

DESIGN THE MANUFACTURING EXECUTION SYSTEM APPLICATION IN PROCUREMENT AND MATERIAL MANAGEMENT DIVISIONS FOR ENTERPRISE ARCHITECTURE SOLUTIONS OF PT INTI (PERSERO)

Dian Suci Astuti¹, Yuli Adam Prasetyo², Rahmat Mulyana³

^{1,2,3}Study Program Information System, Industrial Engineering Faculty, Telkom University

¹diansuci19@gmail.com, ²adam@telkomuniversity.ac.id, ³rahmatmoelyana@gmail.com

Abstract

Implementation of a system in a company provide a significant benefits to align a business activity in the company. A company system is also closely related to the development of information technology. The benefits from the relationship between system and information technology are they can align the relationship between technology and business processes within a company. Enterprise Architecture (EA) is an effective approach, because it has a good structure for system requirements that can be used to design and develop a complex system become a simple system. This research was carried out to build a solution on Enterprise Architecture that can serve as guidelines for achieving the strategic objectives of the company. This architectural solution can be used as a basic sample for manufacture company like PT INTI in the development of Enterprise Architecture, especially in the function of Procurement and Materials Management.

Keywords: Enterprise Architecture, Procurement, Material Management

1. Introduction

In the era of globalization as currently, information technology is highly considered in a company, since corresponds to the policy of regulation of the Minister of State-owned enterprises no. 1 in 2011 which contains that good corporate governance is the existence of the application of information technology [1]. Information technology is a collection of tools, processes, and methodologies (such as programming, data communication, data conversion, storage and retrieval of data, system analysis and design, control systems) and associated equipment used to collect, process, and present information. Information technology policy in the governance of a company are applied in order for the development and utilization of information technology has not only become a tool that facilitates the acceleration of a business, but is also expected to become supporters in the Organization's operational problem solving company.

PT INTI (Persero) is a company engaged in the field of telecommunication Indonesia which has a role as a major supplier to the construction of the national telephone network. PT INTI have been engaged in the business of telecommunications over the past 35 years. The main customers of PT INTI are the four biggest telecommunications operator in Indonesia include PT Telekomunikasi Indonesia Tbk, PT Indosat Tbk, PT Telekomunikasi Seluler (Telkomsel) and PT XL Axiata (XL). Since the growing trend of convergence between telecommunications technology and information technology, the core has been doing business orientation changes from the original pure- based manufacture became an industry-based system solutions, especially in the field of communication and systems integration technologies. PT INTI in the form of organizations contained there in, has several functions that help the company's performance. Procurement and logistics functions are part of important functions in support of performance on PT INTI.

Procurement and logistics division is a division that goes as a support function or supporting functions in PT INTI. This function has a purpose to support and assist the Director of finance in managing and running the activities of companies that substantially covers the areas of procurement and logistics. This Division helps to achieve the objectives of the function that is running the process order acquisition (product-based and project-based) and order execution in terms of goods procurement and services as well as having the company in the form of stakeholder partners.

Based on the figure 1, the relationship between the two functions is necessary so that the relation is able to provide the ease of sharing data and distribution of goods will be out to incoming companies. Aware of the close link between the implementation of the technology, the business processes including corporate function, an enterprise requires a planning approach that can provide a draft corporate strategy known as enterprise architecture. But in 2016, PT INTI changes the business focus into manufacturing business, where the Procurement and Logistics division was separated and turned into two divisions they are, Procurement division and Material Management division. By this change, it can be seen that PT INTI has already had Enterprise Architecture that is used to perform the analysis and design of the company's structure. Due to this changes, activities in each division is already good, but in allocating some activity is still lacking, because the PT INTI only apply one application that is SAP Materials Management.

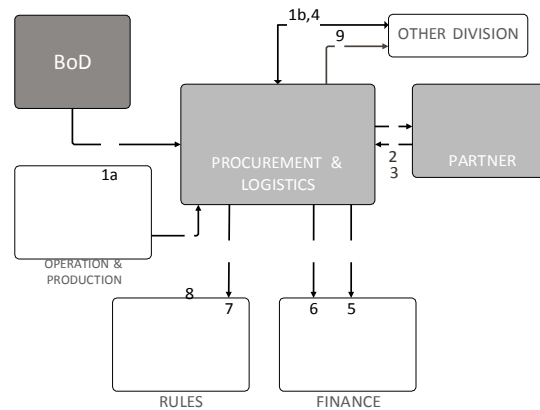


Figure 1 Relations Between Functions (Business Process in 2014-2016 of PT. INTI)

Due to the lack of some function allocation, this study would like to suggest a new application that is Material Execution System of Material Management (MES-MM). The purpose of this application is to add the control and maintenance against the purchasing and inventory functions, where on previous applications are still not applied properly.

2. Literature Review

2.1 Enterprise Architecture

Based on quotations book Enterprise Architecture at Work Modelling Communication and Analysis in revealing that architecture is the fundamental organization of a system embodied in its components which have a relationship to each other, and the relationship to the environment, as well as the existence of a principle of design guidance and evolution. More succinctly the architecture can be defined as a structure with a vision that means an architecture providing a fully integrated system that will be created or studied [2].

As for the enterprise has a definition as any collection of organizations that have a common set of goals. Architecture at the level of entire organizations are often referred to as enterprise architecture, enterprise architecture which means is one unified whole of principles, methods, and models used to design and realization of an organization's structure within the company, business processes, information systems and infrastructure [2].

2.2 Material Execution System

Manufacturing Execution Systems (MES) can be defined as dynamic information systems that drive effective execution of manufacturing operations [3]. In most manufacturing environments, an MES is essential for providing the manufacturing-specific functionality companies need to gain greater control and visibility at the shop floor level- far beyond the functionality that ERP/MRP systems provide. However, some of the larger ERP/MRP solution providers have identified this "gap" in their offering and have incorporated MES-related capabilities in an attempt to offer this specialized functionality. Utilizing a centralized database, the foundational capabilities delivered by a quality MES system include the full range of integrated functionality manufacturers need to effectively control, monitor and manage all phases of the electronics assembly process [4]:

- a. Materials management- including inventory and warehouse management,
- b. Pre-production- control including kitting, offline and online setup verification and work-in-process tracking,
- c. Production control- including scheduling, programming, optimization and assembly modeling,
- d. Materials traceability- from the work order level to the circuit level,
- e. Process traceability and control- including process definition and enforcement, and multi-level routing,
- f. Quality management- from quality and defect data collection for automated equipment and manual processes, to support for repair and returns processing,
- g. Visibility- including real-time information access and visibility across the production process.

2.3 The Open Group Architecture Framework (TOGAF)

TOGAF in its Enterprise Edition remains what it has always been, namely an architecture framework - a set of methods and tools for developing a broad range of different IT architectures. It enables IT users to design, evaluate, and build the right architecture for their organization, and reduces the costs of planning, designing, and implementing architectures based on open systems solutions. The key to TOGAF remains a reliable, practical method - the TOGAF Architecture Development Method (ADM) - for defining business needs and developing an architecture that meets those needs, utilizing the elements of TOGAF and other architectural assets available to the organization [5].

On the TOGAF, there is a domain that is the phase and mutually closely related on a enterprise architecture, where it will be used as the scope of work, they are [6]:

1. Preliminary Phase
2. Phase A – Architecture Vision
3. Phase B – Business Architecture
4. Phase C – Information Systems Architecture
5. Phase D – Technology Architecture

6. Phase E – Opportunities and Solution
7. Phase F – Migration Planning
8. Phase G – Implementation Governance
9. Phase H – Architecture Change Management
10. Requirements Management

2.4 SAP (Systems, Application, & Products in Data Processing)

SAP ERP software is a product that has the ability to integrate a wide variety of business applications where each application represents a specific business area. [7]. SAP ERP provides several modules that can be used as a business solution for the company, including sales and distribution, materials management, production planning, quality management, plant maintenance, human resources, financial accounting, controlling, asset management, and project system. The selection of SAP ERP in the research based on the capabilities of SAP ERP modules that can provide production planning which can serve as a solution to existing problems, as well as SAP ERP is perfect for companies who have business process that its complexity is very high.

3. Research Methodology

3.1 Conceptual Model

A conceptual model is a structured design which contains concepts which mutually interconnected and organized. Conceptual model also gives the order to think, give a direction of research as well as demonstrate a work a round. Figure 2 in appendix, will show the description from this research. In the processes research, method used based on phase in the TOGAF framework. Here is the explanation of the enterprise architecture planning gradually:

A. Business Architecture

In this phase, conducted an analysis of the existing business. Analysis of existing IT Master Plan, which will then proceed with the design for the target architecture.

B. Information System Architecture

1. Data Architecture

In this phase, conducted an analysis of the data used in the applications used by the company.

2. Application Architecture

In this phase, conducted an analysis of the existing application. The analysis includes how performance related Division against the application.

C. Technology Architecture

In this phase will be conducted an analysis of the network infrastructure that is used by the company. Infrastructure that analyzed include LAN and WAN and Data Center.

D. Opportunities and Solutions

In the phase of opportunities and solutions would be obtained as a road-map as a long-term plan that will be used for seven years.

Based on four of the process, it will be invalidated, the target of enterprise architecture. Otherwise it will be invalidated, the GAP analysis also between Existing architecture and target architecture.

3.2 Systematic Research

Systematics research was created as a proposal made in summary in the form of a diagram. Systematics is created by using a clear plot and describe the aspects that will be carried out in this study. Figure 3 in appendix, will show the description from systematic research.

- A. Preliminary Phase – in this phase is the initial phase is done in doing this research, where it defines the entire preparation with regard to research.
- B. Analysis and Design - At this stage will be conducted identification process against the input of research in the form of the identification of the vision and mission and identification of business objectives of the PT. INTI.
- C. Target EA Phase - In Target EA phase activities conducted will result a target, GAP analysis, and IT Roadmap.
- D. Closing Phase - The last phase in the study was a phase of conclusion and advice. In the conclusion part contains conclusions from the results of the entire blueprint architecture has been done on this research. In the section on advice contained suggestions that were given to help the Organization in doing the assessment in its performance.

4. Result and Discussion

4.1 Result

The results obtained from the design of the enterprise architecture is :

1. Application Architecture

In this phase it is achieved the target architecture in the form of a new application that is Manufacturing Execution System for Materials Management (MES-MM). The implementation of this application is based on the results of the analysis of the existing architecture. Based on the results of the analysis, on the use of

previous application, that is SAP-MM there are still deficiencies in the management of inventory and also cost management. On the target architecture is done adding sub-module from MES-MM. Table 1 shows the relationship between logical application and physical application for existing applications and target application with the service system provided by the application against the Division of the company.

Table 1 Application Portfolio Catalog

Logical Application Component	Physical Application Component	Information System Service
Purchasing	SAP- Material Management	Procurement & Material Management
Inventory Management		
Invoice Verification		
Physical Inventory		
Material Resource Planning		
Inventory Monitoring	MES- Material Management	Material Operations Management
Procurement Control		
Distribution Control		

Yellow marks in the table shows the application on the target architecture. The application of MES is done on two divisions namely, Procurement division and Material Management division. The application of MES focuses on Monitoring Inventory, Distribution Control and Procurement Control. The selection of MES application based on the activity module that exists in there. In manufacture company the dashboard module is required, which is used for monitoring activities are ongoing. The application of MES is an application that provides a dashboard module, which corresponds to the existing problems in PT. INTI. In the selection of applications, used the analysis comparisons with other application Materials Operation, for example Factory logix and SAP ME. Table 2 shows the comparison between the third application.

Table 2 Technology Comparison

Comparison of Features Application	Opera MES	Aegis Factory Logix	SAP ME
Integration Process	V	V	V
Time Management	Provide status real time (real-time shop floor, real-time data)	Save Time, Simplify the New Product Introduction (NPI) Process and Eliminate Chaos	Real-time manufacturing data to make quick and informed decisions
Direct Connection to Device	X	V	X
Dashboard Module	V	V	X
Module Integration	V	V	V
Monitoring Feature	V	V	X
Simpler Implementation	V	X	V
Transactional Module	X	V	V

Based on the above comparison can be seen, that the application of MES who focus solely on the dashboard module. It can be concluded that with the focus of an application, then the expected performance given can satisfy and correspond to the functions in the Procurement Division and Material Management Division.

2. Technology Architecture

This was done on phase analysis of infrastructure network in PT. INTI. In general, PT. INTI using two areas in the implementation of the network, IE the LAN and WAN.

a) Local Area Network (LAN)

LAN on PT. INTI using fiber optic converter that connects the two buildings in the head quarters area, they are Gedung Kantor Pusat and Gedung Pusat Teknologi. On the target architecture, there is the addition of network parameters for LAN infrastructure, namely the DMZ Area (De-militarized Zone). The addition of this network into to provide security the firewall on the server of the company especially on the network LAN. Application of the DMZ is only done if the company wants to conduct a segmentation of the network, or extend the installation of the server. Figure 4 shows a depiction of the infrastructure targets in PT. INTI.

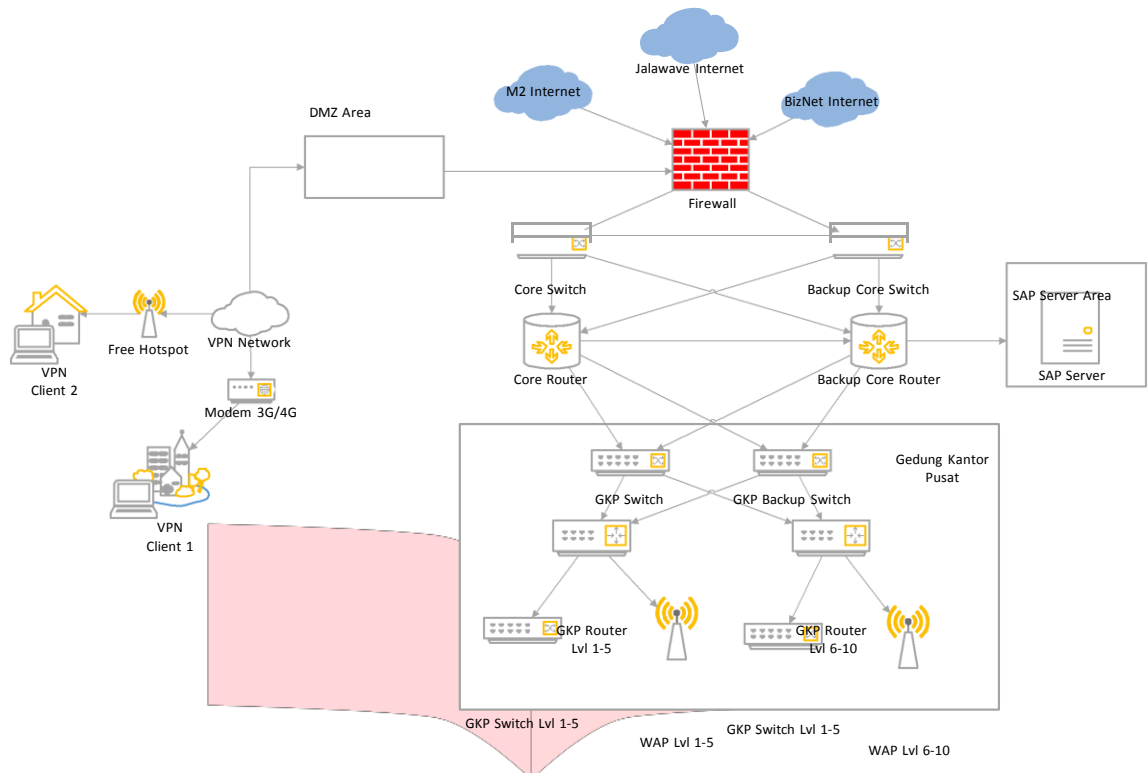


Figure 4 Local Area Network (Target Architecture)

In the image above, looks that PT. INTI has three main server, they are SAP Servers, Production servers, and VPN servers. Therefore it takes a seat for the Area as a DMZ webserver. Because of the existence of the DMZ Area then, limited access rights are applied, both for private LAN or public area. With the existence of the DMZ area then any incoming data on exit activity network will be filtered through the firewall.

b) Wide Area Network (WAN)

On the area of WAN network additions done to Factory. Where is the PT. INTI company of that will develop the manufacturing activity in the corporate plan. On WAN targets, will be installed a network that relate to new applications i.e. MES-MM. networks are made, will connect the Factory server MES with that of the head office. Figure 5 shows the WAN infrastructure targets.

From figure 5, can be seen if the Factory can be connected to the building for get the data access activity from Gedung Pusat easily. In WAN Target, there is replenishment for network infrastructure, it is a VPN network that is directly connected with the internet and directly connected to the Factory. On Factory networks connected by MES Distribution, which consists of Routers and Switches Distribution. Routers and switches are used as connecter for data that comes from a Central Office, which will then be processed in the Engineering Workstation. At the Factory there is a MES Server that used for access control to the network and its resources and provide access to the network members work station (Kantor Pusat). In addition, there are also APP Servers clients who aim to access the services provided by the server and its associated with the MES-Materials Management application.

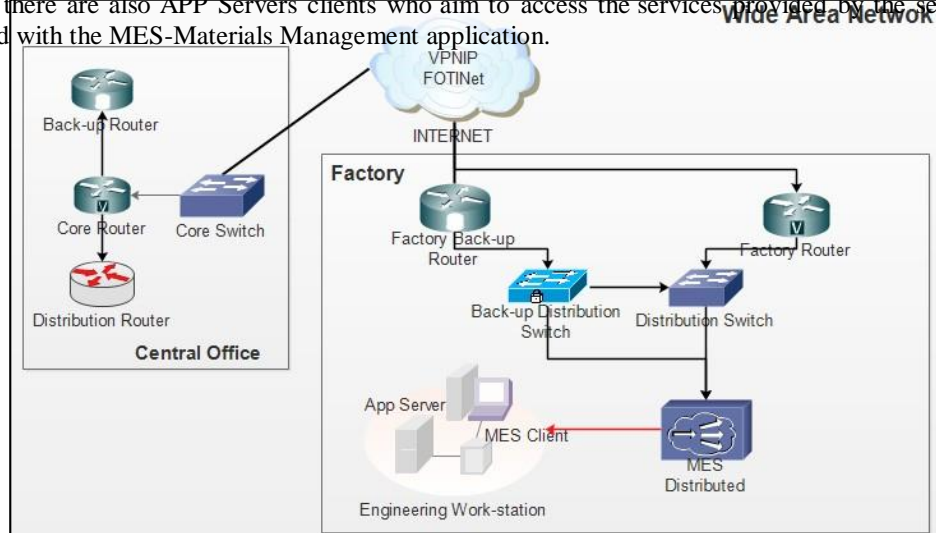


Figure 5 Wide Area Network (Target Architecture)

4.2 Discussion

In this study, data gathering technique used is a direct interview techniques to staff and head of the Division Sales and Marketing Support Division PT. INTI. This technique is at the stage of Identification and Analysis of Baseline Enterprise Architecture. Interview conducted aim to find out how the business process and existing problems on PT. INTI.

The next step is Designing Baseline EA. At this stage will be conducted from three baseline architecture design that is Business Architecture, Information System Architecture (Data and Application) and Technology Architecture. In doing the design architecture, data and information obtained comes from the existing Master Plan IT. Analysis of existing architecture it will be invalidated, problems occurred at PT. INTI.

Next entry in the Target phase of Enterprise Architecture. At this stage it brings some of the target architecture is based on an analysis of the problems found in the PT. INTI. Problems compiling, include three architecture, they are Business, Application and Technology.

1. Application Architecture, application of new application to support the performance of Materials Controls Management
2. Technology Architecture, made the application of the DMZ Area as a new network and network security to factory

The process ends at the design making IT road-map used for a period of seven years. On the road-map IT happened IT infrastructure development and also the MES Preparation. This is done so that the company can develop enterprise architecture so that it can continue to provide the best results.

5. Conclusion and Suggestion

The conclusion that can be drawn from this study is as follows :

1. The design of enterprise architecture in this study using framework TOGAF ADM and focusing on the four phases of architecture (business, data, application and technology) which produces several artifacts such as matrices, catalogs and diagrams of each architecture.
2. Based on the analysis that has been done on phase :
 - a. Business architecture, there are changes in the Organizational Structure, whereby PT INTI adds new Division, that is Material Management Division. This division serves as a control and monitoring activities to the partner.
 - b. Information System Architecture, because of the data in SAP-Materials Management is still not filled all the modules, so the enterprise need application that make filled all the modules. One application for material management, that is Manufacturing Execution System (MES) which available in SAP Application and help to fill all the modules.
 - c. Technology Architecture there are addition of storage media like cloud that is used as the overall data storage of PT INTI.
 - d. For IT Road-map, it has evolution for seven years later, whereby during the time it has preparation for MES-MM application until implementation.

And the suggestion for this study is this study only up to Phase E Opportunities and Solution in TOGAF ADM, is expected to further research can proceed to the next phases based on TOGAF ADM.

References

- [1] B. Dictionary.com, "<http://www.businessdictionary.com>," [Online]. Available: <http://www.businessdictionary.com/definition/information-technology-IT.html>.
- [2] M. Lankhorst, *Enterprise Architecture at Work*, Berlin Heidelberg: Springer, 2009.
- [3] J. Kletti, *Manufacturing Execution System - MES*, Berlin Heidelberg, New York: Springer, 2007.
- [4] R. Boguski and M. Holzmann, "Manufacturing Executions Systems Vs. ERP/MRP," *The Global Assembly Journal for SMT and Advanced Packaging Professionals*, vol. 11, pp. 11-12, 2011.
- [5] W. W. Keller, *TOGAF 9.1 Quick Start Guide for IT Enterprise Architects*, Berlin: All Rights Reserved, 2009.
- [6] The Open Group, "pubs.opengroup.org," The Open Group, 2009-2011. [Online]. Available: <http://pubs.opengroup.org/architecture/togaf9doc/arch/chap35.html>. [Accessed 23 February 2016].
- [7] E. F. Monk and B. J. Wagner, *Concept in Enterprise Resource Planning Fourth Edition*, Boston: Course Technology, 2013.
- [8] *ITGovernance Indonesia*, 2014.

LAMPIRAN

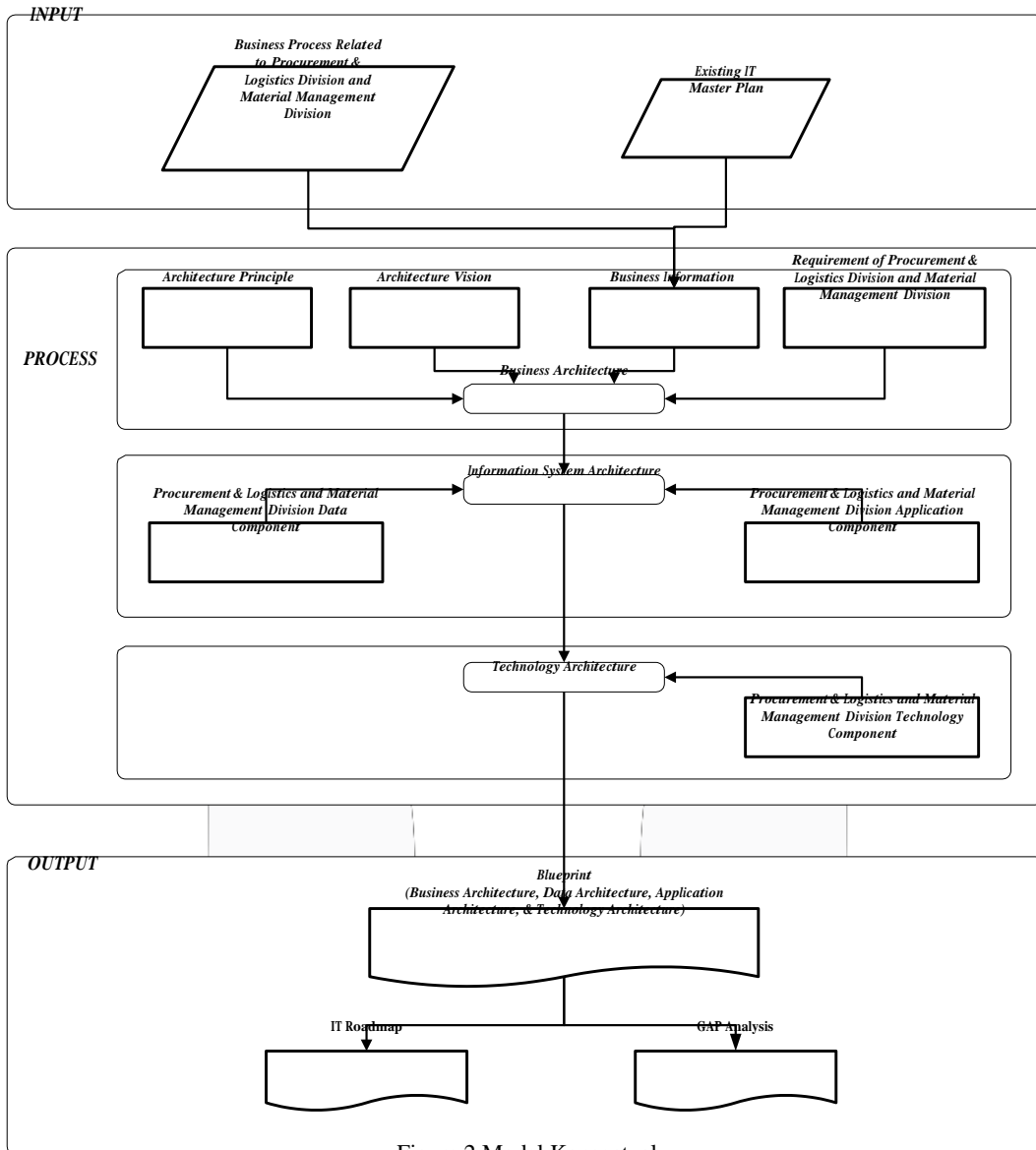


Figure 2 Model Konseptual

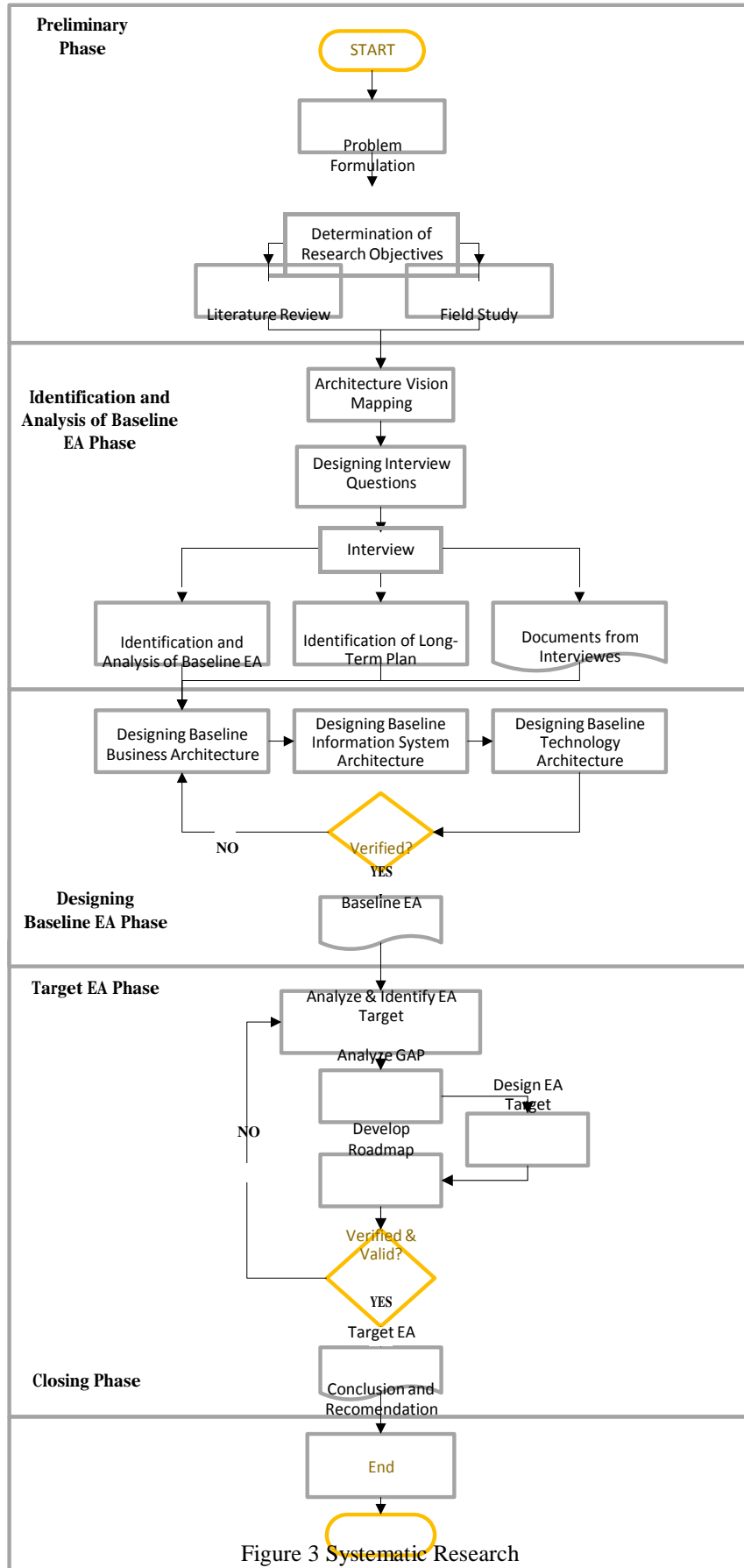


Figure 3 Systematic Research

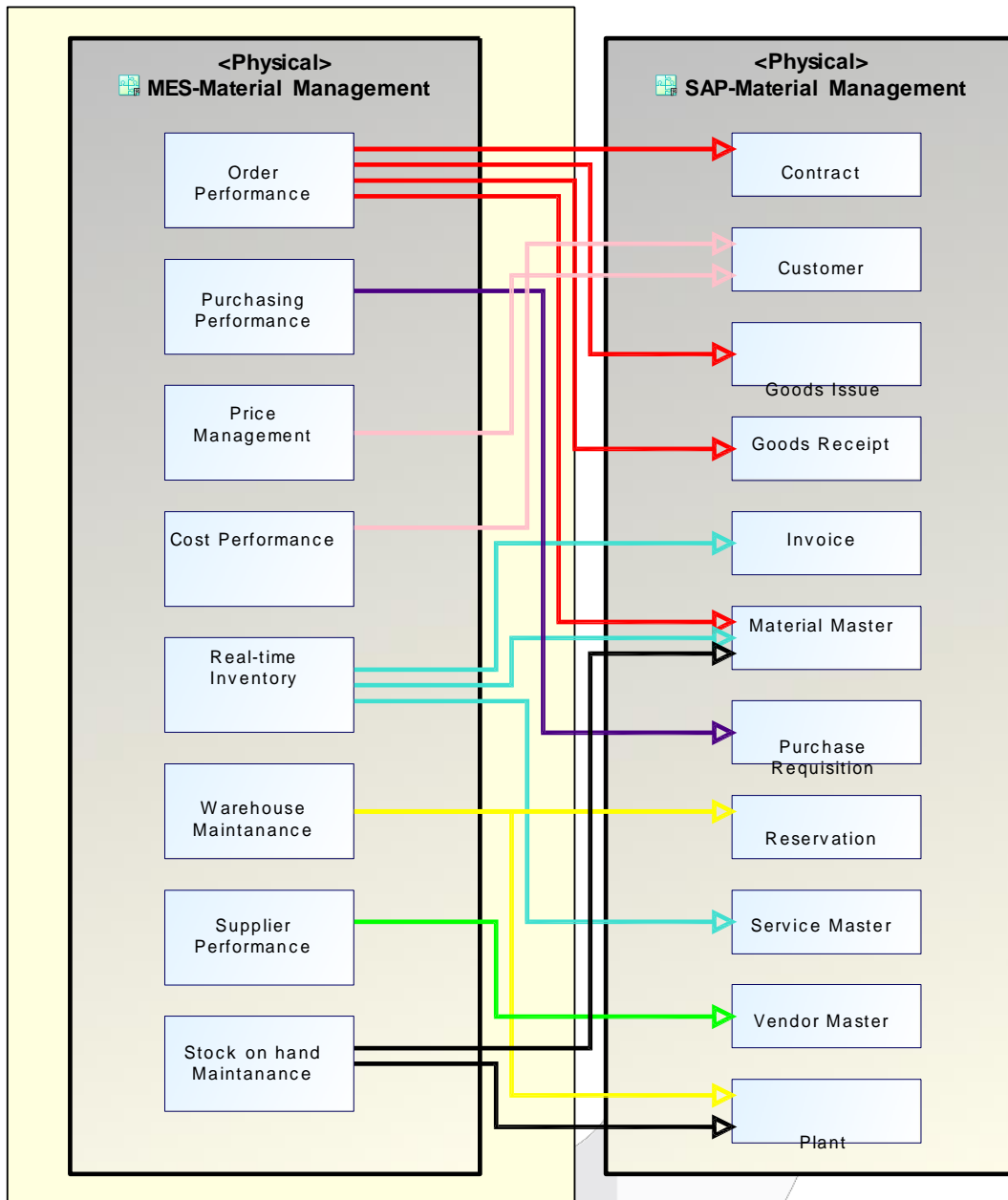


Figure 6 Application Communication Diagram