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Implementation of Cyber-Security Enterprise Architecture Food Industry in Society 5.0 Era

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Abstract: The application of Enterprise Architecture is an important topic in the development of the food industry in the Society 5.0 Era. Enterprise Architecture is used to integrate and optimize corporate information systems so as to generate higher business value. This study aims to evaluate the effectiveness of Enterprise Architecture implementation in improving the performance of the food industry in Era Society 5.0 and implementing Cyber-Security as a defense against the system to be implemented. This study uses a case study method by collecting data from several companies in the food industry. The data collected includes information about the implementation of Enterprise Architecture, business performance, and factors that influence the successful implementation of Enterprise Architecture. The results of the study show that the implementation of Enterprise Architecture has helped companies improve their business performance, especially in terms of operational efficiency, better decision making, and the ability to adapt to changes in the business environment. Factors that influence the successful implementation of Enterprise Architecture include management support, involvement of business users, and availability of resources. In conclusion, the application of Enterprise Architecture can help the food industry in Era Society 5.0 improve its business performance. However, the implementation of Enterprise Architecture must be accompanied by strong management support, greater involvement of business users, availability of adequate resources and adequate Cyber-Security. The novelty of this research is implementing Cyber-Security as protection in implementing Enterprise Architecture.

Keywords: Business User; Cyber Security; Enterprise Architecture; Era Society 5.0; Food Industry

INTRODUCTION

Enterprise Architecture (EA) is a strategic framework that enables organizations to align their business goals and operations with their information technology (IT) systems. The food industry is a rapidly growing sector that is constantly evolving, especially in the current Society 5.0 era, which is characterized by the integration of cutting-edge technologies, such as the Internet of Things (IoT) (Zhang et al., 2021), (Chen & Yang, 2020), (Prakash et al., 2022), artificial intelligence (AI) (Rejeb et al., 2022), and big data, into various aspects of society. PT. XYZ is a leading food industry player in the region, and they have recognized the importance of implementing EA to enhance their business capabilities and stay ahead of the competition. This case study will explore the implementation of EA at PT. XYZ, examining the challenges, benefits, and outcomes of the process. Through this case study, we will gain insights into how Enterprise Architecture can enable organizations in the food industry to optimize their operations, improve their customer experience, and drive innovation in the Society 5.0 era. Additionally, this study will provide a practical example of how a company can successfully

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implement Enterprise Architecture, offering valuable lessons for other organizations seeking to undertake similar initiatives.

The food industry or food industry is a complex and diverse sector that includes various activities related to the production, processing, distribution, and consumption of food products. The industry covers various segments such as agriculture, food processing, food service, food retail and food distribution. Agriculture involves the cultivation of crops and livestock, whereas food processing involves the transformation of raw agricultural products into ready-to-consume food products. Food service refers to the provision of food and beverages in restaurants, cafes and other eateries, whereas food retail involves selling food products in supermarkets, grocery stores and other retail outlets. Finally, food distribution involves the logistics and transportation of food products from producers to consumers. The food industry plays (Lopes et al., 2021) an important role in ensuring food safety and providing access to safe, healthy, and affordable food products for consumers around the world. The industry is also an important contributor to the economy, providing employment and income-generating opportunities for a wide range of stakeholders, including manufacturers, processors, retailers, and distributors. However, the food industry (Xie & Lin, 2019) also faces significant challenges, such as the need to ensure food safety and quality, address issues related to sustainability and environmental impact, and keep pace with rapidly changing consumer preferences and trends. As a result, the industry is constantly evolving, and businesses within the industry are looking for innovative solutions to address these challenges and remain competitive in the marketplace.

Figure 1. Food Production
Source: Google Image

Figure 1 is a series of food production processes before distribution to customers. The manufacturing process for processing raw materials into finished ingredients in the form of food requires a complex series of processes. Starting from the process of procuring raw materials to the stock warehouse. From the stock warehouse to the process of processing food into very complex food and ensuring that the production process runs every day without running out of stock of production materials. A series of food production processes prior to distribution to customers may involve several stages, including: Planning: The initial stage is planning in which the recipes and production procedures are set. At this stage, the food company will determine what raw materials are needed, how to process them, and what quality standards must be met. Procurement of raw materials: The next stage is the procurement of raw materials. Food companies must ensure that the raw materials purchased meet quality and food safety standards. Processing: After the raw materials are obtained, the next stage is processing, where the raw materials will be processed into finished products. At this stage, food companies must ensure that the

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processing is carried out correctly and in accordance with applicable food safety standards. Packaging: Processed food products will then be packaged in appropriate packaging. Packaging must guarantee product freshness, quality and safety. Storage: Once packaged, the food product will then be stored under proper conditions. Storage must pay attention to temperature, humidity, and cleanliness so that the product remains fresh and safe for consumption. Distribution: The final stage is distribution, where the food product will be distributed to the customers. Food companies must ensure that products are distributed in a timely manner, in the right conditions, and according to established food safety standards. During the entire food production process, food companies must pay attention to applicable food safety standards to ensure that the products produced are safe for consumption and meet government regulatory requirements.

From the description of the paper above, the research questions that can be used as a reference for research on "Enterprise Architecture for the Food Industry":

1. How can enterprise architecture help food companies improve operational efficiency and business competitiveness in a changing environment, including factors such as global competition, changing consumer trends, and government regulations? (Research Question 1)
2. What are the challenges and opportunities in implementing enterprise architecture (enterprise architecture) in the food industry, including issues of system integration, data management, and information security, and how can enterprise architecture help food companies in facing these challenges? (Research Question 2)

The state-of-the-art in this research is to conduct discussions on enterprise architecture which includes elements of scalability and cyber security as part of protecting the system if the enterprise architecture is implemented. This is what can protect the system from attackers who are not responsible.

LITERATURE REVIEW

Literature review of this study discusses Enterprise Architecture in several companies, especially food industry companies. Several previous studies that have discussed will be discussed by looking at some of the advantages and disadvantages. This research does not look for deficiencies of previous research, but this research complements previous research.

Towards a sustainable interoperability in food industry small & medium networked enterprises: Distributed service-oriented enterprise resources planning (Shirazi, 2018). Research has discussed a lot about Business Architecture, in terms of application architecture and Information architecture, however there has been no discussion of implementation regarding cyber security.

Information System Architecture Planning at Cafe Warung'e Dony Using the Zachman Framework Method (Afif et al., 2022). This topic has discussed a lot about data architecture, technology architecture, application architects, and planning implementation stages. Discussion of cyber security is not discussed.

Preparation of an Information Technology Master Plan Using the TOGAF Enterprise Architecture Framework Case Study of PT Wijaya Karya (Persero) Tbk. 2018 Year (Ma'sum & Ernawan, 2022). The advantages of this paper discuss all data architecture, information architecture and application architecture. However, cyber security was never discussed in the discussion of the Master Plan from PT Wijaya Karya.

Sustainability of Implementing Enterprise Architecture in the Solar Power Generation Manufacturing Industry (Hindarto et al., 2021). Discussion of information architecture, application architecture, technology architecture has been discussed. However, the discussion regarding cyber security has not yet been discussed.

Application of Enterprise Architecture in Digital Transformation of Insurance Companies (Prawira et al., 2023). This paper has explained various digital technologies by transforming them. One of the strategies is to change the insurance system to digital. Discussions on application architecture, information architecture, technology architecture have also been discussed. However, the discussion regarding cyber security is not discussed in this paper, so that the information system will be weak and have no defense.

Enterprise business architecture as a tool for sustainable development in an enterprise - Case study (Tutaj et al., 2021). This paper discusses business architecture, business strategy and several

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architectural technologies. The problem is the discussion is not detailed and there is still no discussion about the security system. So that the system has no defense.

Reflexive governance architectures: Considering the ethical implications of autonomous technology adoption in food supply chains (Manning et al., 2023). This paper discusses the supply chain for the food industry. The use of Artificial Intelligence is needed in handling company operations so as to produce high productivity. Therefore, all methods are used to build information technology to support company operations. However, technology for system and data security is not used to protect the system from threats and data theft. Therefore, this paper has a weakness, namely not implementing Cyber Security within the company.

Architecture framework of IoT-based food and farm systems: A multiple case study (Verdouw et al., 2019). This paper applies enterprise architecture to agricultural systems based on the Internet of Things. The framework consists of a set of architectural viewpoints with Internet of Things-based technology and Standard Operating Procedures using an Internet of Things-based enterprise architecture model. However, this research does not discuss cyber security, so the system is not protected from various cyber-attacks.

From the description of the research above which has discussed a lot about Enterprise Architecture for companies that produce food, it has been very good in explaining. However, all of these studies do not explain cyber security. The gap that can be raised in writing this research is the need for the implementation of cyber security in the implementation of Enterprise Architecture in the food industry.

METHOD

The research method proposed in this study is a response to the completion of Information Technology Planning for a food company. The following is a step of the research method:

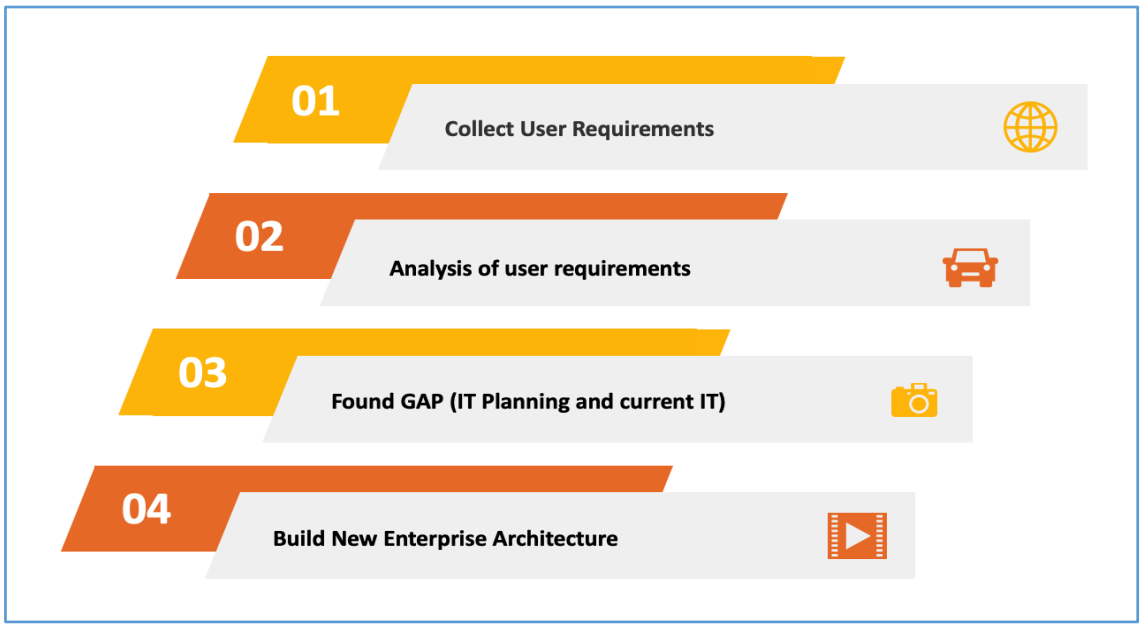

Figure 2. Proposed research for the food industry
Source: Researcher Property

The following is an explanation of Figure 2, from research proposals from the food industry consisting of four steps as follows:

User Requirements or user needs are the needs or requirements that must be met by a system or product to meet the needs or expectations of users or customers. User requirements are often used in the development of software, information technology products, and information systems to ensure that the system or product being developed meets the needs and expectations of users. User requirements can cover a variety of things, including system or product features and functionality, performance and speed,

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appearance of the user interface or user interface, data security and privacy, and compatibility with other devices or systems. To understand and determine User Requirements that are accurate and in accordance with user needs, a user requirement analysis is usually carried out. This analysis involves interviewing users or customers, collecting data, and determining user needs and preferences. The defined user requirements are then used as the basis for designing, developing, and testing systems or products to ensure that they meet user needs and satisfy customers. Gathering User Requirements is an important step in the development of a successful system or product. Here are some ways to collect User Requirements: Interview with users or customers: This step involves directly asking users or customers about their needs, expectations and preferences for the system or product to be developed. This interview can be conducted through face-to-face interviews, telephone, or online surveys. User observation: User observation or user observation is a way to observe users when using existing systems or products. These observations can provide insight into how users use the system or product, what they like and don't like, and the problems or constraints they encounter. User case study: A case study or user case study involves gathering information about the situation and context in which the system or product will be used. This helps in understanding the environment in which the system or product will be used, and the user requirements associated with the situation. Focus groups: Focus groups or user focus groups involve gathering a group of users or customers to discuss their experience with a system or product and provide input on their needs. Group focus can be done in person or online. User surveys: Surveys or user surveys are an effective way of gathering information about the preferences and needs of many users. These surveys can be conducted online or by telephone and allow for quick and easy collection of data. Product benchmarking: Product benchmarking or user product benchmarking involves evaluating similar products that are already on the market to understand the features and functionality expected by users. This can help in determining user needs and developing better and more competitive systems or products. Gat herring good and accurate User Requirements requires good communication with users or customers, setting clear goals, and using appropriate techniques and methods.

The enterprise architecture used in this research uses The Open Group Architecture Framework. TOGAF (Ramadhane et al., 2022) is a framework or framework used to assist organizations in designing, developing, and managing their enterprise architecture. This framework was designed by The Open Group, a global organization focused on developing standards and best practices in enterprise architecture. TOGAF provides a structured structure and methodology to assist organizations in designing and developing an effective and efficient enterprise architecture. This framework consists of four main components:

1. Architecture Development Method (ADM) (Goepp & Petit, 2017): ADM is a methodology used to develop an enterprise architecture in a structured and organized manner. ADM consists of seven phases which include planning, data collection, analysis, design, implementation, monitoring, and evaluation.

   The Architecture Development Method (ADM) is a process framework used in enterprise architectural modeling. ADM includes several steps or phases designed to guide the development of an enterprise architecture from conceptualization through to implementation and maintenance. Here's an example of the steps covered in ADM: Planning Stage: Identification of business problems encountered, clarifying the objectives of the enterprise architecture, and creating a project plan. Business Phase: Analyze organizational structure and business processes, identify business requirements, and develop business architecture models. Data Phase: Determine the data needed for business processes, develop data architecture models, and plan data management. Application Stage: Determine the applications needed to meet business requirements, develop application architecture models, and plan application management. Technology Phase: Determine the required technology infrastructure, develop a technology architecture model, and plan technology management. Implementation Phase: Developing an implementation plan and migrating the enterprise architecture to the existing environment. Operations Phase: Plan and manage enterprise architecture operations, including maintenance and development. Evaluation Phase: Conduct an evaluation of the company's architecture, including measurement of success, improvement, and improvement. Each stage of ADM (Retnawati, 2018)can be further developed according to the needs of the organization. ADM enables companies to plan and develop

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enterprise architecture in a systematic and comprehensive manner, to assist companies in accelerating development and increasing the efficiency and effectiveness of their business.

2. Architecture Content Framework (Denis et al., 2019): This framework provides guidance on developing and managing all artifacts related to enterprise architecture, including diagrams, models, and documents. The Architecture Content Framework (ACF) is a framework used to guide the planning, development, and documentation of enterprise architectures. ACF assists enterprise architects in selecting and defining the type of architectural information needed to create and manage enterprise architectures. ACF consists of several categories or types of architectural information, which are divided into three layers: Business Architecture Layer: Provides information about the business processes, organization, and business requirements that the enterprise architecture must meet. Technical Architecture Layer: Provides information about the technology, infrastructure, and technical requirements needed to build and manage the enterprise architecture. Implementation Architecture Layer: Provides information on how to implement enterprise architecture, including project planning and management, and required architecture documents. Each category within the ACF has several architectural artifacts or products, such as architectural diagrams, data models, technical specifications, and user guides. These artifacts are used to assist enterprise architects in developing, managing, and communicating enterprise architectures with various stakeholders, such as technology teams, business teams, and management. ACF can assist companies in understanding and managing the complexity of enterprise architectures, as well as accelerating the development and implementation of enterprise architectures in a systematic and effective manner.
3. Architecture Capability Framework(Camatti et al., 2020): This framework assists organizations in developing their enterprise architecture capabilities, including architecture development, architecture management, and architecture performance measurement. The Architecture Capability Framework (ACapF) is a framework used to guide the development of enterprise architectural capabilities. ACapF assists companies in developing enterprise architecture capabilities in a sustainable and systematic manner, so that companies can optimize the benefits of using enterprise architecture to support their business. ACapF consists of four main domains: Organizational Domain: Covers the organizational structure, culture, human resources, and leadership needed to build and manage enterprise architecture capabilities. Process Domain: Covers the processes used in developing, implementing, and maintaining enterprise architectures, such as the planning, design, testing, and evaluation processes of architectures. Tools Domain: Covers the tools and technologies needed to develop and manage enterprise architecture, such as architecture software, visualization tools, and document management tools. Knowledge Domain: Covers the enterprise architecture knowledge required to build and manage enterprise architecture, such as architectural concepts, standards, and best practices. Each domain in ACapF has a number of capabilities that must be developed to build enterprise architecture capabilities. For example, in the organizational domain, required capabilities include developing enterprise architecture skills, developing a culture of innovation, and developing leadership that supports enterprise architecture. ACapF can help companies improve their enterprise architecture capabilities in a sustainable and effective manner, as well as increase the benefits of using enterprise architecture to support their business strategy.
4. Architecture Governance Framework: This framework assists organizations in ensuring that their enterprise architecture is always in line with the business objectives and organizational strategy. Governance includes the policies, procedures and controls needed to ensure compliance.

Using TOGAF, organizations can develop an integrated and consistent enterprise architecture, reduce complexity, and increase business efficiency and effectiveness. TOGAF also helps organizations understand their business environment better, so they can adapt more easily to market changes and ever-evolving technologies.

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RESULT

Figure 3 is Proposed research on Enterprise Architecture with the topic "Business Architecture for the Food Industry" will be very interesting and relevant in the current business context. Following are some of the results that can be achieved from this research:

1. Business and requirements analysis: This research can help food companies to conduct a comprehensive and in-depth business analysis. In this analysis, companies can examine and evaluate the business objectives, business models, business processes, and information architecture needed to achieve their business goals.
2. Business architecture development: This research can help food companies to develop the right business architecture. By using a proven business architecture framework, companies can design effective and efficient business architecture solutions to achieve their business goals.
3. Optimization of business performance: In this research, companies can examine and evaluate the performance of their business, as well as find areas where improvement is needed. By deeply understanding how business architecture affects business performance, companies can improve their operational efficiency and effectiveness.
4. Safety (cyber security) and compliance assurance: The food industry is highly regulated by strict safety regulations and standards. In this research, companies can evaluate their business architecture to ensure that they comply with applicable regulations and security standards.
5. Innovation: This research can help food companies to increase innovation in their business. By understanding their business architecture in depth, companies can identify areas where innovation can be applied to improve business operations and introduce new products to the market.

Thus, research on business architecture for the food industry can provide great benefits to food companies in improving their business efficiency, effectiveness, and security, as well as introducing new innovations.

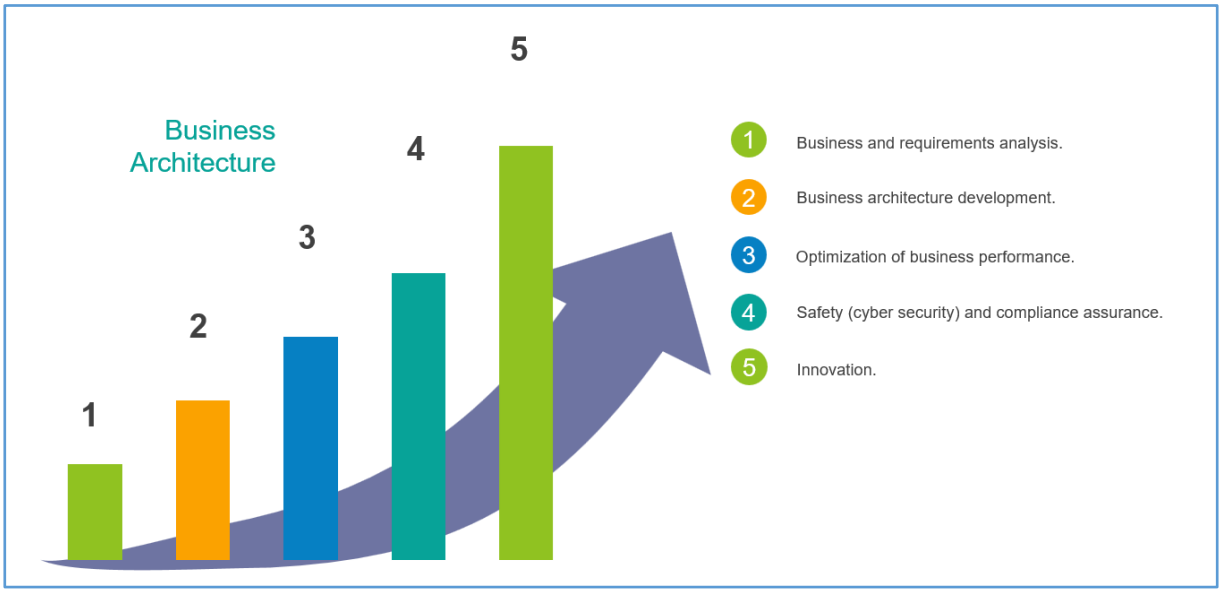

Figure 3. Proposed research on Enterprise Architecture
Source: Researcher Property

Figure 4 is Application architectures for the food industry can vary widely depending on the specific business goals and needs of the food industry. However, some of the architectural elements that may be required for food industry applications are as follows:

1. Front-end: This is part of the user interface of the application. In the context of the food industry, front-ends need to be attractive and easy to use, so that users can easily browse menus, order food, view customer reviews and more.

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2. Back-end: Is part of the application that is connected to the database and contains business logic that governs how the application functions. In the food industry, the back-end must be able to handle tasks such as managing inventory, managing orders, processing payments, and more.
3. Database: This is the part of the application that stores and manages data, such as menu information, customer lists, orders, and more. Databases in the food industry must be able to handle large amounts of data and provide quick and easy access to that information.
4. Integration with Third Party Systems: Third party systems such as payment systems, inventory management systems or restaurant management systems may be required for integration with food industry applications, to simplify tasks such as inventory management, payments and more.
5. Security: Application security is critical in the food industry, as it protects customer information such as credit card numbers and email addresses from unauthorized use. Application architecture should include security features such as data encryption and user authentication systems to protect sensitive data.
6. Scalability: The application architecture must be able to be scaled according to business requirements. In the food industry, for example, applications need to be able to handle increased traffic during peak hours such as holidays or special events. Therefore, applications must be designed to be easily scaled and developed quickly.

Overall, the application architecture for the food industry should be designed with the goal of making things easier for users, managing orders and inventory, integrating third-party systems, and keeping customer information secure.

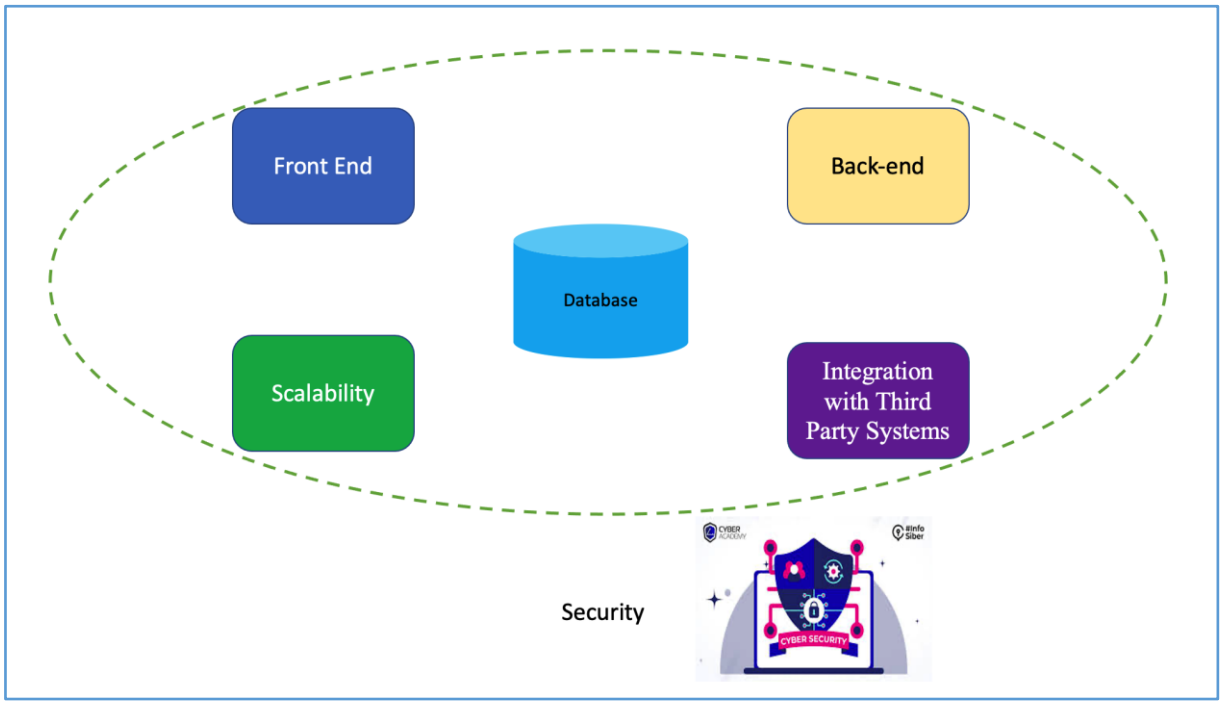

Figure 4. Application architectures
Source: Researcher Property

DISCUSSIONS

The discussion sections for the Enterprise Architecture research paper for the Food Industry are:

Research Question 1: How can enterprise architecture help food companies improve operational efficiency and business competitiveness in a changing environment, including factors such as global competition, changing consumer trends, and government regulations?

Enterprise architecture can help food companies improve operational efficiency and business competitiveness in a changing environment in several ways. Better system integration: Enterprise

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architecture can help food companies integrate disparate systems and applications within their IT environment to reduce data redundancy and duplication, improve data and information integration, and ensure better data coherence. This can help food companies gain greater visibility into their business operations and make better, faster decisions. More effective data management: Using enterprise architecture, food companies can manage their data more effectively, including optimizing data quality and ensuring data security. This will help food companies make better and timely decisions based on quality data. Higher operational efficiency: With an integrated enterprise architecture, food companies can reduce redundancy and speed up data processing, thereby increasing operational efficiency. This can help food companies reduce operational costs and increase productivity, thereby strengthening business competitiveness. Improved security and compliance: Enterprise architecture can help food companies meet applicable security regulations and standards, such as General Data Protection Regulation and Payment Card Industry Data Security Standard. The General Data Protection Regulation (GDPR) is the European Union data privacy regulation that came into force in May 2018. The GDPR provides stronger protection for the personal data of EU citizens and gives individuals the right to control their data and how it is used by organizations. The GDPR applies to any company that collects, stores, or processes the personal data of EU citizens, whether the company is based inside or outside the EU. The Payment Card Industry Data Security Standard (PCI DSS) is an information security standard implemented by the payment card industry, such as Visa, Mastercard and American Express. This standard is designed to help protect consumer payment information from theft or misuse. Any company that receives, processes, or stores payment card information must comply with the PCI DSS standard. In addition, by implementing enterprise architecture, food companies can strengthen data security and reduce the risk of data breaches that could damage the company's reputation. Better business responsibility: Enterprise architecture can help food companies better plan and manage business changes. Using enterprise architecture, food companies can predict the consequences of business changes and plan effective strategies to deal with emerging challenges. This can help food companies better anticipate and respond to global competition and changing consumer trends.

Research Question 2: What are the challenges and opportunities in implementing enterprise architecture (enterprise architecture) in the food industry, including issues of system integration, data management, and information security, and how can enterprise architecture help food companies in facing these challenges? Challenges and opportunities in implementing enterprise architecture in the food industry include. System integration: Challenges in system integration can occur because the food industry often uses different systems. This can cause difficulties in integrating data and information from various systems into one platform. However, enterprise architecture can help integrate systems and ensure better integration of data and information. Data management: The challenges in data management are mainly related to the large amount of data and its various types. In addition, the problem of data silos can also make it difficult for companies to manage data effectively. Enterprise architecture can help optimize data quality and ensure better data coherence, so food companies can make better, timely decisions. Information security: Challenges in information security are mainly related to increasing security and cybersecurity risks. Food companies must ensure that their data is well protected from cyberattacks and data leaks. Enterprise architecture can help improve information security by enforcing security standards and establishing strict security protocols. Global competition: An opportunity for food companies in implementing enterprise architecture is to increase business competitiveness in the global market. By using enterprise architecture, food companies can improve operational efficiency, reduce operational costs, and increase productivity. This will strengthen business competitiveness and help food companies compete in the global market. Changing consumer trends: An opportunity for food companies in implementing enterprise architecture is to anticipate and respond to changing consumer trends. By using enterprise architecture, food companies can manage data and information better, so they can better understand consumer needs. This will enable food companies to respond quickly to changing consumer trends. In facing these challenges, enterprise architecture can assist food companies in optimizing the use of technology and data to strengthen business competitiveness, improve operational efficiency, improve information security, and respond quickly to market changes and consumer trends.

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CONCLUSION

In general, the implementation of cybersecurity in enterprise architecture in the food industry is very important in the increasingly digitally connected Society 5.0 era. In the food industry, cybersecurity should be considered as a top priority because sensitive data such as customer information, business secrets and financial data must be protected from cyberattacks and leaks. Therefore, food companies must ensure that their enterprise architecture is designed with cybersecurity in mind from the start and equipped with state-of-the-art security systems to prevent cyberattacks. Implementing cybersecurity in enterprise architectures can also help food companies meet increasingly stringent regulatory requirements and cybersecurity standards. This can enhance a company's reputation and build customer trust. In an increasingly digitally connected Society 5.0 era, the implementation of cybersecurity in enterprise architectures in the food industry is becoming increasingly important. By ensuring that enterprise architectures are designed with cybersecurity in mind from the start and equipped with state-of-the-art security systems, food companies can protect their sensitive data, meet regulatory requirements and security standards, and enhance their reputation and customer trust.

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