the integration of information systems and the digitalization of business processes. The Minister Regulation no. PER-02/MBU/03/2023 further emphasizes the requirement for state-owned enterprises (BUMN) to submit all obligatory reports electronically using the system developed by The Ministry of BUMN themselves. They have established information system-based work reporting mechanism to expedite accurate performance reporting and enable more precise evaluation [3].

XYZ is a holding company that was established in early 2020, comprising several pharmaceutical companies. Among them, a selected company serves as the parent company, while the other three are the subsidiaries. The collective objective of XYZ is to enhance the autonomy of the national pharmaceutical industry, increase product availability, and optimize the efficiency of raw materials. This, in turn, allows for the expansion of business operations while ensuring more affordable prices for medicines. As enterprises, the entities of XYZ had already implemented their own ERP systems to support their business activities even prior to the merger.

One of the elemental business functions within XYZ is the procurement function, which is responsible for organizing and executing the necessary processes for goods and services procurement. The procurement unit was established on consideration of the existing conditions of the holding entities, with a primary focus on initiating joint procurement processes and developing procurement strategy for the entire holding. Presently, the transactional data of goods and services procurement is compiled and submitted in Microsoft Excel format from the procurement units of the subsidiaries to the parent company. The parent company then consolidates the data using Microsoft Excel as well without any integrated system involved between the entities of the enterprise. Over the past three years, the total recorded expenditure for procurement transactions has reached Rp 49.44 trillion. This scenario could potentially result in challenges arising from the absence of integrated management information and the necessity for redundant data entry, potentially leading to stakeholder discontent due to additional efforts required [4]. Conversely, contemporary information technologies facilitate the monitoring of activities, operations, and processes through the collection, analysis, and real-time utilization of data, enabling informed and impactful decision-making [5].

Given the massive transaction volume and the absence of an integrated system, coupled with the fact that each holding entity within XYZ has already implemented an ERP system, XYZ has devised a plan to implement a centralized ERP system encompassing the entire holding. The objective is to achieve seamless integration across all components of the holding. To accomplish this, a study and analysis of the existing ERP systems, which are Microsoft Dynamics AX and SAP, are necessary to determine the potential option for adoption within XYZ. This analysis forms the focus of the research, specifically targeting the Microsoft Dynamics AX-based ERP system. The purpose is to assess the system's capabilities to the requirements and conditions of XYZ, mainly from the perspective of the procurement function. The analysis also involves TOGAF as the framework for conducting the research.

2 Literature Review

2.1 Enterprise Resource Planning (ERP)

ERP system is an operational IT system that supports adequate data-driven analysis of managerial function cause of its capability to gather comprehensive information from various business functions within an enterprise, including HR, finance, logistics, production, order management, and vendor management, covered by integrated modules that are encompassed within the ERP system [6]. Implementing the ERP system could lead to several benefits as well as some potential risks. Enterprises can achieve automated cross-functional transactions, access real-time data from the entire organization due to centralized data storage, gain comprehensive insights into the performance of all components, and benefit from continuous technical support from the ERP system vendor, including seamless deployment of system improvements.

The implementation phase is the critical component in achieving successful ERP implementation within an organization [7]. Before proceeding, it is essential to ascertain that the chosen system offers a high ROI, meets accurate and clear requirements, and delivers definite impacts by assessing the existing processes, evaluating initial and maintenance costs, considering installation, implementation, and software training, ensuring technical support availability, gauging user-friendliness, checking system integration compatibility, exploring opportunities for customizations and improvements, and assessing how well the system aligns with the enterprise and its employees [8].

2.2 Microsoft Dynamics AX

Dynamics AX is an integrated business management solution designed to meet the needs of companies operating at the middle to multinational levels by providing comprehensive support in various areas such as sales and marketing, supply chain management, production, procurement and sourcing, financial management, human capital management, business intelligence, and reporting that considered user-friendly due to its familiar Microsoft common interface, known from the popular products Windows and Office which also integrated with Microsoft's products, ensuring a smooth and efficient user experience [9][10]. Microsoft Dynamics AX provides solutions of automate and simplify financial processes, business intelligence, and supply chain to the enterprise [11]. The Dynamics AX-based ERP solution caters to large international enterprises with complex business processes and significant transaction volumes, particularly in manufacturing companies, through integrated system that facilitates agile and accurate reporting while boasting robust analytics capabilities [12]. It also capable to be implemented to a holding company, providing centralized procurement model to share resources and enable more efficiencies, improving logistics and inventory management, including sharing company data between the entities, allowing aggregate reporting and analysis of performance across all subsidiaries [13]. The following figure 1 is the User Interface of Microsoft Dynamics AX.

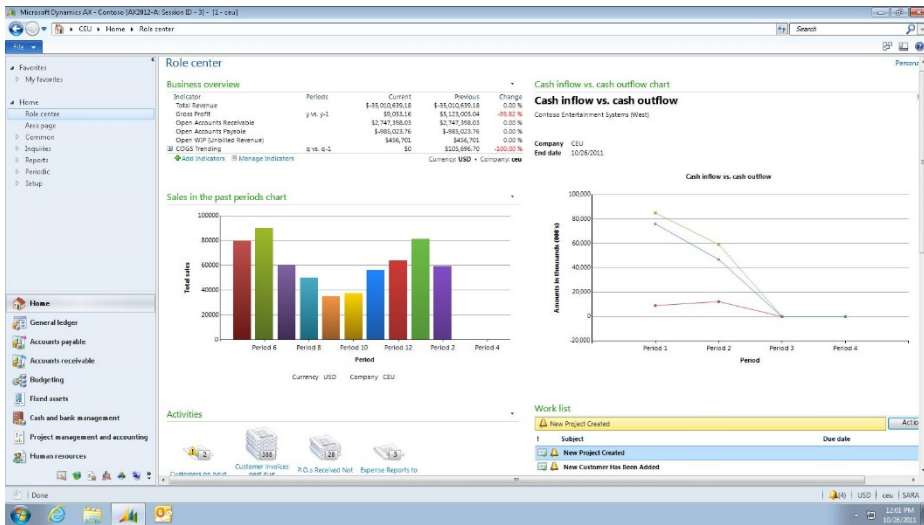


Fig. 1. User Interface of Microsoft Dynamics AX [14]

2.3 TOGAF

The Open Group Architecture Framework (TOGAF) is an Enterprise Architecture (EA) framework developed by The Open Group that offers comprehensive methods and guidelines to support the EA implementation throughout its lifecycle, encompassing adoption, development, implementation, and maintenance, where the framework is based on an iterative process model widely regarded as a best practice. [15]. It provides detailed methods of development, management, and implementation of enterprise architecture and information systems into the four domains, namely business architecture, data architecture, application architecture, and technology architecture [16]. The Open Group has also established the TOGAF Architecture Development Method (ADM), which facilitates the development and management of the EA cycle. This cycle comprises several phases, including Preliminary Phase, Architecture Vision, Business Architecture, Information Systems Architecture, Technology Architecture, Opportunities and Solutions, Migration Planning, Implementation Governance, Architecture Change Management, and Requirement Management. TOGAF could be used either to formally describe or design a detailed system plan in components level, including guide the implementation, interaction, and evolution, based on principles and guidance, hence applicable in various environments thanks to its generic and flexible framework for organizations to define their business requirements, serving as the foundation for EA development [17][18].

3 Methods

This study comprises four primary execution steps referring to analysis study by Siregar et al [19]. The first phase involves problem identification, which necessitates observations and a comprehensive literature review to fully comprehend the issue and establish a solid foundation for analysis. In order to facilitate this interpretation, essential data can be acquired through interviews with key personnel within the company of interest or by consulting relevant supporting documentation.. These results undergo thorough validation through verification, ultimately culminating in the provision of actionable outcomes. The following figure 3 is an illustration of the research method used.

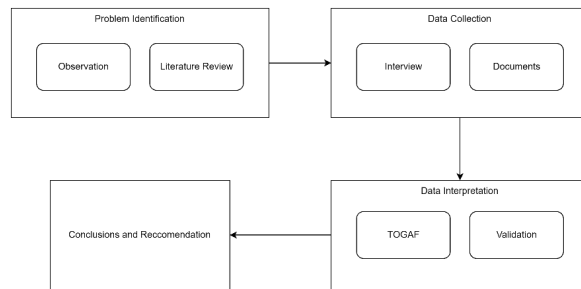


Fig. 2. Research Method

The methodology employed in this study for discerning the enterprise's requisites follows the delineations of TOGAF ADM phases. The initial six phases encompass a comprehensive execution, yielding numerous artifacts that arise from the scrutiny of the focal enterprise. Subsequently, a comparison is conducted between the requirements of the company and the envisaged system, aiming to assess the convergence between the two. The artifacts in use are listed in Table 1.

Table 1. TOGAF Artefacts Output According to The Architecture Phase

Architecture Phase	Input	Output
Preliminary Phase	Organization's Vision and Strategy	Principle Catalog
Architecture Vision Phase	Business Activities in the organization	Value Chain Diagram
Business Architecture Phase	Business Process of Organization and System Business functions details	Process Flow Diagram Business Interaction Matrix
Information System Phase	Existing system used in the organization	Application Portfolio Catalog
Technology Phase	Organization and System Technology Standard	Technology Standard Catalog
Opportunity and Solution Phase	Information obtained from prior phases	-

4 Results And Discussion

4.1 Preliminary Phase

TOGAF has defined architectural principles to guide the work of enterprise architecture. The following in table 2 are 11 principles from the recommended principles that matched with the enterprise principles, derived from the four architectures in the following figure.

Table 2. Principal Catalog [15]

No	Architecture	Principal	Description
1	<i>Business Architecture</i>	<i>Primacy of Principles</i> <i>Maximize Benefit to the Enterprise</i> <i>Compliance with Law</i>	Information management is set by the parent company involves all subsidiaries beneath the holding. Information management is set to bring advantage to the entire holding. Applied information management set according to regulations that abide BUMN dan its information management.
2	<i>Data Architecture (Information System Architecture)</i>	<i>Data is an Asset</i> <i>Data is Shared</i> <i>Data is Accessible</i> <i>Data Trustee</i> <i>Data Security</i>	Data in the enterprise is considered a valuable asset and thus properly managed to be resourceful to the enterprise itself. Data in the enterprise is shared across functions and units and accessible to anyone to support their work. Data in the enterprise is available to anyone to perform their job. Each data bounded to an obligated user to ensure quality. Data security is guaranteed from any unauthorized usage of any protocols and procedures.
3	<i>Application Architecture (Information System Architecture)</i>	<i>Ease-of-Use</i>	Implemented application feasible to endure the users.
4	<i>Technology Architecture</i>	<i>Control</i> <i>Technical Diversity</i> <i>Interoperability</i>	Technology diversity is controlled to maintain integration between technologies/applications/data/entities. Implemented technology should be complied to the applied standard to maintain the compatibility within other technologies/applications /data/entities.

4.2 Architecture Vision

XYZ is involved in several business functions/activities as a pharmaceutical manufacturing company, which can be illustrated in the following value chain diagram. To deliver their values, involving pharmacy products and services, XYZ carries out a number of activities, mainly in manufacturing, e.g., production, quality assurance, inventory control, distribution, etc. The company has already reached the global scope

of business, leading to various focuses on selling and intercommunication. Supporting activities are also required in such a big company, including HR management, legal, project management, IT, and the focus of the research, procurement. Figure 4 shows the company value chain diagram.

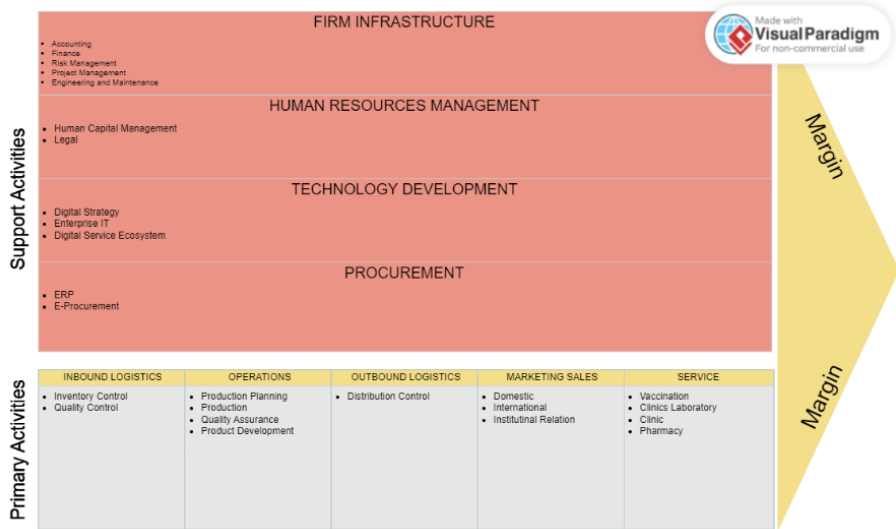


Fig. 3. Company Value Chain Diagram

The procurement division at XYZ undertakes segmented tasks aligned with distinct responsibilities aimed at bolstering business operations by providing essential resources to the enterprise, primarily category management, purchasing, and receipt & invoicing. Proper vendor management is also necessary to support the procurement activity, along with the dispersed function to maintain policies and manage the administration of foreign procurement. Figure 5 is the Procurement Unit Value Chain Diagram.

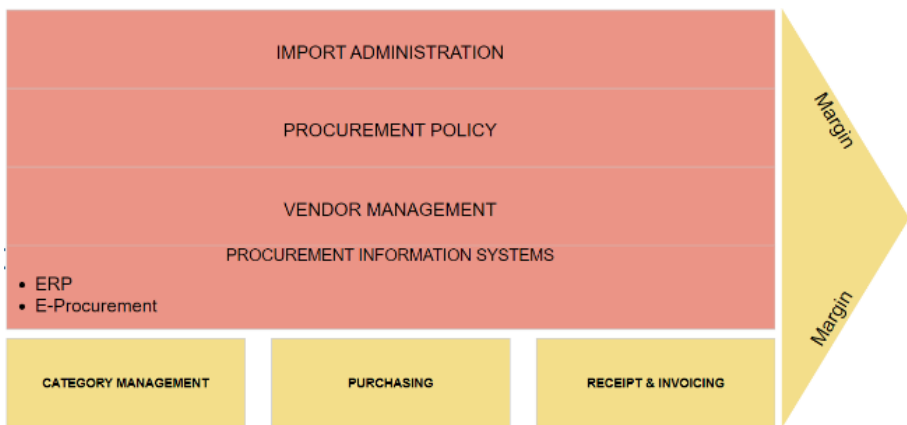


Fig. 4. Procurement Unit Value Chain Diagram

4.3 Business Architecture

XYZ implements a unified procurement process that spans the entire holding and caters to the needs of its entities. This process is initiated by the parent company's procurement unit and then continued by the units of each subsidiary. To facilitate this process, sales forecasts and procurement needs estimations are obtained from the supply chain function, resulting in the generation of purchase orders, goods receipts, and payment information. These elements serve as references for the supply chain function to fulfil the required tasks. Additionally, the finance function is involved in performing the invoicing process for the received products. The following figure 6 is the Process Flow Diagrams.

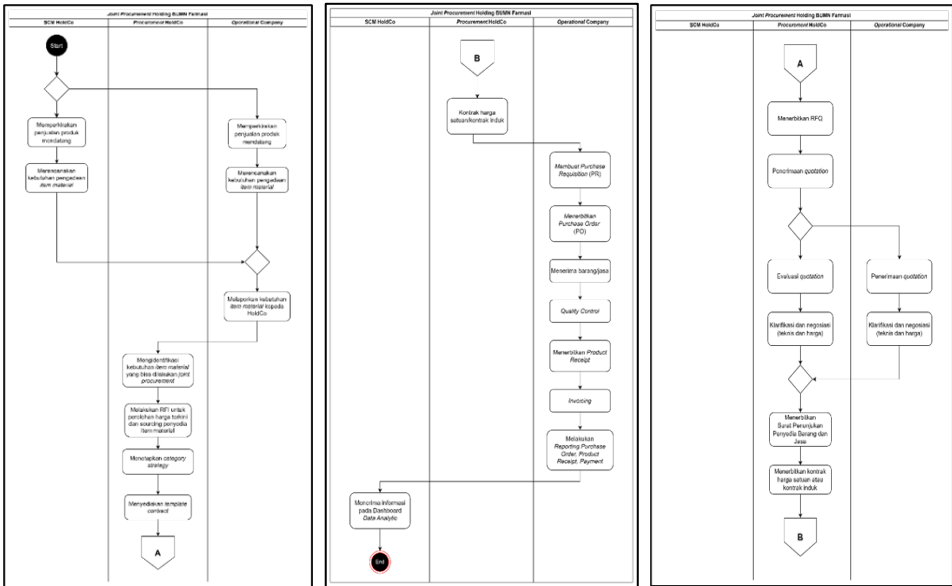


Fig. 5. Process Flow Diagrams

Table 3. Business Interaction Matrix

Input (X)/Output (Y)	Procurement	Finance	Supply Chain
Procurement		Product Receipt	Product sales forecast, procurement demand estimation
Finance	Invoice		-
Supply Chain	Purchase Order, Goods Receipt, payment	-	

On the other hand, the initial procurement business process model of Microsoft Dynamics AX involves user who made resource requisition to be purchased. A built-in transaction-based spend analysis is also included in the system, facilitating the

generation of reports for future forecasting purposes. Microsoft outlines the procurement process in a systematic manner, organizing it into distinct phases such as sourcing, vendor management, contract management, purchasing, receipt, invoicing, and spend analysis. The purchasing processes encompass a spectrum of activities, ranging from procurement initiated by purchase requisition to executing request for quotation and managing vendor bidding. Additionally, this involves the management of purchase orders and other essential procurement functions.

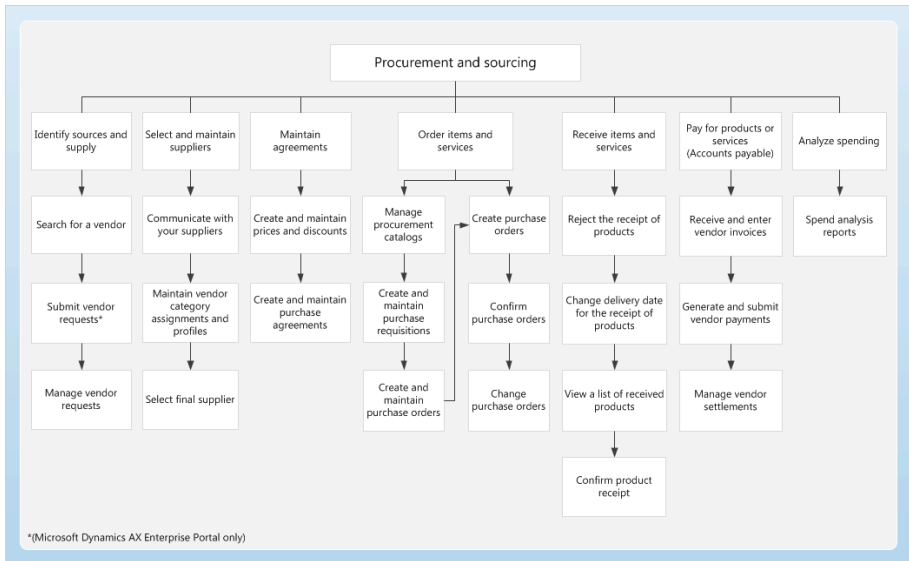


Fig. 6. Microsoft Dynamics AX Procurement Business Process [20]

4.4 Information System Architecture

The subsequent phase delves into the architecture of the information system that supports the previously discussed architectures. Within XYZ, Microsoft Dynamics AX serves as the existing ERP system in one of its entities, encompassing various business functions across the company. In addition to the ERP systems, the procurement unit also incorporates an e-procurement application with components similar to those found in the ERP procurement module, creating an interconnected system. The following table 4 is the Application Portfolio Catalog.

Table 4. Application Portfolio Catalog

Physical Application Component	Logical Application Component	Description
E-procurement	Vendor Management	Registers and loads vendor data and evaluates the performance and qualifications of the vendors.

Physical Application Component	Logical Application Component	Description
Microsoft Dynamics AX	Tender Management	Runs the procurement processes according to the requisitions.
	Contract Management	Reviews and signs the procurement agreements of the assigned parties.
	Vendor Management	Stores vendor list, including vendors' account details.
	Tender Management	Stores procurement process details, particularly information regarding vendors' proposed bidding towards the requisition.
	Contract Management	Creates, establish, and controls procurement contract between the parties in the procurement process.

Aligned with the roadmap objective of the company at implementing a single ERP system across the entire holding, Microsoft Dynamics AX is projected to supersede all prevailing systems currently underpinning enterprise operations, especially for the procurement activities. Notably, Microsoft Dynamics AX encompasses a procurement module housing a series of functions akin to those currently used by the business unit, in line with the envisaged functional requirements. Furthermore, the system can be adeptly configured to seamlessly integrate business processes spanning entities within a holding company, thus effectively addressing the company's operational demands.

4.5 Technology Architecture

Being a company that has implemented ERP, XYZ possesses the infrastructure to operate ERP systems within the enterprise. The outline of the utilized technological specifications is provided in Table 5.

Table 5. Company Technology Standard Catalog

Logical Technology Component	Physical Technology Component	
<i>Platform</i>	<i>Technology Component</i>	<i>Standard (Benchmark)</i>
Server Platform	Server	1.4GHz (x64) processor
	OS Server	Windows Server 2012
	Database Server	Microsoft SQL Server 2012
	Application Server	Application Object Server
	Web Server	IIS 7.0, ASP.NET 2.0
Data Distribution	Access Point	Wireless Access Point
Client Platform	User Device	PC
Security	Firewall	Proxy Firewall
	Antivirus	Norton Antivirus
Data Transaction	Internet	100 Mbps

Meanwhile, Microsoft has provided the recommended technical specifications to hold the operation Dynamics AX within an organization as detailed in the system requirement released by Microsoft itself. Another technology standard catalog details the list of the specifications in Table 6.

Table 6. Microsoft Dynamics AX Technology Standard Catalog [21]

Logical Technology Component	Physical Technology Component	
<i>Platform</i>	<i>Technology Component</i>	<i>Standard (Benchmark)</i>
Server Platform	Server	Intel/AMD compatible 1.1 GHz (x86) or 1.4 GHz (x64) processor. (Minimum) Intel/AMD compatible 2 GHz processor. (Recommended)
	OS Server	Windows Server 2012/2012 R2/2016 Standard/Datacenter Edition, Windows Server 2008 R2/2008 Standard Edition, Enterprise Edition, Web Edition, or Datacenter Edition
	Database Server	Microsoft SQL Server 2014/2016 Standard Edition, Enterprise Edition, or Business Intelligence Edition, SQL Server 2008/2008 R2/2012 Standard Edition, Enterprise Edition, Datacenter Edition, or Business Intelligence Edition.
	Application Server	Application Object Server
	Web Server	IIS 7.0/7.5/8.0, ASP.NET 2.0
Data Distribution	Access Point	Local Area Network (LAN)/Wide Area Network (WAN)
Client Platform	User Device	PC
Security	Firewall	-
	Antivirus	-
Data Transaction	Internet	100 Mbps

4.6 Opportunities and Solutions

Starting from the business architecture, XYZ's fundamental requisites entail the establishment of an integrated system capable of seamlessly facilitating the procurement processes spanning the enterprise's entities. The Financial and business management integrated system could improve rapidity and accuracy of financial reporting and ability to control procurement globally in a holding company, resulting in significant procurement cost savings and diminish of computing and reconciliation error [13]. Cost-effective quality product procurement is one of the Good

Pharmaceutical Procurement guidelines that the World Health Organization (WHO) introduces [22][23]. The same guideline also concerning selection of qualified vendor which has enforced in XYZ who does vendor tender and bidding form of procurement process with regularly vendor qualification evaluation, which also could be supported by Microsoft Dynamics AX.

However, certain disparities have surfaced between the company's existing operational procedures and the preconfigured process model of the system. In general, the provided functions in the procurement module of Microsoft Dynamics AX have satisfied the needs of procurement operations in XYZ. Several adjustments might need to be made, especially in administration matters, considering the obligation of XYZ as a state-owned enterprise to obey some administrative standards. Adherence to pharmaceutical regulatory mandates is imperative, given the issues that have surfaced in the procurement processes within the pharmaceutical industry, extending beyond mere technical or personnel-related errors [22]. The outcomes produced by the system's operations must be tailored to meet the requisite standards. During the implementation phase, a concerted effort is required to align the pre-existing processes with the workflow introduced by the system. Formulation of procedures and the delineation of parameters are necessary to facilitate the seamless execution of the system's operations [4][24].

The adoption of a unified ERP system will necessitate XYZ's adjustment, as the prior ERP and e-procurement integrated systems are superseded by a centralized framework. Initiating a substantial transformation of this magnitude may initially evoke a measure of unease among the involved stakeholders, although the adaptation would lead to satisfaction of the stakeholders themselves [4]. Despite these identified gaps, it is noteworthy that the enterprise's technological standards align with the stipulated requirements of the proposed ERP system, thus rendering XYZ well-equipped to seamlessly accommodate the new system.

5 Conclusions

The proposed ERP system, Microsoft Dynamics AX, stands as a viable choice for adoption within XYZ, serving as the central backbone of the enterprise's business operations. The alignment of XYZ's requisites with those of Microsoft Dynamics AX substantiates the suitability of implementing this system within the organization. However, it's imperative to acknowledge potential drawbacks associated with this approach, including the need for recalibrating certain business processes to bridge existing gaps and the consequential replacement of incumbent systems, which could entail further adjustments. While certain adjustments are requisite to harmonize Microsoft Dynamics AX with the company's specific requisites, integrating this ERP system into XYZ remains a feasible endeavor.

Subsequent research endeavors may encompass an extended implementation plan for Microsoft Dynamics AX within XYZ, encompassing a broader scope than examined in this analysis. Analogous analysis involving alternative ERP options is also advisable, with a particular emphasis on an SAP-based ERP system, given the existing utilization

of this system within XYZ's subsidiary. It is advisable to incorporate TOGAF as an enterprise architecture framework, particularly in extensive IT planning and development practices.

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