Designing Enterprise Architecture And Governance To Support Digital Transformation In Manufacturing Companies (Case Study At PT ABC)

Weny Verawaty [1]**, Tanty Oktavia** [2]

[1,2]Information Systems Management Department, BINUS Graduate programs, Master of System Information management, Binus University, Jakarta, Indonesia
Email: weny.verawaty@binus.ac.id[1], toktavia@binus.edu[2]

Abstract

Digital transformation can enhance business performance significantly by improving productivity and efficiency. However, it also creates challenges, such as overlapping application functions, data silos from poor integration, and high IT investment and operational costs. To address these issues, this study aims to design an enterprise architecture (EA) framework to support digital transformation by integrating the Open Group Architecture Framework (TOGAF) with Control Objectives for Information and Related Technologies (COBIT, 2019). This research employs The TOGAF Architecture Development Method (ADM) as the core methodology for EA development, complemented by COBIT 2019 to establish governance mechanisms and internal controls. The integration of TOGAF and COBIT 2019 provides a robust methodological and governance foundation for EA. This synergy enables organizations to align IT investments more effectively with business strategies, strengthen governance, and ensure consistency and quality in EA implementation. This study is based on a single case within a manufacturing company, which may limit its generalizability. Time constraints and stakeholder availability pose challenges in gathering complete inputs across departments, potentially affecting the comprehensiveness of the architectural model. In addition, although COBIT 2019 was used as a governance reference, its practical implementation could not be fully validated within the research timeframe. The combined framework offers organizations a structured pathway to overcome digital transformation challenges, enhancing operational efficiency, strategic alignment, and sustainable governance. This study contributes an integrative approach that embeds governance and control into EA design, ensuring resilience, alignment, and long-term value in digital transformation initiatives.

Keywords: Digital Transformation, Enterprise architecture, TOGAF Framework, COBIT, Governance

1.   INTRODUCTION

The acceleration of digital transformation (DX) supports business growth, because technology helps companies increase their productivity and efficiency. According to [1] using applications are essential for enhancing a company's capabilities and development. [2] Similarly, digitalization boosts productivity, cost efficiency, and innovation. However, rapid and large-scale digital transformation can lead to new challenges such as applications with overlapping functionalities, data silos, and inefficiencies, which complicate the analysis and decision-making processes and ultimately increase unnecessary IT costs. To overcome these challenges, as mention by [3], organisations need to define and implement a clear digital transformation strategy by adopting an enterprise architecture to align themselves with business requirements. [4] emphasized that many organizations invest heavily in enterprise architecture [EA] to manage complex IT systems and steer digital transformation. [5] also stated that heterogeneous data conditions and digitalization processes require effective architectural management. They argued that information exchange is crucial and requires a detailed process architecture. Firms struggle to integrate and exploit new digital technologies in an increasingly turbulent and complex environment [6]. EA aligns business strategies with the IT architecture and helps standardize operations and systems. [7] Mentioned EA is a method and an organizing principle that combines functional business objectives and strategies with an IT strategy and execution plan. Meanwhile, [8] points out that EA fosters innovation and adaptability. [9] highlighted the importance of EA frameworks for managing complex information systems. [10] added that IT strategy should align with DX strategies to facilitate transformation, ensuring that IT requirements are clearly defined and supported by robust EA frameworks. In line with [11], the adoption of enterprise architecture seeks to tackle issues related to system interoperability and data silos, ensuring alignment between IT and business strategies, as well as investments within the organization. It aims to reduce the complexity of IT infrastructure while promoting organizational agility and facilitating dynamic change. The Open Group Architecture Framework (TOGAF), developed by The Open Group

(2018), is an excellent EA framework for integrating management across all aspects of a company. [12] TOGAF is designed for use by companies and has been frequently presented and utilized in various studies [9],[13],[14].

PT. ABC, a company that produces packaged milk and yogurt, aims to enhance factory performance through digital transformation, including the implementation of the Internet of Things (IOT) in production machines and the development of supporting applications integrated with ERP systems. Need to establish clear objectives and strategies as mention by [3] To keep up with the evolving digital landscape and address the challenges of digital transformation, organisations must establish and implement a clear and well-defined digital transformation strategy. For these purposes, it is necessary to establish an EA that aligns digital transformation with business strategy. More businesses embrace digital transformation and recognize the advantages of aligning their IT strategy, technology, and processes with broader business goals [15]. However, EA implementation has its own challenges, as explained by [16] and [17], who found that many organizations struggle to implement EA effectively, often because of a lack of commitment from stakeholders. To address these challenges, the research questions of this study were as follows:

RQ1: How to design enterprise architecture to support the company's digital transformation?

RQ2: What is the proper governance procedure to ensure its successful implementation?

This study aims to prepare an EA complemented with governance by combining two key frameworks, Control Objective for Information and Related Technology (COBIT) and TOGAF, to ensure consistency of implementation. The goal is to develop a suitable EA and governance framework to support digital transformation in PT ABC's manufacturing division. [5] noted that, while COBIT focuses on governance, TOGAF provides a roadmap for implementing EA. Both frameworks emphasize aligning IT strategies with business objectives, which can enhance business performance [18]. The TOGAF framework includes eight phases from the preliminary phase to Phase H (architectural change management). However, this study focused on the first four phases: architectural vision, business, information systems, and technology. Additionally, COBIT can be used to support EA governance.

1.1 Digital Transformation

Digital transformation (DX) in Industry 4.0, is defined as the adoption of disruptive technologies that enable new business and operating models across all sectors. Organizations are working to reshape their processes to align with the latest advancements, including digital twins, the Internet of Things (IoT), connected devices, artificial intelligence, cyber-physical systems, integration, social media platforms, blockchain, robotics, drones, data analytics, and 3D printing.[10] Digital technology not only impacts the transformation of products, business processes, or sales, but also the entire business model [2].

1.2 Enterprise Architecture

CISR defines Enterprise Architecture (EA) as the management of business processes to enable IT infrastructure in the process of integration and standardization of the company's operations as an operational model. An operational model is an integrated business process and business process standard created to produce goods and services from a company to consumers [17]. An EA is a complete set of methods and modes that can be designed and includes an organizational enterprise structure, business processes, information systems, and infrastructure [19]. EA can be used as a means of communication between stakeholders at a higher level, and can represent stakeholders participating in the design of a company's system.

1.3 Building blocks for digital transformation

Based on research from [10] Although DX has a significant disruptive impact on business and society, and organizations are aware of its potential effect, many do not have a clear roadmap to re-engineer the existing processes in line with the emerging technologies. Research results from [20] show that companies that have successfully transformed into high-performing digital enterprises can integrate six key elements: strategy and innovation, customer decision journey, process automation, organization, technology, and data and analytics. However, not every digital initiative requires all of these elements to be developed or applied equally. Depending on the company's specific situation, some elements may serve as natural starting points. This framework offers executives a clear structure to evaluate and manage large-scale digital initiatives.

1.4 TOGAF Framework

The Open Group Architectural Framework (TOGAF) developed in 1995 is based on the Department of Defense Technical Architecture Framework for Information Management. TOGAF provides a comprehensive methodology that includes a set of tools for developing an enterprise architecture (EA).

This is based on an iterative process model supported by best practices and a set of reusable architectural assets. TOGAF contains rules for developing appropriate principles, and offers several architectural principles. The TOGAF framework provides IT resource guidance and maintains architectural principles for practical growth and execution [9].

Figure 1. TOGAF framework phase (Source : [14])

1.5 COBIT

Control Objectives for Information and Related Technology (COBIT) is a well-known framework for managing and organizing IT processes [21], as referenced in [22]. It helps companies govern their information and technology, encompassing all IT systems and processes across the organization, not just within the IT department. According to COBIT, governance should ensure that stakeholders' needs, conditions, and choices are evaluated in order to determine balanced and agreed-upon corporate objectives. This includes setting directions through prioritization and decision-making, monitoring performance, and compliance with these objectives [21]. This approach helps align IT activities with business goals and objectives by focusing on what should be achieved rather than on the implementation of requirements [5].

1.6 Information Technology Governance

According to Weill and Ross (2004) in [23] information technology governance is a specific framework for decision-making and accountability to support companies in utilizing information technology. Information technology governance, as defined by the IT Governance Institute (2003) and still cited by [23], aims to ensure that the use of technology aligns with business objectives. [24] stated that IT governance mechanisms are necessary to ensure alignment between IT-related activities and organizational strategies. A similar finding was reported by [18], who noted that IT performance enhanced business performance. IT and business executives must collaborate to define IT goals and enable them to achieve a company's objectives.

2.   METHOD

This study aims to create an enterprise architecture and map it with governance procedures to answer the research question. TOGAF was used as a reference, complemented with COBIT, to complete governance and control over the implementation of enterprise architecture in the company. As mentioned in [12], the architecture development method includes eight phases for implementing enterprise architecture. However, this study focused only on the design phase, aligned with [25] TOGAF, which is a high-level framework for designing typical structures in four layers: Business, Application, Data, and Technology. It is based on modularization, standardization, and existing technologies and products.

Figure 2. Research Framework (Source: Author data)

Step 1: Problem identification is conducted through discussions with all stakeholders related to the digital transformation plan. Continuing to Step 2, data collection applies focus group discussions and interviews with all stakeholders and collects literature from other research related to digital transformation, enterprise architecture, and governance. Step 3: Focus on establishing an EA for vision, business, information, and technology architectures. In Phase A, the vision architecture, objective of the architecture, scope, stakeholders' concerns, and business requirements were identified. In Phase B, the business architecture, which reflects the business model and challenges, shapes the detailed decomposition of each process. After developing the target Business Architecture, it was necessary to identify its impact on the existing baseline architecture. What changes do management need to make, or do investments need to be realized? In Phase C, the information architecture consists of two layers: information and data architecture.

We collected all available applications and data, as well as those that needed to be developed within the company, particularly in the manufacturing department. We also defined the baseline and target architectures, covering both the data and application domains. The functions of the applications should be interconnected, and the data should be stored in a single database to ensure that the data structure is well-established and consolidated. Phase D: Technology architecture outlines the structure and interaction of a service platform as well as the logical and physical components of technology. The implementation planning process involves identifying the IoT requirements for the architecture defined in the previous phase. An initial implementation plan was created to identify the IoT technologies within the architecture outlined earlier.

Step 4, which involves designing the governance procedure, occurs after the entire architecture is developed. Based on COBIT 2019, this step establishes procedures for all stakeholders involved in the digital transformation project to ensure compliance. The process begins with an understanding of an enterprise's context and strategy, followed by determining the initial scope of the governance system, refining its scope, and concluding the design. Step 5. We need to conduct validation to ensure that all recommendation strategies of the enterprise architecture are already in line with the business requirements.

3. RESULT

3.1 Enterprise Architecture

Based on [26],[13],[27], TOGAF is recommended as a framework for providing architecture for a company's processes and governance to enhance the organizational development process by offering architectural vision, business architecture, information architecture, and technological architecture. The TOGAF method follows an iterative process approach supported by best practices [25]. RQ1: How can EA support digital transformation in a company? We built the enterprise architecture using TOGAF as follows:

3.2 Vision Architecture

PT.ABC has developed a business strategy to achieve its goals. Its vision and mission drivers, which are considered important by the company for its business, are product availability, brand awareness, production performance, and competitive cost of manufactured goods.
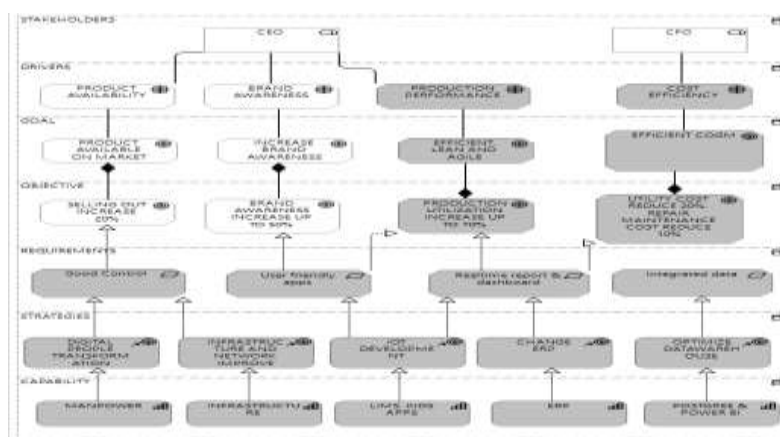

Figure 3. Vision and mission PT ABC (Source: Author data)

In Figure 3, the manufacturing department's vision states that the goals to be achieved by the manufacturing department are efficient COGM and efficient, lean, and agile processes. The requirements to achieve these goals include the development of real-time reports and dashboards, effective control, integrated data, and applications that are easy to operate and accessible.

All strategies were assigned to each related function and unit, with the assigned parameters being important. To ensure alignment, it is important to analyze the organization's value chain in the manufacturing department. The analysis of the value chain, which underpins the business functions within the firm and encompasses various domains and core business functions, is the end result. Value chain analysis aims to identify processes within a company and provide stakeholders with the greatest margin[25]. The main process in PT ABC's manufacturing department is to produce products and distribute them to customers. Each supporting department is an RND, PPIC, Procurement, and manufacturing service that provides support to ensure that all the primary processes are doing well (Figure 4).
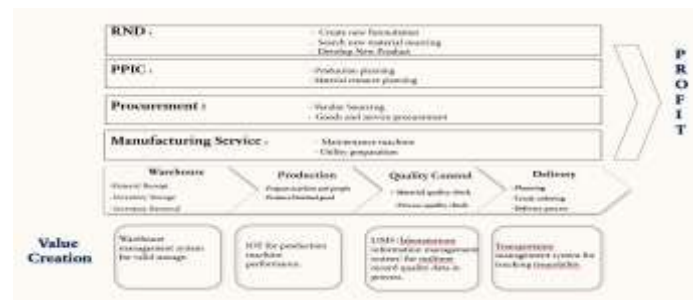

Figure 4. Value chain Analysis of PT ABC (Source: Author data)

To face digital business challenges, as stated by [28], the manufacturing industry is currently challenged by the digitalization trend that drives the adoption and use of digital technologies in the production environment. Enterprise architecture serves as the foundation for future development and IT investments. To determine the current state of the DX process in a company, five building blocks were developed (Figure 5): strategy and innovation, process automation, organization, information technology, and data analysis.
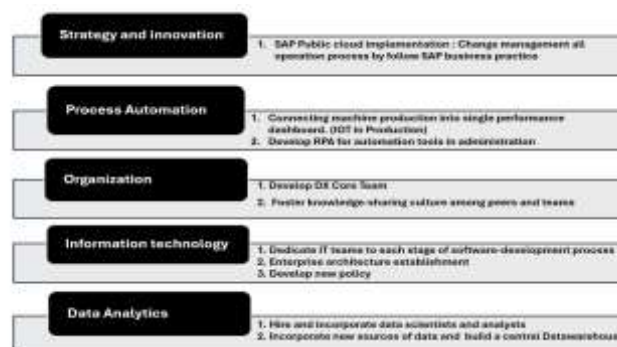

Figure 5. Five Building blocks (Source: Author data)

The PT ABC Digital Initiative in manufacturing begins with the implementation of SAP S/4HANA Cloud Public Edition, which requires adherence to SAP business practices. Some applications are directly linked to SAP and feed data into the data warehouse. The IoT project, following SAP go-live, will focus on tracking product quality and measuring machine performance and energy consumption across production lines, to establish baseline data for future improvements. The company also enhances its IT capability by placing a dedicated IT person in each role, improving and building a new central data warehouse, and embedding and fostering knowledge-sharing to achieve accelerated knowledge balancing.

3.3 Business Architecture

The current business processes of manufacturing departments have been mapped and standardized, and some automated processes are still performed manually. This paper presents recommendations for automated processes, as shown in Figure 6.
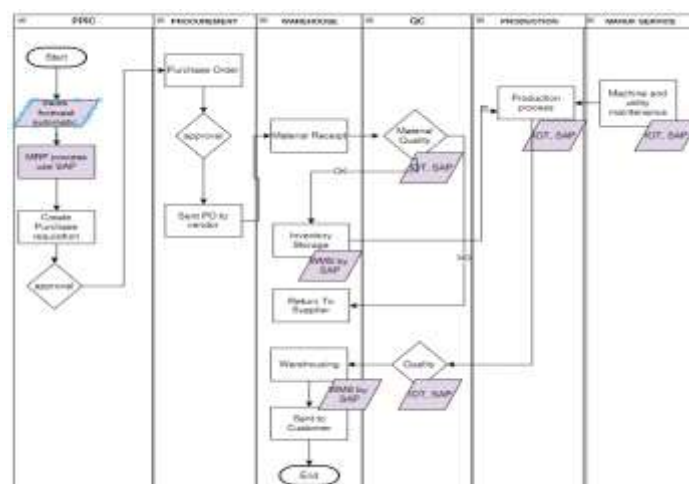
Figure 6. Recommendation Process Flow(Source: Author data)

Sales forecast, material resource planning, and WMS will be automated by the SAP S4HANA public cloud, and in detail activities for quality control in process, material, and finished goods; the performance record in the production machine will also be supported by IOT technology. This recommendation was formulated on the basis of the company's main objectives: improving control, integrating data, enabling real-time monitoring, and enhancing performance to achieve cost efficiency.

3.4 Information Architecture

As mentioned in [29], software development currently requires agility and speed to respond to the highly changing demands of organizations. Various business processes are automated through SAP, including MRP, quality inspection logging, material consumption tracking, machine utilization, and maintenance planning with an enterprise asset management module. In addition, IoT technology can accelerate data acquisition to monitor machine performance, record production, and take quick action to prevent production disruptions.
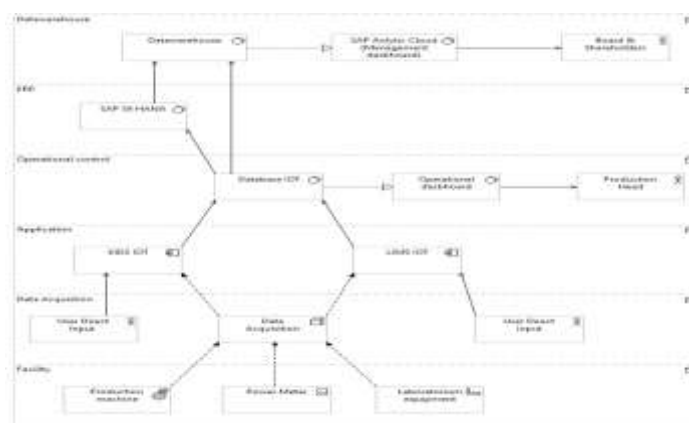

Figure 7. Targeted application architecture(Source: Author data)

Figure 7. The IoT KIDS and LIMS applications in the manufacturing department accommodate real-time data record for production and quality control. Currently, production and quality control do not have applications for process automation. The IoT and LIMS applications are designed to complement each other, with LIMS requiring CCP(critical control point) data for quality control and IoT needing quality evaluation data from LIMS for production process reference. SAP S/4HANA aims to integrate transactions across departments, with the manufacturing department as the primary user. By integrating IoT and LIMS in production and laboratories, all processes can be analysed and monitored in real-time base.

Figure 8. Manufacturing data acquired from the IoT KIDS and LIMS applications is stored in real-time in the IoT database on the company's on-premise server. The data will be acquired to the OLAP server located on the cloud server, before being extracted, transferred, and loaded into the data warehouse.
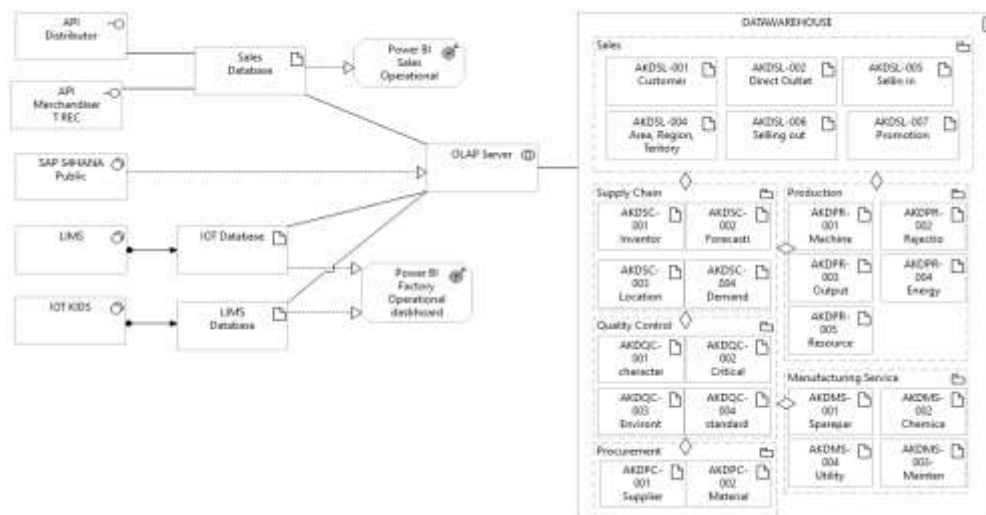
Figure 8. Targeted data Architecture (Source: Author data)

3.5 Technology Architecture
The company operates in two locations: a factory in the sub-district of Bandung Regency and a head office in South Jakarta, Indonesia. Currently, each site operates independently and is not interconnected, which means that communication between sites must pass through a wide area network (WAN). Traffic monitoring was performed manually at each site. A firewall is not available in the current company network and no segregation network layer for each device source affects the risk level in the company network. This condition makes it difficult to control security and network usage. An update to the network and the addition of security control functions are necessary to ensure its reliability and availability. The proposed network architecture is illustrated in Figure 9.
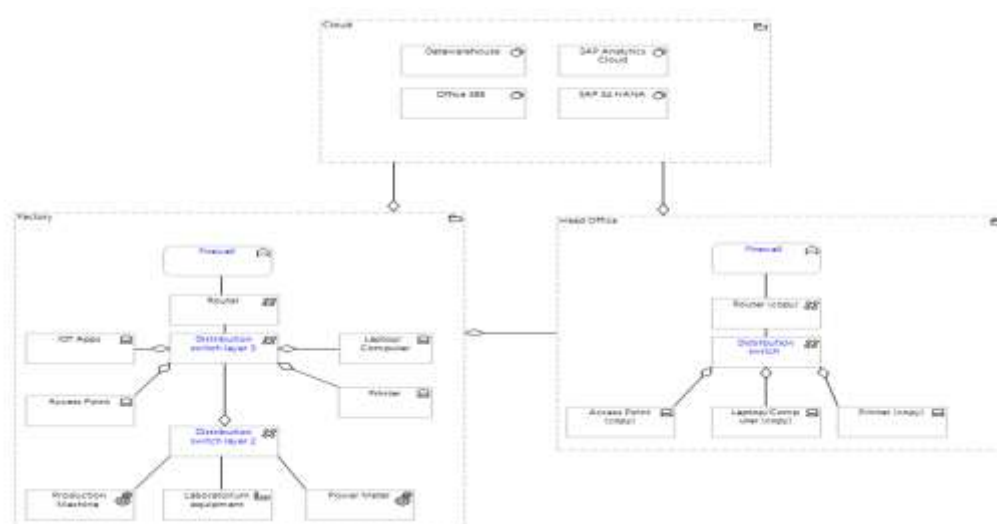

Figure 9. New Architecture network propose (Source: Author data)

Figure 9. All networks are integrated into a single LAN, allowing traffic monitoring to be conducted from the head office also protected with firewall.
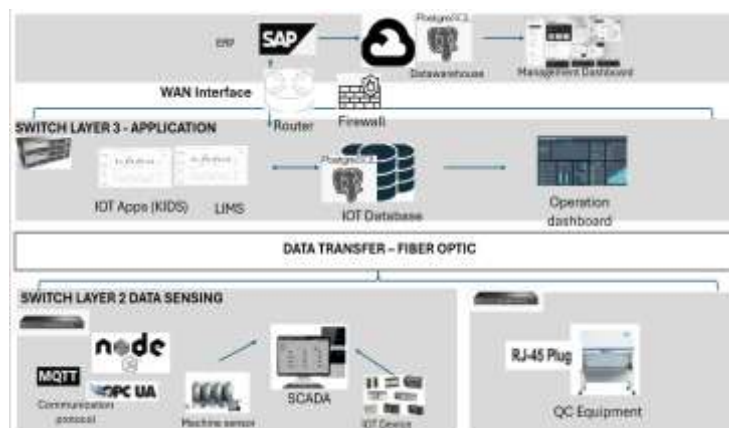
Figure 10. IOT Architecture (Source: Author data)

Related to [30], the data sensing layer uses information acquisition and sensing technologies to collect diverse data with various industrial attributes, and then uploaded to the data transfer layer through advanced communication technologies such as Wi-Fi, Bluetooth, the Internet of Things (IOT), 5G, and others. Serving as an intermediary layer, the data transfer layer (built on the Internet backbone) is responsible for transmitting industrial data to the data processing layer by implementing Traffic Engineering (TE) or data routing policies in accordance with specified requirements. In the PT ABC IIOT architecture, the data-sensing layer comprises data acquisition related to the machine sensors, IOT devices, SCADA, and QC equipment. All data were transferred to Layer 3 using fiber optics. The data in layer 3 interface through the WAN into the cloud server, and are embedded by a firewall to protect it from any cyberattack.

3.6 Governance
Current software development practices are reshaping the governance and management of software projects to align software products and services with business requirements, ensure business continuity, optimize resource allocation, and fostering robust stakeholder relationships [29]. Companies should provide robust and reliable methods for accessing and extracting critical operational data [31]. To achieve this, companies should develop digital platforms that harness their technological and business capabilities to ensure high performance and accuracy in their procedures and operations. [31] Need to provide governance to cover IT development and implementation. A company should consider some IT-related issues owing to new IT use to enlarge digital transformation processes.

Based on several issues that occur in the company, such as cybersecurity, inappropriate IT investment, overlapping app functions, data silos, turnover IT employees, low digital knowledge, and lack of Internet support, it is better to evaluate the performance and risk management of information technology governance implemented in the manufacturing department to assist companies in the successful implementation of digital transformation. All IT investments must be assessed to ensure that they meet the requirements of the existing technologies, applications, or data. A well-established enterprise architecture is expected to optimize IT investments in supporting a company's operations, as concluded by [24] Governance has a positive influence on IT exploration and exploitation, while IT exploration and exploitation positively impact organizational agility. Its design, by identifying enterprise goals and strategy and considering the role of realizing digital transformation, resolves inherent potential conflicts. This study identified the organizational strategy of the manufacturing department, which refers to a company's strategy of using a balance score card in 4 (Four) domains: financial, customer, internal process, learning, and growth.

Table 2. PT ABC Business strategy (Source: Author data)

Domain	Strategy
Financial	Increase the efficiency of the production machine to reduce cost of good manufactured.
Customer	1. Get real-time data performance and quality. To get better performance and quality 2. Faster and safe internet network. 3. Application and data consolidation

Domain	Strategy
Internal process	1. Develop a Compatible application and data design and protect it from any cyberattack. 2. Provide better compliance.
Learning and growth	1. Improve employee capability with digital people transformation. 2. Combination and co-working between users and IT to develop digital environment

After identifying the business strategy, the next step was to align it with COBIT 2019 enterprise goals. For the analysis process, we examined the relationship between the objectives of the PT ABC enterprise strategy and enterprise goals in COBIT 2019. Table 3 lists the selected COBIT 2019 Enterprise Goals.

Table 3. Align Selected Enterprise Goals (Source: Author data)

Reference	Domain	COBIT 2019 enterprise goals	Business Strategy	Related or unrelated
EG01	Financial	Portfolio of competitive products and services	Increase the efficiency of the production machine to reduce cost of good manufactured.	Related
EG06	Customer	Business service continuity and availability	1. Get real-time data performance and quality. To get better performance and quality 2. Faster and safe internet network.	Related
EG07	Customer	Quality of management information	Application and data consolidation	Related
EG08	Internal	Optimization of internal business process functionality	Get real-time data performance and quality. To get better performance and quality	Related
EG11	Internal	Compliance with internal policies	Provide better compliance.	Related
EG12	Growth	Managed digital transformation programs	1. Develop a Compatible application and data design and protect it from any cyberattack. 2. Combination and co working between users and IT to develop digital environment	Related
AG12	Growth	Competent and motivated staff with mutual understanding of technology and business	Improve employee capability with digital people transformation.	Related

We defined recommendations related to enterprise goals after mapping the IT-related issues and goals of the company (Table 4).

Table 4. Governance coverage (Source: Author data)

No	Enterprise goals	IT related issues	Recommendation
1	Portfolio of competitive products and services	- Not an appropriate IT Investment - Overlapping functions of applications.	The company need to build or invest technology which compatible to support company efficiency and improve quality
2	Business or service continuity and availability	- Data Silos - Overlapping function of application	The company need to control the utilization of technology to improve quality of information management.
3	Quality of management information	- Data silos - Low of digital knowledge	
4	Managed digital transformation programs	- Cyber Security - The Internet not support - Turn over IT Employee	The company need to well manage all of application and technology

After analyzing recommendations to support enterprise goals, we continued mapping the proposed new policy for establishing the implementation of enterprise architecture at PT ABC (Table 5) and answer RQ2: What is the proper governance procedure to ensure its successful implementation?

Table 5. New Propose Procedure (Source: Author data)

No	Recommendation	New Propose Procedure
1	Company need to build or invest technology which compatible to support company efficiency and improve quality	Develop Procedure to build application or invest new technology IT.
2	Company need to control utilization of technology to improve quality of information management.	Develop Procedure which supports consistency of system IT implementation.
3	Company need to well manage all of application and technology	Develop Procedure to manage system and IT assets.

The first procedure was developed to cover any requests for new application development that should first be assessed against the existing applications and data. The review was conducted by users and department heads with consultations from the IT department. If the required data or applications are already available, then the request is dismissed. New application development must define KPIs related to the operation of the application, such as cost efficiency, increased labor productivity, or process reduction. These KPIs should be established to ensure consistency in the system implementation. An second policy needs to be established, starting that future investments in IT infrastructure and equipment will only be realized after an assessment is conducted in collaboration with the IT department. However, maintenance of each IT asset should also be conducted periodically.

4. DISCUSSION

Enterprise Architecture design focusing on ABC's manufacturing department. The goal is to guide the early stages of digital transformation, ensuring that applications, data, and technology are well inventoried to avoid overlap and enable easy integration. Business architecture improves several manual processes and reorganizes them by using technology for better integration. Processes such as sales forecasting, material resource planning, warehouse management those several process are covered using SAP cloud public edition, in the other hand, real-time machine tracking and laboratory activities have been updated provided by IOT and LIMS system. In Data Architecture, entity identities, attributes, and data types are

identified and grouped by data owners. The resulting artifacts facilitate data integration and consolidation. Additionally, the application architecture helps identify and map the applications used by stakeholders. Technology analysis produces artifacts in technology architecture. As departments race to digitize, technology procurement aligns with right investments. Business processes adapted to technological developments. The application architecture is designed to meet operational needs, whereas the data architecture details all the applications used in manufacturing. An integrated network architecture can help mitigate cybersecurity risks and maintain network uptimes. Google Cloud enables flexible access to applications and data through a cloud base and reduces the risk of data loss owing to sufficient security protection.

To ensure compliance in the implementation of enterprise architecture, this study developed three procedures: 1. procedure for new applications or data requests and implementation; and 2. procedure for new technology investments and a 3. Procedure for the maintenance period of IT assets. These procedures are designed to support the implementation of enterprise architecture with the following objectives: increasing the efficiency of production machines to reduce the cost of manufactured goods, controlling the utilization of technology to enhance the quality of information management, and managing all applications and technologies to support business operations.

After completing the design phase, the next step is to prepare for the implementation phase, which includes Phase E: Opportunities and Solutions and Phase F: Migration Planning. Notably, Phase G: Implementation Governance has already been addressed in this study, with reference to COBIT 2019. Additionally, the change management phase must be carefully considered once a full cycle of the Enterprise Architecture phase has been successfully implemented.

4.1 Implementation

To successfully implement Enterprise Architecture (EA) within an organization, it is recommended to adopt a structured approach that integrates the principles of COBIT 2019 for governance. This integration will ensure alignment between business goals and IT strategy, while maintaining robust oversight of processes, risk management, and resource allocation. The following steps are suggested for an effective implementation:

1. Define Clear Objectives: Align the EA framework with strategic business objectives to ensure that both IT and business stakeholders work towards common goals.

2. Establishing a governance framework: Implementation of COBIT 2019's Governance System to ensure that decision-making, accountability, and risk management practices are in place to support EA initiatives.

3. Monitor and Evaluate: Regularly assess the performance of enterprise architecture and its alignment with business goals.

4. Foster Stakeholder Engagement: Actively involves both IT and business stakeholders throughout the EA implementation process to ensure that their requirements are met and that the architecture will be adopted smoothly.

By incorporating COBIT 2019 governance principles, organizations can achieve greater transparency, accountability, and alignment between IT and business, ultimately leading to improved operational efficiency and decision-making.

4.2 Validation

Refer to [32]. In the context of EA products and services, quality is understood as the extent to which EA products and services fulfil EA stakeholder requirements. In order to identify whether the developed EA has addressed and met all the requirements of the stakeholders, a gap analysis needs to be conducted, comparing the previous conditions with the recommendations provided by the enterprise architecture that has been established (table 6).

Table 6. Consolidation and gap analysis map (Source: Author data)

Requirement	Recommendation	Related Architecture	Type
Realtime operation and dashboard for	1. Migrate ERP into SAP S4 HANA	Business	Upgrade
	2. Provide automation for sales forecast, warehouse management,	Business	New

improvement company performance	Material resource plan with SAP capability		
	3. Automation laboratory and production data through IOT	Business	New
Data integration	1. Connecting all machine data into single dashboard	Technology	New
	2. Build IOT apps	Information	New
	3. Build data warehouse	Information	New
Effective Technology	1. Improvement company network	Technology	Upgrade
	2. Create new procedure for apps development and improvement.	Governance	New
	3. Create new roles for data engineer and data analyst.	Vision	New
Good Control	1. Improve firewall technology	Technology	Upgrade
	2. Network segmentation	Technology	New
	3. Create and implement an enterprise architecture	Governance	New

5. CONCLUSION

Combining TOGAF and COBIT 2019 offers a practical approach to addressing the challenges of digital transformation. This integrated framework ensures that the enterprise architecture is not only comprehensive but also governed effectively, leading to a better alignment of IT strategies with business goals and improved operational efficiency. TOGAF provides a comprehensive methodology for enterprise architecture. Meanwhile, to ensure compliance in the implementation of enterprise architecture, it is recommended to adopt a structured approach that integrates the principles of COBIT 2019 for governance. This integration will ensure alignment between business goals and IT strategy, while maintaining robust oversight of processes, risk management, and resource allocation.

Limitations and Future Research

This study has several limitations that should be acknowledged. First, it is based on a single case study conducted within a specific manufacturing company, which may limit the generalizability of the findings to other industries or organizational contexts. Second, time constraints and the availability of key stakeholders pose challenges to gathering comprehensive inputs across all departments, potentially affecting the completeness of the architectural model. Finally, although COBIT 2019 was used as a governance reference, its practical implementation of governance mechanisms could not be fully validated during the research period.

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