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Designing Enterprise Architecture Using TOGAF Framework (Case Study: PT. Indorama)

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Abstract*— PT Indorama is an organization engaged in manufacturing. In business process activities, IT has been proven capable of increasing effectiveness and efficiency in planning business strategies and can establish relationships with customers that can create increased buying and selling transactions in a competitive manner. However, in the process of implementing IT into the company, there are many challenges with developments that are not under customer needs, which can be grouped into four main problems: lack of ownership of business strategy by customers, low level of alignment of IT development plans with strategy business, low capability to use IT as a competitive advantage, and reasonable standards for IT Operation services in business are not available. To obtain solutions that can be used to achieve its business goals, this study uses the Enterprise Architecture approach to identify the current and expected target architecture and perform a gap analysis. The gap is used as a recommendation to be fulfilled in answering the problems found. The methodology used is TOGAF ADM, which is process-based and provides flexibility in using artifacts according to the organization's specific conditions. The study produces business models and enterprise architecture on customer relationship management systems and services, recommendations for strengthening business areas, recommendations for aligning IT plans with business strategy, and recommendations for using IT solutions in the form of artifacts in the form of catalogs, analysis, and schematics.

Keywords*— Enterprise Architecture, Customer Relationship Management, TOGAF ADM

I. INTRODUCTION

Every company involved in manufacturing has a production process by which products and services are delivered and widely distributed from producers to consumers. One of the essential things a manufacturing company must face is maintaining customer satisfaction, so customer relationship management is needed so the company can develop as a whole [1]. Customer Relationship Management is an integrated concept in information technology and business with the primary goal of building a long relationship between the organization and its customers. Organizations invest heavily in CRM projects to better understand customers and respond quickly to their requests and needs [2].

In addition to improving the company's relationship with customers with customer relationship management to achieve a competitive advantage, companies also need the role of Enterprise Architecture (EA) related to business strategy planning. Enterprise architecture is an essential tool for organizational success. In practice, enterprise architecture has many methodologies used by organizations for IS / IT development, one of the most popular methodologies today is The Open Group Architecture Framework (TOGAF) [3].

Due to its complete architectural process, the TOGAF framework is widely used by most companies [4]. One of the companies that will be discussed in this research is PT. Indorama. PT. Indorama is one of the manufacturing companies in Indonesia. In the process of its business activities, PT. Indorama has tried to work on a strategic plan, but there are obstacles in the planning process. In other words, some plans are not following the objectives, so they cannot be carried out properly, such as one of the facilities' shortcomings in supporting PT's business activities. Indorama does not yet have an enterprise architecture system design plan.

There are several elements of the problem in different fields, including in the field of business, companies that do not optimize information technology in their business which makes companies feel unable to compete with their business competitors because, in the absence of specific needs, customers and prospective

customers who want to do business in the company will also retreat. In the field of data, some current business processes, such as data management and reporting, require a long processing time because they are still being executed manually [4]. These problems make the sales team often late in conveying information to the leadership in taking needs and handling complaints or complaints from customers. In the application field, integration between application systems is needed to accommodate business needs effectively and quickly to improve company performance in targeting or capturing all the needs that customers need. In the field of technology, from an element of technology, several applications are the same and also provide the same services but different infrastructures. Companies need help to make the right decisions [5].

Based on the problem above description above, the company's current IT architecture needs to be identified in depth to obtain a precisely targeted IT architecture planning solution to achieve the expected IT strategy objectives. The TOGAF ADM framework is adapted to the manufacturing department, has complete steps, and has a systematic structure. This design allows the company to create a corporate architectural design that produces detailed blueprints for developing information systems, especially in purchasing, manufacturing, and selling raw materials and customer relationship management systems at PT. Indorama can realize the goals that exist in the company [6].

The enterprise architecture implementation plan is designed to solve problems and failures that arise, and this is one of the best business strategic planning solutions needed by manufacturing companies such as PT. Indorama, so that further business activities can be integrated, planned, centralized, and efficient.

II. METHOD

a. *Customer Relationship Management*

Customer Relationship Management is how a business or other organization manages customer interactions, using data analysis to study large amounts of information [7]. Customer relationship management focuses on acquiring and retaining customers by enhancing customer relationships with the company [8]. Customer relationship management (CRM) refers to all activities or marketing activities carried out to stabilize, develop and exchange good customer relationships [9].

b. *Enterprise Architecture*

Enterprise Architecture is a management and technology practice aimed at improving company performance by seeing the company as a whole and integrated following the view of strategic direction, business practices, information flow, and technological resources [10].

Enterprise architecture consists of documents such as drawings, diagrams, textual documents, standards or models, and business methods that explain what kind of information system the company needs. Enterprise architecture will be used as a reference for developing information systems because developing a system without having a good architecture will be challenging in achieving maximum results [11]. The Open Group Architecture Framework (TOGAF).

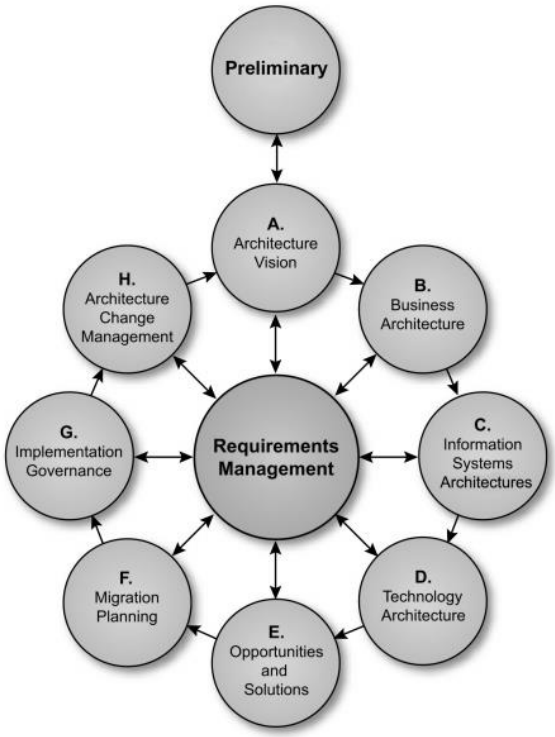

Figure 1. Architecture Development Method [8]

The stages of TOGAF ADM can be briefly explained as follows [12]:

- Preliminary Phase, explain the preparatory and initiatory activities needed to prepare to meet business objectives for the new company architecture, including an explanation of the organization-specific architecture framework and definition of principles.
- Phase A: Architectural Vision describes the initial phase of the architecture development process. This includes information about defining spatial boundaries, identifying stakeholders, creating an architectural vision, and getting approval.
- Phase B: Business architecture, explain business architecture development to support the agreed architecture vision.
- Phase C: Information systems architectures, describes the development of information systems architecture for architectural projects, including data architecture and applications development.

- Phase D: Technology architecture, describe the development of architectural technology for architectural projects.
- Phase E: Opportunities and solutions, planning for implementation, and identifying delivery vehicles for the architecture specified in the previous phase.
- Phase F: Migration planning, discuss the preparation of a series of transitional architecture sequences in detail with a supporting implementation and migration plan.
- Phase G: Implementation Governance provides architectural oversight of implementation.
- Phase H: Architecture Change Management, establish procedures for managing changes to the new architecture.

c. *Theoretical Framework*

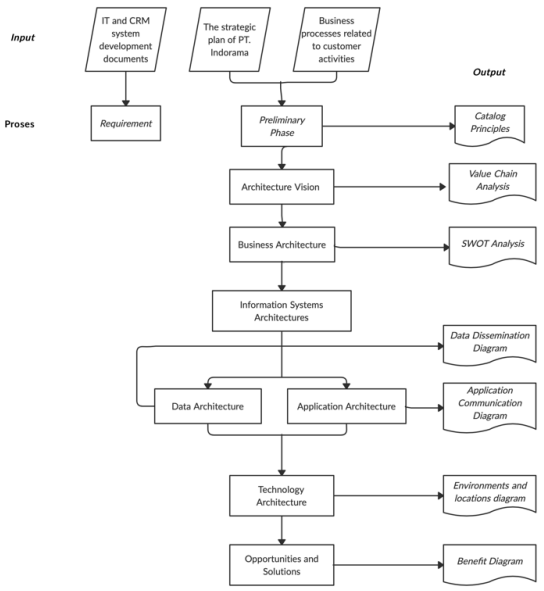

Figure 2. Theoretical Framework

The theoretical framework will consist of the following: [13]

- Requirement
  Input: documents related to IT and CRM system development.
  Process: it takes several documents from the company to support the process needs, such as reading documents related to the development of IT and CRM systems in the company and understanding the background of the CRM system services currently underway in the company. From this background, the researcher identified the problems faced by companies in providing CRM system services.
  Output: can describe the functionality or services of the system.
- Enterprise Architectural Design
  Input: a strategic plan of PT. Indorama and business processes related to customer activities.
  Process: strategic plans and business processes are analyzed into 5 phases of TOGAF ADM. There are three stages in order to fulfill the strategic plan related to the new CRM system to be built, namely:
  – Determine the purpose and scope of the research, while the scope of this research refers to the CRM system, such as customer visits, claims, and complaints at PT. Indorama by using TOGAF as its framework.
  – Literature study where researchers look for sources of literature on CRM system services carried out by previous researchers. Researchers conduct research comparisons to distinguish the research conducted by previous research.
  – Conduct interviews with resource persons with roles and experience in developing CRM systems in the IT field.
  Output: the results of the analysis of the 5 phases of TOGAF ADM, namely the preliminary phase, the vision architecture phase, the business architecture phase, and the business architecture phase, which is divided into two parts, namely the data and application architecture phase, the technology architecture phase, and the opportunity and solution phase.
- Enterprise Architecture Design Results
  Input: the results of the analysis of the 5 phases of TOGAF ADM.
  Process: drafting a new CRM system design based on the TOGAF framework. The data obtained from the ADM stages are analyzed using qualitative methods to be used as a basis for determining the condition of the running system or the baseline to determine the target of the new CRM system.

Output: from the diagram, it can be an artifact that will later be used as the final result of the enterprise architecture design

III. Result and Discussion

a. Preliminary Phase

The artifacts from the preliminary stage are the principles catalog. The Principles catalog is used to capture the principles of architectural solutions. The catalog principle is used to review and approve a result for a defined architectural decision. In determining the

Principle catalog, an interview was conducted with the IT manager at PT. Indorama

Table 1. Principle Catalog

No.	Principle	Category
1	Facilitate the management of customer relationship management services	Business principle
2	Add value to customer relationship management services	Business principle
3	Integrated data	Information systems principle
4	Ease of data access	Information systems principle
5	Data security	Information systems principle
6	Easy to use	Information systems principle
7	Stability	Information systems principle
8	System speed	Technology principle
9	Service backup plan	Technology principle

Table 1 above shows the capabilities required by the company in the enterprise architecture being developed. Nine required skills cover business principles, information systems principles, and technology principles [14].

b. Requirement Management

Requirement management is a dynamic set of requirements. The artifact of the requirement management stage is the architecture requirements specification. The following are the architecture requirement specified in this research:

- Architectural Vision
  - Make it easy for customers to contact the company
  - Add value to the company's customer relationship management service
- Business Architecture
  customer relationship management service improvement
- Information System Architecture
  - Easy to use user interface
  - Integrated apps and data
  - Automatic reporting app
- Technology Architecture
  - High availability server availability
  - Availability of bandwidth management for CRM system bandwidth management.
- Opportunities and Solutions
  A description of the benefits of designing customer relationship management services.

c. Architecture Vision

This phase is also the initial phase in the TOGAF ADM. This phase has the objective of defining the vision of the architecture. Furthermore, this phase includes defining the scope and identifying stakeholders. One of the artifacts explained in this phase is Architecture Vision, as in this phase. The Architecture Vision is as follows:

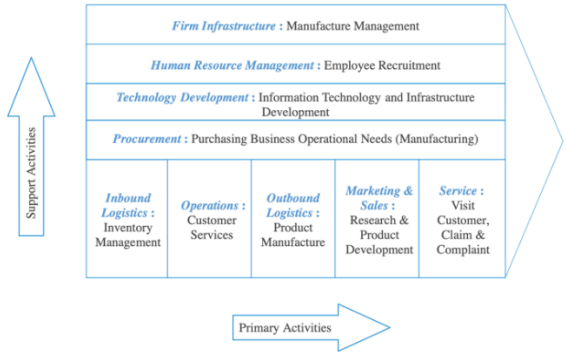

Figure 3. Value Chain Diagram

Based on Figure 3 above, the CRM service of PT Indorama has four leading activity roles: inventory management, customer services, product manufacturing, research and product development, customer visits, claims, and complaints. Meanwhile, the supporting activities are manufacturing management, employee recruitment, infrastructure, information technology development, and purchasing activities for operational business needs (for manufacturing)—Customer Relationship Management System at PT. Indorama is the main activity in serving customers. The team from Customer Relationship Management at PT. Indorama is involved in various activities ranging from service activities, scheduling visits (visiting customers), and serving any complaints from customers (claims and complaints).

d. Business Architecture

This phase provides the architecture of the business of customer relationship management. One of the artifacts used in this section is the SWOT analysis carried out to see companies' strengths, weaknesses, opportunities, and threats in developing customer relationship management services [15]. PT. Indorama has an experienced team, besides the availability of funds and management support in developing customer relationship management services, PT. Indorama. These things are the strength of PT. Indorama. Limitations in customer relationship management services are the limitations of the

information technology team needed for system development. Opportunities and development of customer relationship management services are to reduce telephone usage costs and reach markets and potential customers through the customer order application. The threat that arises is losing customers due to customer dissatisfaction with current customer service.

Table 2. SWOT Analysis

Strength (S)	Weakness (W)
Company management	Limitations of information technology team
Product quality	
Have an experienced team	
Availability of funds for service development	
management support in service development	
Opportunities (O)	**Threats (T)**
Reduce phone usage costs	Company competition in the same category
Marketing trend is increasing	Lost customers due to customer service dissatisfaction
Customer loyalty	

From the results of the SWOT analysis in table 2 above, there is a threat of losing customers due to dissatisfaction with customer service. The opportunity to reduce telephone usage costs because every incoming customer call is charged to PT. Indorama. Likewise, with the opportunity to reach a wider audience. From the results of the SWOT analysis, seeing the opportunities and threats that arise, the development of customer relationship management service designs relates to the attention of stakeholders and the requirements of business capabilities mentioned in the architecture vision stage.

The following is a gap analysis at the business architecture stage, which can be seen in table 3 below:

Table 3. Gap Analysis Business Architecture

No.	Present condition	Future Conditions
1.	It only has one customer service.	Has two customer services, namely by phone and customer order application.
2.	The filling in data is not practical because it is done more once.	The system is integrated with emails that are automatically distributed to stakeholders.
3.	Reporting from marketing on claims & complaints is not real-time.	Reporting from marketing on claims & complaints can be real-time.
4.	Customers can access no system.	There is already a system or application that customers can access to provide feedback, claim tickets, and complain directly.
5.	The web-based system cannot be accessed from anywhere (real-time).	The system is web-based and can be accessed in real-time.

e. Information System Architecture

The Information System Architecture phase explains the data and application architecture. The diagram will describe the data dissemination diagram that explains the relationship between the logical application and the data entity with the common objectives of the company [16].

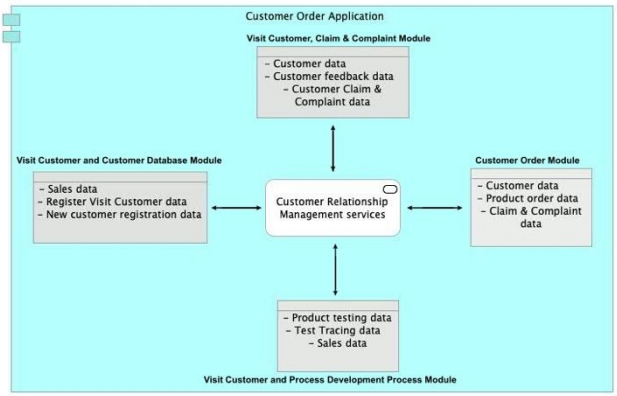

Figure 4. Data Dissemination Diagram

In figure 4. describes the relationship of customer relationship management services with customer order applications and data. In the customer visit, claim & complaint module, there are customer data, customer feedback data, and customer claim & complaint data. The customer order module has customer data, product order data, and claim & complaint data. The customer visit and process development process module include product testing data, test tracing data, and sales data. The customer visit & customer database module includes sales data, customer visit register data, and new customer register data.

Future / Current	Customer Relationship Management System	Visit Customer, Claim & Complain System	Visit Customer and Process Development Process System	Visit customer & customer database System	Customer order System
Customer Relationship Management System	Retain				
Visit Customer, Claim & Complain System		Retain			
Visit Customer and Process Development Process System			Retain		
Visit customer & customer database System				Retain	
Customer order System					New

Figure 5. Gap Analysis Information Systems Architecture

In figure 5 above, a new application is used, namely the customer order application. Four applications are maintained, namely the customer relationship management application, customer visits application, claims & complaints, customer and process development process application, and customer & customer order application.

f. Technology Architecture

Technology architecture identifies the usage of technology to enable applications within the company. Hence business performance could be improved [17]. In this phase, the relevant technology architecture will be developed using previously developed application architecture. The environment and location diagram is one of the artifacts produced in this architecture. The environment and location diagram shows the identified and proposed technology to support the application and data requirement.

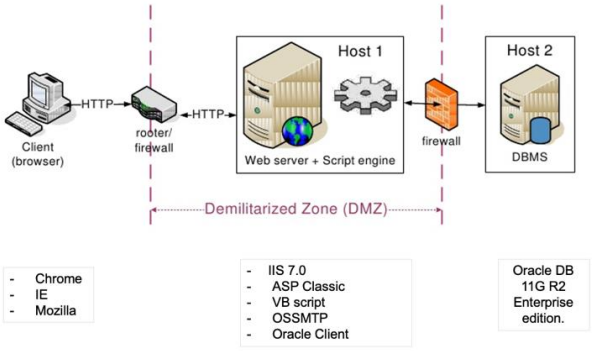

Figure 6. Existing Network Topology

The current network topology in figure 6 relies on a single router as a single-point service. The router currently functions as an internet gateway, user gateway, DHCP server, and bandwidth management. Using a router as a single-point service results in high CPU and memory usage, so the router's performance becomes unstable. Today's switches are still unmanageable, so it is impossible to do more in-depth configurations. Network and internet connections are needed to support business operations and customer relationship management services because data exchange is carried out through the DBMS system, customer service management uses software as a service, and voice-over IP connections to providers using SIP trunks are connected via the internet. The critical need for stable network and internet connections requires adjustments to network configurations to support business operations and customer relationship management systems.

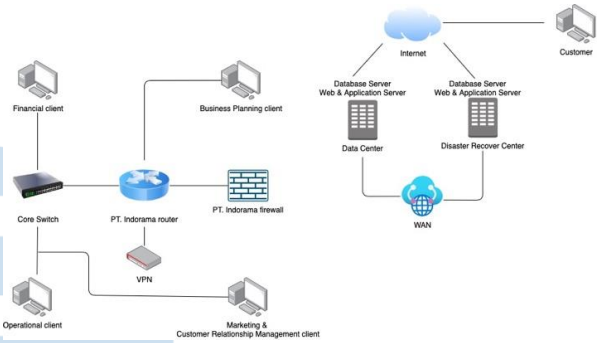

Figure 7. Environment and Location Diagram

In figure 7 above shows that the head office has business planning, customer service, operations departments, customer relationship management, finance, and IT divisions connected to the switching core and the router. IT departments use core switching and central office routers to unify and control internal networks such as data centers, disaster recovery centers, and customer sites so that the central office with customer clients can connect. Enterprises use private virtual or wide area networks using network methods. The customer headquarters and the customer must be able to connect to the data center and disaster recovery center so that the wide-area network uses the necessary VPN scheme. All customers can connect to the Internet to access the company's website and applications.

Future / Current	Router	Firewall	Switch	VPN	Core Switch	Wireless Lan Controller	Data Server
Router	Replace						
Firewall		Replace					
Switch			Replace				
N/A				New	New	New	New

Figure 8. Gap Analysis Topologi pada Technology Architecture

g. Opportunities and Solutions

Opportunities and Solutions is one of the TOGAF Architecture Development Method phases that aims to evaluate the design model of developed architecture [18]. This phase will then be the foundation or guidance for the implementation plan [19]. This phase helps the implementation plan to achieve its target implementation. One of the artifacts used in this application is the benefit diagram. This diagram aims to explain the relationship between the benefit of the opportunities identified and proposed [20].

Based on figure 9 below, it is stated that there are two goals in customer relationship management services, namely the first goal: is to find out the comparison of customer relationship management systems using the TOGAF ADM framework, and the second goal: to produce an architectural model that can be used as a reference in the development of new infrastructure. The first goal is to provide a solution to provide tactical, strategic, and forecasting analysis applications, provide better decision-making results for customer relationship management services and provide an improved service decision measurement. The second goal is to provide a single solution, which is to provide integrated applications for managing strategy, policy, and process management, to provide faster and more integrated strategy, policy, and process management results, and to provide measurements with a higher chance of adapting strategies, policies, and new processes. Then from combining the two goals and their solutions, results, and measurements, two benefits or benefits from each goal are obtained, namely higher customer service and leading to higher revenue for the company and policies and processes that are faster in customer service and can generate revenue and better customer service. From the combination of these two benefits, the final result is in the form of benefits, namely better customer satisfaction overall and can generate better income.

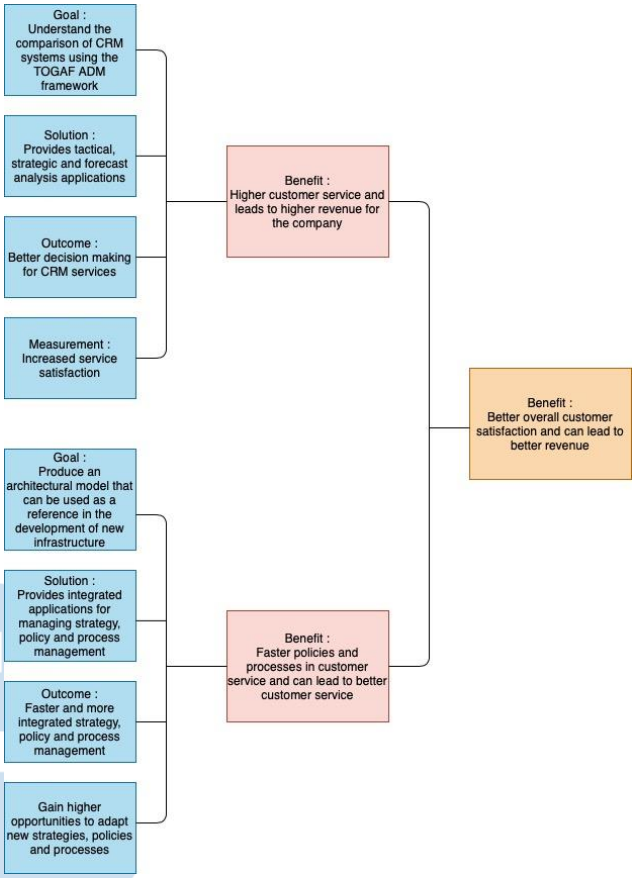

Figure 9. Benefit Diagram

IV. CONCLUSION

Based on the results of planning and designing a business model and analyzing the company's architectural system and customer relationship management services at PT. Indorama can be concluded as follows:

1. Design business models and enterprise architecture on customer relationship management systems and services at PT. Indorama was only carried out from the preliminary phase to the opportunities and solution phase. This adapts to the company's needs and time constraints so that it cannot produce an application that can be executed and passed on to the next step.
2. Planning and design of the application architecture stage have a target design that adds customer order applications in each function that is useful for managing applications for each existing function.
3. In the design phase of the technology architecture, technology adjustments are made to the application that will be used. Previously, the

technology was simple, using only one router and a standalone wireless network.

4. In this research, enterprise architecture design produces various artifacts at each stage. These artifacts can be in the form of catalogs, analyses, and schematics used in designs that can help achieve business strategies.

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