

Enterprise Architecture Landscape using Zachman Framework and Ward Peppard Analysis for Electrical Equipment Export Import Company

Johanes Fernandes Andry^{1,*}, Lydia Liliana¹ and Aziza Chakir²

¹Universitas Bunda Mulia, Jakarta, Indonesia

²Hassan II University of Casablanca, Casablanca, Morocco

(*Corresponding author's e-mail: jandry@bundamulia.ac.id)

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Abstract

Companies have begun to use Information Technology (IT) to fulfill the demands of technology and business development as IT has progressed in terms of data processing and distribution. The largest electrical equipment export-import firm in Indonesia is one of the enterprises that uses information technology. The current business processes have not widely implemented strategic Information Technology/Information Systems (IT/IS) and integrated systems with each other. Enterprise Architecture Landscape is also needed for the application of information technology and information systems. The goal of this research is to develop an enterprise architectural landscape utilizing the Zachman framework in conjunction with the Ward and Peppard framework. The research method used involved literature studies, data collection, internal business analysis using Value Chain and Critical Success Factor (CSF), external business analysis using Political, Economic, Social, and Technological (PEST) and the Five Force Model, resulting in IT/IS. The strategy used in the mapping of enterprise architecture and IT portfolio proposals is McFarlan Strategic Grid. The research yielded an enterprise architectural landscape based on the Zachman framework, which has been translated into its appropriate lines and comprises of business-oriented (considerations, visions, outlines) and information technology (IT) focused components (standards, landscapes, designs). These results can help electric trading firms create and deploy information technology and information systems that will help them accomplish their vision and purpose.

Keywords: Blueprint, Enterprise architecture, Zachman framework, Ward and Peppard framework

Introduction

When used properly, information technology may provide a company a competitive value and even allow it to develop quickly [1,2]. Most business operations rely heavily on utilizing Information Technology/Information System (IT/IS) which enables a company or organization to achieve its business strategy [3,4]. The right IT/IS strategic planning can support plans to improve the work efficiency of various information management processes as well as increase competitive advantage [5,6]. Almost all companies have implemented IT/IS, but there are still many gaps. The implementation of IT/IS is not yet accurate and aligned in supporting business activities due to inadequate strategic planning.

A mature IT/IS application requires a mapping of the enterprise architecture landscape that contains the company's strategic plan in which there are guidelines for the company's information system requirements. The development of a good enterprise architecture landscape can support business processes that provide quality data or information to reduce costs, increase productivity and improve customer service [7]. Data integration in a large-scale company is important [8]. To reduce this gap, it is necessary to plan for the improvement of business processes and technology design, such as information, applications, and networks to improve the ability to manage the company [9]. Enterprise Architecture development requires a framework [10,11] that can be used to develop enterprise architecture, namely the Zachman framework [12]. A good enterprise architecture design can create harmony between information technology and business needs for managerial activities in an organization [13,14]. Companies are required to quickly adapt to the situation of information technology developments in their current business processes [15,16].

The electrical equipment export-import company provides a complete and integrated solution with 3 independent electricity distributors in 7 major countries in Asia, one of which is located in Indonesia. The company has implemented IT/IS to support business processes, but there are problems in terms of data collection, requests for leave, and attendance and bug handling, so it is necessary to create an enterprise architecture landscape to improve business and implement technology. Based on this description, this research focuses on creating an enterprise architecture in the form of an enterprise architecture landscape using the Zachman framework in combination with the Ward Peppard analysis. The Zachman framework was chosen because it is a tool that provides a formal and structured complete picture of enterprise [17,18] while the use of Ward Peppard was chosen because it describes the results of internal and external analysis from the business to technology side [19,20]. The output of the strategy process consists of 3 groups, namely business strategy, management strategy, and IT strategy which are used to map the proposed application portfolio [21]. Ward Peppard's analysis method used is the Value Chain, CSF, PEST, and Five Force Model to analyze the internal and external business environment, so that the resulting IT/IS Strategy is used in the mapping of enterprise architecture and the McFarlan Strategic Grid. The results of this study are in the form of an enterprise architecture landscape with the Zachman framework that is spelled out in each line and consists of business-focused (considerations, visions, outlines) and IT-focused (standards, landscapes, designs) that can help electrical equipment export-import companies develop and implement IT/IS to achieve the company's vision and mission.

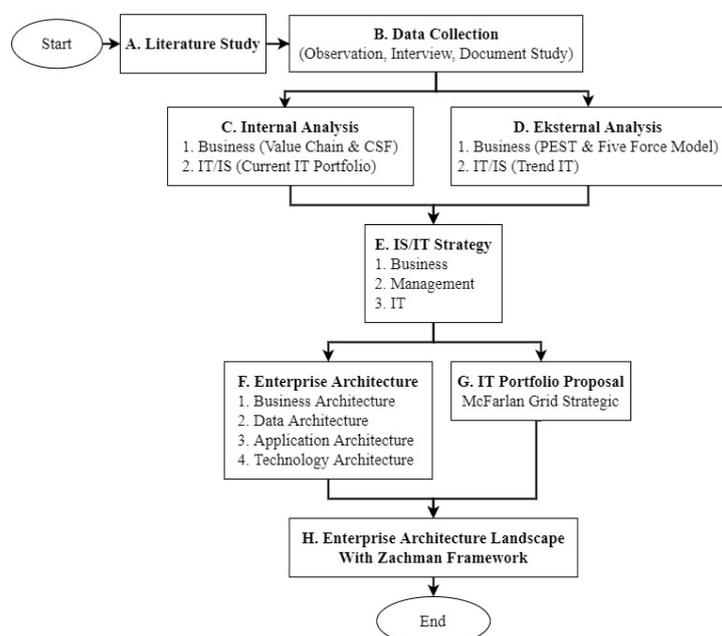


Figure 1 Research stages [22,23].

Materials and methods

The research methodology used in this study is shown in **Figure 1** Research Stages [24,25].

A) Literature Study - comprehending the problem and determining the scope and objectives of the research. The author designed a blueprint using the Zachman framework in the form of an enterprise architecture landscape.

B) Data Collection - collecting data on company business processes, main and supporting activities by conducting interviews, direct surveys to research sites, and company documents.

C) Internal Analysis. The business side used the Value Chain and CSF (Critical Success Factors), and from the IT/IS side sees the current IT portfolio.

D) External Analysis. The business side used the PEST and Five Force Model, as well as from the IT/IS view of IT trends.

E) IT/IS Strategy. On the business side, each function in the business unit took advantage of IT/IS. The management side ensured harmony in implementing IT/IS. The IT side dealt with the procedures for technology and human resource management.

F) Enterprise Architecture. The Zachman framework focuses on mapping business architecture, data architecture, application architecture and technology architecture.

G) IT Portfolio Proposal- mapping the proposed applications based on contributions by classifying them into the Strategic, High Potential, Key Operational, and Support quadrants.

H) Enterprise Architecture Landscape with the Zachman framework. The output is a description of the development strategy from the business side (consideration, visions, outlines) and the IT side (standards, landscapes, designs) which can be used to improve the company's vision and mission.

Results and discussion

Literature study

The problems experienced by electrical equipment export-import companies are loss of data due to the process of inputting new products to the system which makes users repeat from scratch, long waiting times in data processing, bug handling is not resolved for months. In addition, the company does not have documentation in terms of human resources. The research scope focuses on mapping the enterprise architecture landscape from a business perspective using value chain analysis, critical success factor, PEST, and Five Force Models. Apart from the business side, mapping also focuses on the information technology side by analyzing the current technology used by companies and information technology trends. The results of the internal and external analyses are carried out in the form of an IT/IS strategy from the business, management, and IT side that will be used to design the enterprise architecture and IT portfolio proposals. This study aims to solve company problems by designing a blueprint in the form of an enterprise architecture landscape using the Zachman framework combined with Ward and Peppard's analysis.

Data collection

Data collection was carried out by direct observation to the company so that the current company business process documents were obtained. The sales department comes to the customer and the customer makes a purchase request. Sales check product availability to the company's supplier and wait for the supplier to provide a price list via email. After getting a price list, the salesperson gives it to the customer for negotiation. If the price has been agreed upon, the customer applies for a purchase order and records the finance section to make an information collection order. Customer orders are forwarded to the purchasing department and product orders are made to suppliers. The supplier sends the product to the company and repacked it before sending it to the customer. Products are sent using the company's goods car and if the customer has received the product, the customer pays immediately. The finance department creates a paid product invoice and an invoice for product purchase payments to the supplier.

Internal analysis

A. Business

The following are the stages of mapping the internal business side of the electrical equipment export-import company:

Value Chain

The main activity currently that occurs between suppliers and companies (inbound logistic) is in the form of ordering products by email or telephone according to the price offered by the customer and the supplier sending invoices that must be paid. The catalog provided by the supplier has been explained the product specifications and brands. If there is a problem with the product, the company can file a complaint about a product exchange solution. In the company's operation process, before sending the product, the salesperson looks for the customer, the customer gives inquire, checks inquire from the supplier, gets the price from the supplier then provides a quotation to the customer, bids the price with the customer, the customer makes a purchase order then the company will issue a purchase order to the supplier, deliver products, and create invoices to suppliers and customers. The outbound logistic stage, namely the delivery of goods to consumers. The product is put into the freight car and the driver delivers the product to the delivery address. After arriving at the destination address, the driver provides a road letter for the recipient's signature and invoice. For the marketing and sales stages, it is done through a system of connections, recommendations, direct offers, and direct negotiations. Services provided by the company, in the form of guarantee on time, guarantee of goods until safely, security and the best product productivity standards in the world, can provide an explanation of the correct product application and help find the right solution for various problems.

In the company’s current supporting activities, the firm infrastructure that supports the business is product storage warehouses, parking lots, and office buildings. In human resource management, it deals with recruitment, selection and placement of employees, employee training, payroll, giving sanctions and rewards. The technology development currently used by the company is Microsoft Word for writing letters, Microsoft Excel for invoicing and bookkeeping as well as disseminating information via email and phone. Procurement is used to help business processes, such as delivery cars, office stationery, computers, and fuel.

Critical Success Factors (CSF)

CSF analysis is needed to determine the factors that influence the success and success of the company. The following is a CSF analysis mapping, shown in **Table 1** Critical Success Factors.

Table 1 Critical Success Factors (CSF).

Main purpose	Critical success factors
Quality of Products Produced	Check product functionality that arrives from the supplier. If the product has a problem, you can immediately file a complaint. The company carries out packaging and product functionality tests to function properly.
Services to Customers	Provide product information quickly and accurately. Make it easy for customers to place an order through a sales application. Make it easy for customers to supervise the delivery of products purchased. Facilitate complaints or customer service complaints to customers.
Marketed Product Prices	Able to negotiate with suppliers who work with companies to provide the lowest prices with good quality of products purchased by the company. Conduct market surveys of products being sold by looking at competitors' prices.
Company Resources	Implement product stock processing to make it more accurate. Provide training to human resources in utilizing technology.
Technology Used	Applying technology for salary management and leave application. Apply technology for ordering products to suppliers. Implement debt payment technology and record important dates.

Based on **Table 1**, an important factor is determined in the success of the company, in the form of the quality of products produced, service to customers, the price of products marketed, company resources, and the technology used.

B. IT/IS

The stages of mapping the information technology side of the electrical equipment export-import company using the McFarlan Strategic Grid. Currently, companies only use Microsoft Office to support the company's business processes, which are included in the support quadrant.

External analysis

A. Business

The following are the stages of mapping the external business side of the electrical equipment export-import company:

1. PEST Analysis. The following is the PEST Analysis that affects the electrical equipment export-import company business process:

a) Politics. The following describes the political factors that affect the company's business processes:

- Law No. 7 of 2014 concerning trade contains the terms of industrial trade.
- Law 30 of 2009 concerning electricity.

b) Economy. The following describes the economic factors that affect the company's business processes:

- Public interest is good enough to choose to use electric tools from the company because of the varied production.
- Consumption from various sectors is a strong pillar of economic growth in line with the high purchasing power of the people. Opportunities that can be obtained are increasing the number and value

of consumer spending purchases, while the challenge faced is the determination of the selling price of goods that must be dynamic.

c) Social. The following describes the social factors that affect the company's business processes:

- The need for various types of electrical equipment is getting higher because of the number of companies that have been established to increase customer satisfaction.

- Increased population, the number of households, and income per capita of Indonesian society. Opportunities obtained are an increase in the number of consumers due to an increase in population and the challenge faced is the need to provide some variations in products and prices.

d) Technology. The following describes the technological factors that affect the company's business processes:

- The adaptation process for employees in dealing with new technology, such as training in operating technology to support the company's progress.

- Many companies have successfully implemented technological developments to support their business activities and create a competitive advantage. Companies must be able to keep up with technological developments to stay on a safe path in competition with competitors.

2. Five Force Model. Analysis of business development strategies is not only about internal analysis, but also external analysis. The following is Five Force Model Analysis:

a) Threat of New Entrants. The threat of new competitors in this industry is low because it requires a large amount of capital in this company, starting from purchasing quality products to suppliers to create good quality for customers. The company has loyal customers of the company's products from various sectors and has also operated in Asian countries, such as Singapore, the Philippines, Thailand, South Korea, China, and of course in Indonesia. The large capital requirement is also an obstacle to the entry of new competitors. To open this company requires a capital of around Rp 2,000,000,000.

b) Rivalry Among Existing Competitors. There are 200 companies engaged in the same industry causing competition in sales. The company guarantees a proven track record of success and offers Design, Engineering, and Integrated Solutions with Global Best Practice Quality Assurance.

c) Threat of Substitute Product or Services. The development of increasingly qualified research poses a threat to the development of substitute products in the form of generators. Although several companies use UPS and generators together, there are also companies that prefer to use generators because the cost required is much cheaper.

d) Bargaining Power of Buyers. The buyers of company products come from various large companies/wholesalers spread across several company sectors. The market share of this company is quite large because almost every region requires electric tools. The number of customers who are regular customers of the company is spread across various sectors.

e) Bargaining Power of Suppliers. The company works closely with many electrical distributors who have more than 100 years of experience to ensure the best supply and price for customers. Supplier selection is seen from payments that do not have to pay in cash before 90 days. The way companies choose suppliers is by offering good quality products at low prices. When a supplier provides a price quote, the company also negotiates a price reduction.

B. IT/IS (Trend IT)

The following are the stages of mapping external IT trends from the electrical equipment export-import company:

a. Hardware Technology. Perform maintenance so that hardware components are not easily damaged, such as protecting hardware from extreme temperatures (overheating) and data backup.

b. Software Technology. Applications/software used by companies helps work faster, such as Microsoft Office for invoicing, travel documents, and recording raw materials in warehouses.

c. Operating System Technology. The operating system used is Microsoft Windows 7 and Windows Server licensed to avoid errors/bugs.

d. Infrastructure Technology. The infrastructure technology used is a LAN to make it easier for one computer to another or to a server to easily connect. Use a router on each LAN cable and the computer will be connected to the router.

C. IT/IS strategy

Based on the analysis that has been done, it can be determined the business strategy, management, and Information Technology (IT) in the electrical equipment export-import company. The IT strategy can be broken down into application architecture and technology architecture when mapping the enterprise architecture.

1. Business Strategy. Based on the analysis done on the internal and external environment of IT/IS, a business strategy is obtained:

- Create mobile-based sales applications to expand online sales.
- Create a company website to provide company profile information and promote products.
- Create a tracking application to make it easier for companies to monitor product shipments.
- Create a Finance Application helps with letter printing, bookkeeping to product invoices.
- Create an Inventory Application to record stock of goods.
- Create an E-Procurement Application for the process of purchasing company needs, the supplier selection process, and the negotiation process with suppliers.
- Create HRIS to help payroll and manage leave.
- Create an Event Reminder List Application to manage debt payments and record important dates.
- Provide training to existing human resources regarding IT/IS.
- Add skilled human resources related to IT/IS.
- It is necessary to increase the security of information systems such as data backup and maintenance regularly.

2. Management Strategy. Based on the analysis that has been carried out on the internal and external environment of IT/IS, the current management conditions are obtained with the proposed IT/IS management strategy.

- Making IT/IS development guidelines or directions contained within the company, such as designing SOPs during development to regulating IT/IS when implemented or executed within the company.

- Planning the budget that will be issued for updating IT/IS proposals.

- Establishment of a division and job description in the IT/IS field.

3. IT Strategy. Based on the analysis that has been done on the internal and external environment of IT/IS, IT strategies are obtained.

- Perform data processing and business processes (sales) within the company by utilizing IT/IS.
- Promoting company products (advertisements, etc.) by utilizing IT/IS (social media, websites, electronic advertisements, and others).
- Increasing IT/IS which can be used to manage management within the company.
- Increased knowledge in IT/IS in company resources.

Enterprise architecture

At this stage, an enterprise architecture mapping will be carried out. The focus of the mapping is seen from the business side (business architecture), the management side (data architecture), and the information technology side (application architecture).

1. Business Architecture. Explain new value chain proposals for future business processes.

a) Inbound Logistics. There has been a change from the process of purchasing products and supporting goods to suppliers through the application, the process of receiving products and equipment with the application and viewing a list of debt payments and important dates through the application.

b) Operation. There is a significant change from the way marketing currently uses the application, checking product stock, purchasing order processes through the application, completeness of the truck with GPS, and making bills to report using the application.

c) Outbound Logistics. Customers can monitor the products sent by the company, giving bills and digital travel documents.

d) Marketing and Sales. The change was seen from the use of the company profile website and sales application, but the connection system, recommendations to direct negotiations were maintained.

e) Services. The addition of services in the form of customer service to the handling of complaints from customers.

f) Firm Infrastructure. Additional data server space and other supporting infrastructures for IT/IS.

g) Human Resource Management. The process of paying and taking time off uses the help of an application that details the details.

h) Technology Development. Email and phone facilities are still maintained, then the addition of the proposed application, namely the company profile website, sales application, e-procurement application, finance application, HRIS, inventory application, tracking application, event reminder list application.

i) Procurement. This change can be seen from the addition of GPS and IT/IS equipment in the form of cables, internet connections.

2. Data Architecture. Describe the process of identifying and designing the architecture according to the data requirements of the company's business processes. Seven business entities are focused on supporting business processes, namely:

- Marketing, with the required data entities such as message data, article data, product data, and account data.
- Sales, with the necessary data entities such as sales data, account data, inventory data.
- Procurement, with the required data entities such as supplier data, inventory data, and data accounts.
- Finance, with the required data entities such as sales data, buy products from supplier data, and data accounts.
- Human Resource, with the necessary data entities such as employee performance data, salary data, employee leave.
- Product Stock Storage, with the necessary data entities such as inventory data, data accounts, procurement data.
- Product Shipment, with the required data entities such as driver data, address data, date and time data.
- Event Reminder, with the required data entities such as account data, debt payment data, important date data.

3. Application Architecture. Explain the identification process and the list of applications used during the company's business processes as shown in **Table 2** Application Architecture. Eight applications will be proposed to the company to support business processes, so that application proposals are obtained, the relationship between applications and business functions, and the relationship between applications and the company.

Table 2 Application architecture.

Business process	Application code	Data entity
Marketing	App1	Company Profile Website
Sales	App2	Sales Application
Procurement	App3	E-Procurement Application
Finance	App4	Finance Application
Human Resource	App5	HRIS
Product Stock Storage	App6	Inventory Application
Product Shipment	App7	Tracking Application
Event Reminder	App8	Event Reminder List Application

4. Technology Architecture. Describe the definition of the technology used for the proposed application. The hardware specifications required are a TP-link SG108E switch, RJ45 network cable, fiber optic, Huawei HG8245H router, 2.4 GHz Intel Core I5 processor, 16 GB memory, 1 TB hard drive, Q150 motherboard, Canon IP2770 printer, and Intel Xeon E2124 PC server, RAM 8 GB, 1TB HDD.

IT portfolio proposal

This section will explain the results of the portfolio analysis of the 8 proposed applications in the application architecture using the McFarlan Grid Strategic.

Table 3 IT portfolio proposal.

	Key operational	Support
Strategic	Sales Application	HRIS
	Company Profile Website	
High Potential	Inventory Application	Finance Application Event Reminder List Application
	Tracking Application	
	E-Procurement Application	

Based on **Table 3** IT Portfolio Proposal, we get a sales application and company profile website that falls into the strategic, key operational quadrant because it supports the sustainability of future business strategies and can be used for operations. For the strategic quadrant, there is 1 application support, namely HRIS which can help support business sustainability in the future because it functions as payroll and taking leave so that it can be a support for the company's business processes. High potential quadrant, key operational there are 3 applications, namely inventory application, tracking application, e-procurement application because it can achieve success in the future. Inventory applications can help manage product stock, tracking applications improve service to customers by monitoring the products they buy, and while e-procurement can help companies buy products from suppliers and buy other goods. The high potential, support quadrant is filled with 2 applications, namely a finance application that can support accurate financial and billing reporting along with an event reminder list application to help record payment lists and reminders of important dates which can certainly support success.

Enterprise architecture landscape with Zachman framework

Enterprise architecture landscape mapping needs to be done to classify all EA artifacts into 6 general types, in the form of considerations, standards, visions, landscapes, outlines, and designs which are then grouped based on business-focused and IT-focused so that we know how to use, purpose, and benefits. All of these EA artifacts explain rules and conceptual considerations important for business and relevant for IT utilization.

Table 4 Enterprise Architecture Landscape.

	Rules	Structures	Change
Business Focused	Considerations Identified artifacts: Critical Success Factors (CSF), PEST Analysis Typical purpose: Help achieve policies, strategies, governance Expected benefits: Conceptual results that can be used in the future	Visions Identified artifacts: Current Value Chain Typical purpose: Help achieve a combination of business strategy and IT strategy Expected benefits: Optimizing the application of IT and business	Outlines identified artifacts: Proposed Value Chain, Data Architecture Typical purpose: Helps predict future proposed business processes Expected benefits: Optimizing the application of IT and business investment
	Standards identified artifacts: IT/IS Strategy (Business Strategy, Management Strategy, IT Strategy) Typical purpose: Achieve usage policies and procedures regarding IT Expected benefits: Reducing the risk of implementing and implementing IT costs	Landscapes identified artifacts: Current IT Portfolio, Trend IT Typical purpose: Help mapping IT infrastructure that will be proposed in the future Expected benefits: Resulting in the use of flexible information technology	Designs identified artifacts: Application Architecture, Technology Architecture, IT Portfolio Proposal Typical purpose: Assist in IT implementation based on business processes and architectural planning Expected benefits: Improve project results and services provided

Mapping the enterprise architecture, shown in **Table 4** Enterprise Architecture Landscape, can provide a clear, direct, and complex-based explanation of the concept of enterprise architecture and provide a clear description of the concept of enterprise architecture with the Zachman framework. EA artifacts depict in the organization to show all EA artifacts can be grouped based on what the EA artifacts describe and how the EA artifacts describe. EA artifacts can help with the description of objects from those more general to more specific, namely by determining global definitions that discuss the organization or its divisions, structures that describe the high structure of the organization or its parts, while seeking specific explanations as needed. For the organization, EA artifacts can help based on descriptions supported on business and information technology. In business-focused, it consists of 3 things, namely considerations focusing on identifying principles, policies, strategy architecture, and

conceptual data models. Visions focus on business structures that look at business activity models, the company's business processes. Outlines focus on changes that are applied to the business by offering solutions in the future. In IT-focused consists of 3 things namely standards in the form of rules that focus on the application of technology such as IT principles, data models. A landscape focuses on IT structures in the form of application portfolios, IT assets, and corporate technology models. Designs focus on changing technology by providing IT solutions for the future.

Conclusions

The Zachman framework and Ward and Peppard analysis are used to map the enterprise architectural landscape in this study. Data loss, long data processing wait times, bug management, and a lack of documentation in terms of human resources are all issues that electric equipment export-import firms face. It is necessary to map an enterprise architecture landscape to classify all artifacts into 6 general types so that IT / IS problems in the company can be resolved. The results obtained in this study are on a business-focused, part of the considerations, that the company must be able to formulate the principles of strategic success using Critical Success Factors and PEST analysis. The results of the company's CSF must focus on the quality of products produced, services to customers, marketed product prices, company resources, and technology used. In a PEST analysis, companies must pay attention to the application of laws, economic growth, increase in population, and developments in information technology. The visions section, allows companies to optimize the application of technology and business by analyzing the company's current value chain. The company still runs its business processes conventionally with the help of technology that is already used by many people. Value chain mapping is currently being carried out to achieve a combination of business strategy and IT strategy. As part of the outlines, companies should try to optimize their investment implementation by designing the proposed value chain and data architecture. The proposed value chain results in updates to key activities and support activities. Data architecture helps companies meet data requirements in producing proposed applications. The overall results of the outlines can help predict the proposed future business process.

The results obtained on IT-focused are on the standard part in the form of the IT/IS strategy. The business strategy is to make applications. Its management strategy provides guidelines for technology development. Its information technology strategy manages technology to solve internal company problems. Companies can reduce the risk of implementing and implementing IT costs. On landscapes, the company maps the proposed technology infrastructure by analyzing current IT portfolios and IT trends. Currently, the company only uses Microsoft Office to support its business processes. In addition, companies need to pay attention to IT trends in terms of software-hardware, information systems, and infrastructure in case of changes in the use of new technology. The design department makes the company try to improve project results and services to customers by designing application architecture, technology architecture, and IT portfolio proposals. The application architecture section produces 8 proposed applications, namely the company profile website, sales application, e-procurement application, finance application, Human Resource Information System (HRIS), inventory application, tracking application, and event reminder list application. The technology architecture produces the hardware components used for the proposed application. Then, in the IT portfolio proposal, we can find out which applications are strategic, high potential, key operational, and support for the company. If the company succeeds in implementing the entire enterprise architecture landscape, it can help implement the technology that has been created and overcome the company's current internal and external problems.

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