Enterprise Resource Planning: Analysis and Utilization of Open-source Applications with the EAP Method

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Abstract

This research explores the application of the Enterprise Architecture Planning (EAP) method to select an open-source Enterprise Resource Planning (ERP) system by FF Company, a micro, small, and medium enterprise (MSME) in the food sales industry. This research uses EAP to map FF Company's business processes, data, applications, and technology needs. The methodological approach includes analyzing current systems and technologies, building data and application architectures, and recommending technology support. The result was the adoption of an Open-source ERP application to digitize and automate business operations, demonstrating the effectiveness of the EAP method in guiding MSMEs through digital transformation and improving business process efficiency.

Keywords: Enterprise Resource Planning; Enterprise Architecture Planning; Open-source; MSME.

I. INRTODUCTION

Today, automation systems have become essential for various industrial sectors, ranging from small and medium-sized businesses to large, leading companies. The concept of a computerized system is increasingly in demand because of the shift in the industrial era 4.0. There are many options for using the concept of an integrated computerized system, from building a system, hiring third-party services to create an application, to using open-source facilities.

The selection of software applications for modern business management provides an integrated system concept that includes many business function modules connected to a central database. The system concept is known as Enterprise Resource Planning (ERP). Implementing an ERP system is to run business operations in today's highly dynamic and competitive environment much better and more efficiently than in previous conventional ways [1]–[5]. In its implementation, companies can divide ERP applications into two models: licensed and open-source. Commercial software development vendors usually provide licensed ERP applications and require the purchase of a full license for their use. Meanwhile, open-source ERP applications can be downloaded and used for free, and the source code can be freely modified by users as needed [6]–[9].

Several studies have compared the two ERP system models in terms of total cost of ownership, flexibility, and level of customization. In general, open-source ERP applications are considered more flexible and cost-effective, but licensed ERP applications provide professional support and services from vendors. Any organization planning to adopt an ERP system should consider the advantages and disadvantages of each model [8], [10]–[15].

FF Company is an MSME in frozen and ready-to-eat food sales with five branches in several cities. Despite its rapid growth, FF Company has yet to utilize technology to monitor and integrate its business processes. All data and reports are still stored manually, so they are prone to human error, difficult to monitor, and lack integration between branches.

Considering FF Company is an MSME, implementing an open-source ERP application is very appropriate because the cost is relatively low. However, the large selection of open-source ERP applications from various developer communities is an obstacle. Each developer competes to provide as complete ERP features as possible in their application. Therefore, FF Company must evaluate the available open-source ERP solutions before choosing. Some crucial aspects that FF Company should consider in the evaluation include the ease of use of the ERP application, the completeness of the features offered, the flexibility of the application to adjust to the specific needs of the company, the ability of the application to scale as the company grows, and the cost that FF Company has to spend. Once FF Companies have found and selected the open-source ERP application that best suits their needs, they can implement it to digitize business data, automate business processes, and make optimal strategic decisions.

This research aims to analyze the application of the Enterprise Architecture Planning (EAP) method as a guideline for FF Company in choosing the proper open-source application to support its business processes. EAP is a framework that provides systematic stages to map the company's information system architecture to align with business goals. By applying this EAP framework, the researcher wants to evaluate whether this method can help FF Company formulate the functional requirements of the open-source ERP system, analyze the current business process overview, and recommend the best information technology solution to support the operations and growth of FF Company in the future [16]–[23].

II. METHOD

This research uses the stages of Enterprise Architecture Planning (EAP), which will produce an overview of the company from business processes, data, applications, and technology. With the results of this description, one can choose an ERP application based on open-source that is right with the pattern of ongoing business processes. The stages of the EAP method can be seen in the following figure:
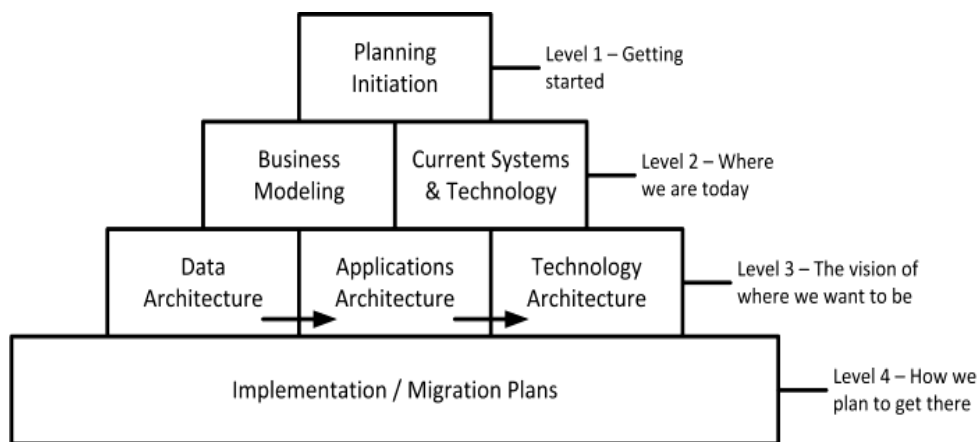

Figure 1.   Stages of the EAP Method [24]

Planning Initiation

This research uses Porter's value chain, which focuses on the system and how inputs are converted into outputs purchased by consumers. Using this point of view, Porter illustrates a chain of activities common to all businesses, and he breaks them down into primary and support activities [25]. Primary activities begin with the arrival of orders from suppliers, which are stored in warehouses and then moved to stores for display and sales to consumers, as well as customer service. Support activities include the company's infrastructure to improve customer service, human resource management, Purchase Reports, and other aspects of the company. Activity can be seen in Porter's Value Chain [25], as shown in the figure 1:
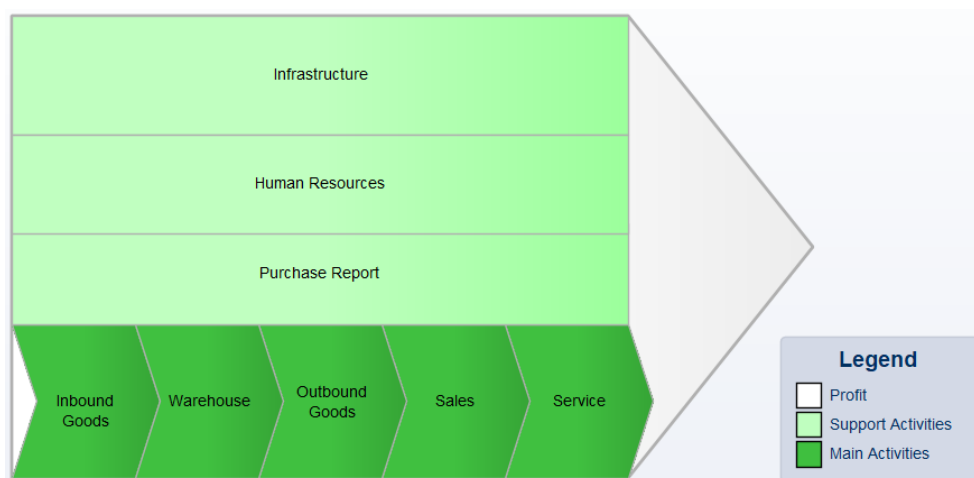

Figure 2.   FF Company Value Chain

Business Modeling

At this stage, the research focuses on identifying business functions and the organization's business activities. Get an overview of the area and function of the business [20]. The tool used at this stage utilizes the Unified Modeling Language on the Use Case diagram to identify all the actors involved [26]. Use Case diagrams not only describe internal activities, but external relationships with suppliers and customers must also be considered [21], [27], [28].

FF Company's business process modeling is intended to map the flow of information between business activities so that the entities involved are known. The mapping uses a UML use case diagram that shows the interaction of 5 actors through 7 main business processes that are still conventional. The five actors are integrated into FF Company's business activities that interact with each other. The use case diagram of FF Company's business process can be seen in Figure 3.
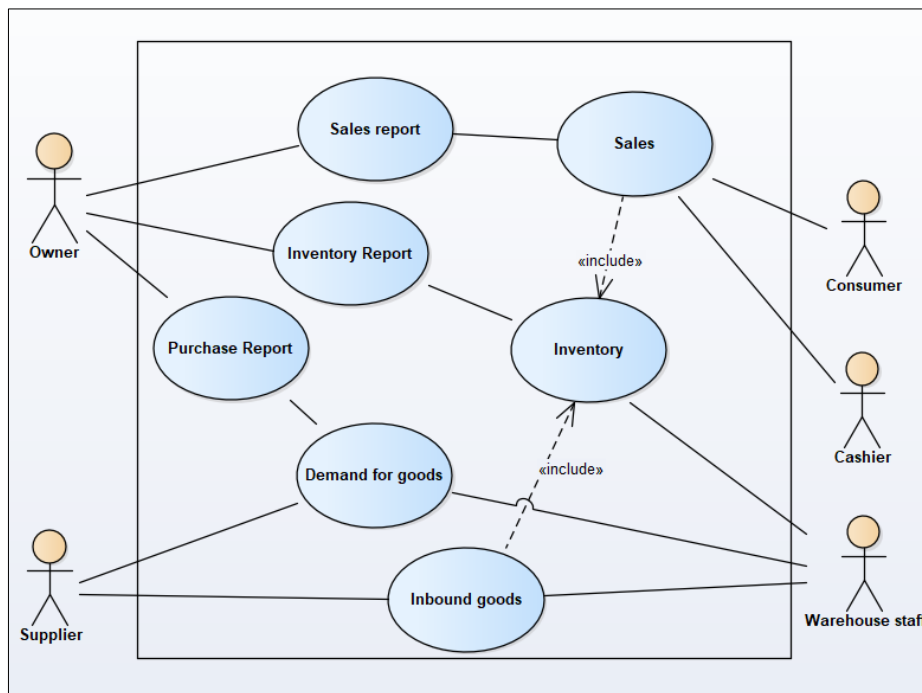

Figure 3.   Use Case Diagram

Current System and Technology

This is a table that describes the condition of the existing system and technology so that it aims to provide an overview of what needs are needed to build and use ERP applications in the future. By mapping the current system and technology, it is possible to identify the gaps that still need to be filled in supporting FF Company's business processes. This condition allows for recommendations for solutions to overcome the limitations of the current conventional system. Table 1 shows the current condition of the technology facility and its recommendations, considering FF Company still relies on manual systems in every business process.

TABLE 1
ANALYSIS OF CURRENT SYSTEMS AND TECHNOLOGIES

Current Condition	Recommended
The implementation of business processes has not used Information Technology.	Procurement
There is no database on every business process.	Procurement
There is no application to support business processes.	Procurement
No application at the company owner level	Procurement

Current Condition	Recommended
There are no supporting servers for databases, applications, and information technology.	Procurement

Data Architecture

At this stage, show more how data is interconnected with existing business processes so that there is no confusion between data content and business processes that will produce information in the future. At this stage, it produces a matrix associated with business processes which are entered in the letter C (Create) to state which process produces and U (Use) for which process strengthens [29].

Here are the steps to create a matrix that connects business processes. The letter **C (Create)** indicates a process that generates new data or activities in the business process. The letter **U (Use)** indicates a process that uses and strengthens the data or information generated by the previous process so that the data becomes more accurate and reliable. As shown in Table 2, each business process is labeled **C** or **U** to indicate its role in the information flow of FF Company's business processes.

TABLE 2
BUSINESS PROCESS AND DATA ENTITY RELATIONSHIP MATRIX

		Data Entity				
		Warehouse staff	Cashier	Owner	Supplier	Consumer
Business Process	Demand for goods	C			U	
	Inbound goods	C			U	
	Inventory	C	U			
	Sales		C			U
	Purchase Report			U		
	Sales report			U		
	Inventory Report			U		

Applications Architecture

It is the stage where the results of the business stages that produce existing data can be accommodated by the application or application module, which will later be adapted to the proper open-source ERP application. This section produces a table of recommendations for the required applications and a matrix of relations between business processes and applications [20], [28].

From the data architecture stage that produces a matrix of relations between business processes and data entities, the matrix can be taken as a candidate for the recommended ERP application module, while the ERP application module has 4 modules which can be seen in table 3 as follows.

TABLE 3
LIST OF RECOMMENDED ERP APPLICATION MODULES

	Num.	Application Module Candidate
Enterprise Resource Planning Application	1	Purchase Module
	2	Sales Module
	3	Inventory Module
	4	Cashier Program Module

In order to map the support of the ERP system to FF Company's business processes, a matrix was created that describes the relationship between business processes and ERP application modules. This matrix is needed to show specifically the role and contribution that each ERP application module provides to each business process running at FF Company. Thus, the ERP system implementation can be truly tailored to the functional needs of FF Company's business processes. Details of the relationship matrix between business processes and ERP application modules can be seen in Table 4.

TABLE 4
BUSINESS PROCESS RELATIONSHIP MATRIX WITH APPLICATIONS

		Purchase Module	Sales Module	Inventory Module	Cashier Program Module
Business Process	Demand for goods	X			
	Inbound goods	X			
	Inventory			X	
	Sales		X		X
	Purchase Report	X			
	Sales report		X		
	Inventory Report			X	

Technology Architecture

The stages in this research recommend that the technology that must be provided to support the implementation of ERP applications are seen from the business model, current technology, and the stages of data and application architecture.

After the data and application architecture stages are described, the technology architecture stage describes how the application can be supported by technology so that business processes can run in real-time because, at this stage, the technology concept used utilizes the internet as a liaison medium and the website as a media interface for the Company Owner, supplier, Warehouse staff and Cashier. An overview of the technology architecture can be seen in the following figure.
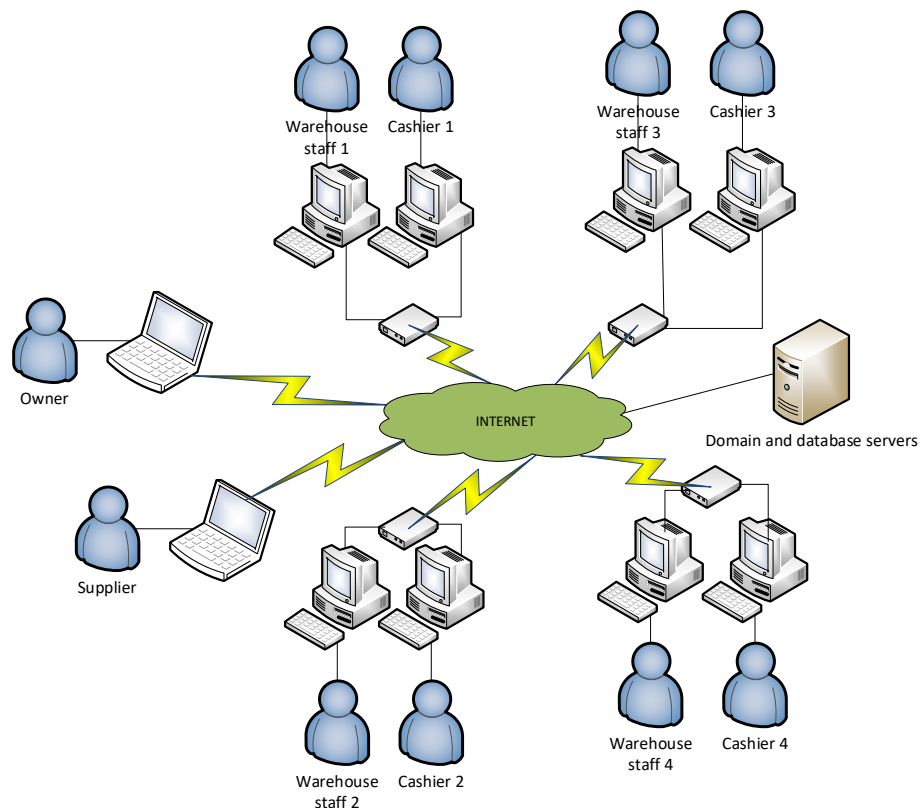

Figure 4.   Network Technology Architecture Schematic

Implementation plan stage

Selects the proper open-source ERP application according to the existing EAP analysis stages. The uniqueness of this research is due to the need for similar topics discussed in previous publications. Only a few

studies have utilized the Enterprise Architecture Planning (EAP) method to map the implementation of open-source-based Enterprise Resource Planning (ERP) applications. In fact, EAP is a systematic methodology for designing enterprise information system architecture in line with its business goals. Meanwhile, open-source ERP is now widely used by various types of organizations because of its relatively affordable cost. Therefore, this research is expected to fill the research gap by exploring the utilization of EAP in the context of open-source ERP implementation, especially for MSMEs that are in the process of digital transformation, such as FF Company. The results of this study are expected to provide new insights and useful references for similar research in the future.

III. RESULTS AND DISCUSSION

In this research, the implementation plan stage aims to select an open-source ERP application that falls on an application called Dolibarr ERP & CRM. The official Dolibarr website explains Dolibarr ERP & CRM as an open-source and free software package for managing companies, freelancers, or foundations. Dolibarr can say Dolibarr is ERP or CRM (or both depending on the enabled module). This Open-source project is built by adding modules (enable only required features) on a WAMP, MAMP, or LAMP server (Apache, Mysql, PHP for all Operating Systems). Dolibarr was developed to offer an ERP and CRM suite with the primary goal of simplicity: Easy to install, Easy to use, and Easy to expand. Dolibarr is available to install as a Cloud or On-Premise solution, with an automatic installer for users without technical knowledge to install Dolibarr and all its prerequisites (Apache, Mysql, PHP) with just one package [13].

The reason for choosing the Dolibarr ERP & CRM application is the free Dolibarr ERP & CRM application without purchase or subscription, considering that FF company is a type of MSME business that still relies on running business processes and capital turnover, not focusing on the development of the company's technology infrastructure. However, the cost of leasing the domain is still there, but the nominal fee is not that big compared to companies hiring vendor services and building ERP applications from scratch. Furthermore, the selection and customization of the application are to the company's needs, and the installation is relatively easy. The example of the display of the Dolibarr ERP & CRM application that is applied to the FF company can be seen in the figure 5.

Figure 5 shows the ERP application login page interface. All actors involved in FF Company's business processes, as previously identified, are required to log in on this page to be able to access the ERP system according to their respective access rights. This login page is the initial gateway for user interaction with the ERP system. After a successful login, users will be directed to the main menu according to their role, for example, a special menu for owners, suppliers, cashiers, and warehouse staff. With a structured login system, the security and integrity of data in the ERP system can be maintained.
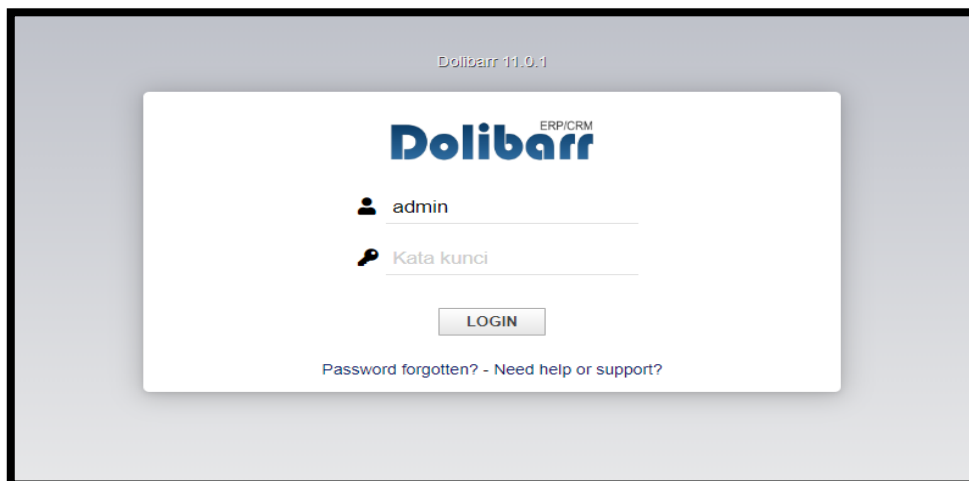

Figure 5.   Dolibarr ERP Application Login Display

Figure 6 shows the interface of the ERP application's initial setup page that allows input of FF Company's profile and initial information. This page serves to set up and customize the ERP application to suit FF Company's specific identity and needs. Company data such as company name, address, phone number,

logo, branches, system users, and other details can be inputted on this initial setup form. Thus, after the setup process is complete, the ERP application has adjusted to the conditions and information of FF Company in real time. This process is very important so that ERP implementation can run optimally to support company operations.
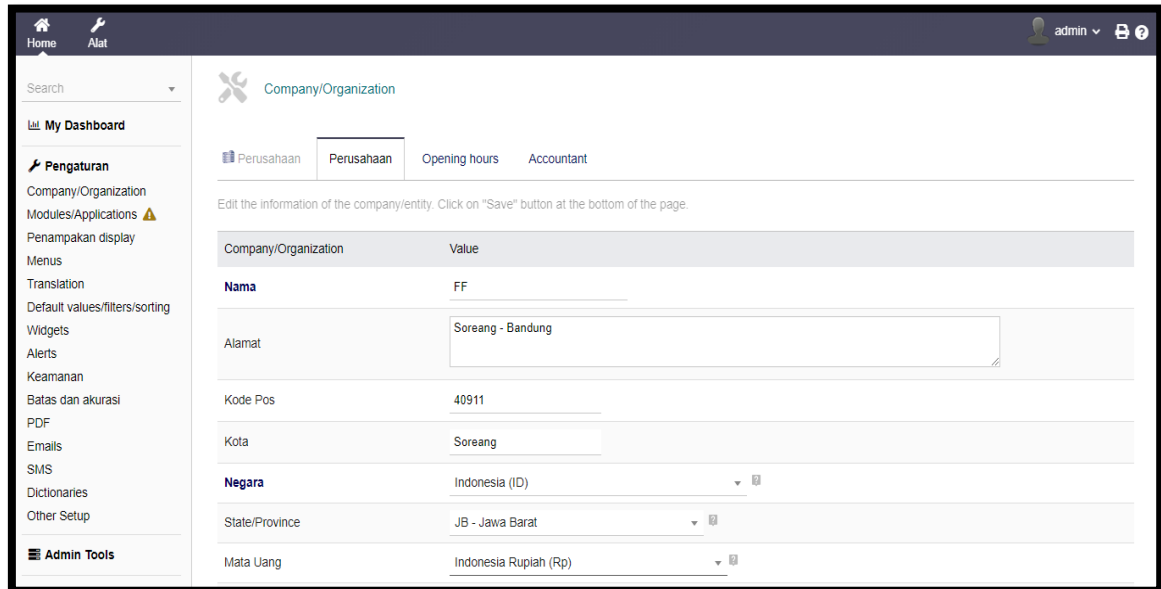

Figure 6. Company Profile Configuration View

Figure 7 displays the ERP application module settings interface that is tailored to the needs of FF Company's business processes. This stage is the implementation of FF Company's business process analysis and mapping that has been done in the previous chapter. The main modules of the ERP system, such as sales, purchasing, inventory, and user management, can be enabled or disabled in this menu, depending on the results of the analysis of the functional needs of FF Company's business processes. Thus, the implementation of the ERP system is carried out in accordance with the operational activities carried out by FF Company. This flexibility in customizing modules is one of the advantages of ERP system implementation.
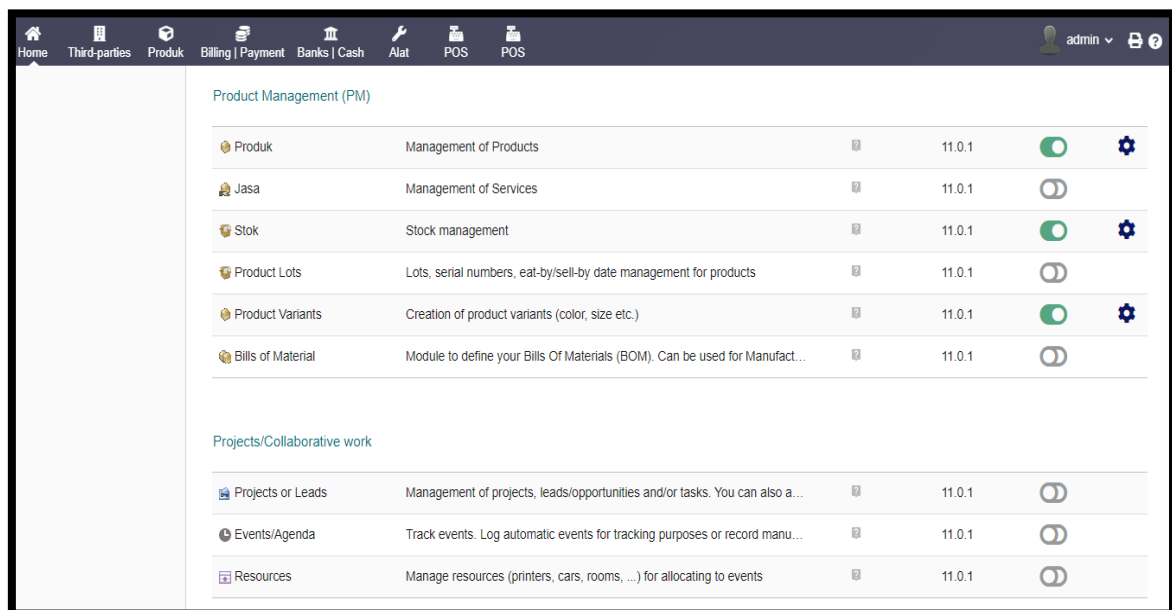

Figure 7. Application Module Configuration View

Figure 8 displays the product input interface in the ERP application. This page serves to make the initial settings of product data that FF Company will sell. Products such as frozen food and ready-to-eat food need to be inputted one by one, including product name, category, selling price, minimum stock, and other settings. Product master data management is very important as an initial reference for FF Company in purchasing inventory from suppliers, managing stock, and determining selling prices to consumers. With accurate and up-to-date product master data, FF Company's business planning and strategy can run smoothly.
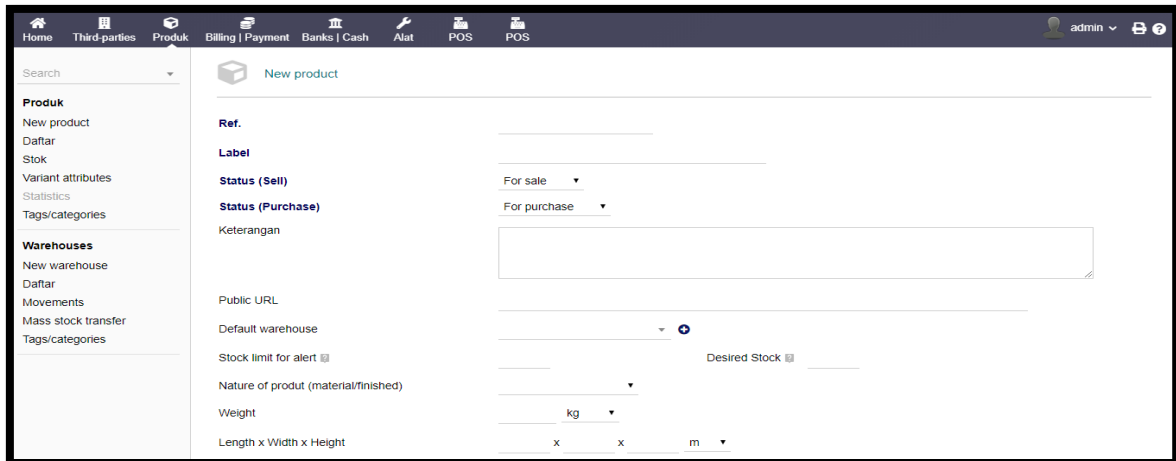

Figure 8. Product and Sales Input Display

Figure 9 shows the interface of the cashier menu in the ERP application that implements the Point of Sales feature. This menu is a bridge of interaction between the cashier and FF Company's customers who will buy products. In the cashier menu, the cashier can enter the consumer's shopping list, calculate the total price, receive payment, and print the purchase receipt. This sales transaction data will also be stored in the ERP system to be processed into daily, monthly, or specific period sales reports as information input for FF Company management in making strategic decisions. The implementation of this computerized cashier menu is certainly very helpful rather than having to do it manually.

Figure 9. Cashier Program Display

Figure 10 shows the purchasing and inventory module of the ERP application that manages FF Company's inventory. Product data and stock quantities that have previously been inputted in the product master data (Figure 8) and sales transactions (Figure 9) will become a reference for this purchasing and inventory module. For example, the system will automatically calculate and warn when the stock of a product

reaches its minimum point. Then, the purchasing user needs to buy back the product to fulfill orders from stores or consumers. Thus, FF Company's inventory management can be optimized and well-coordinated.
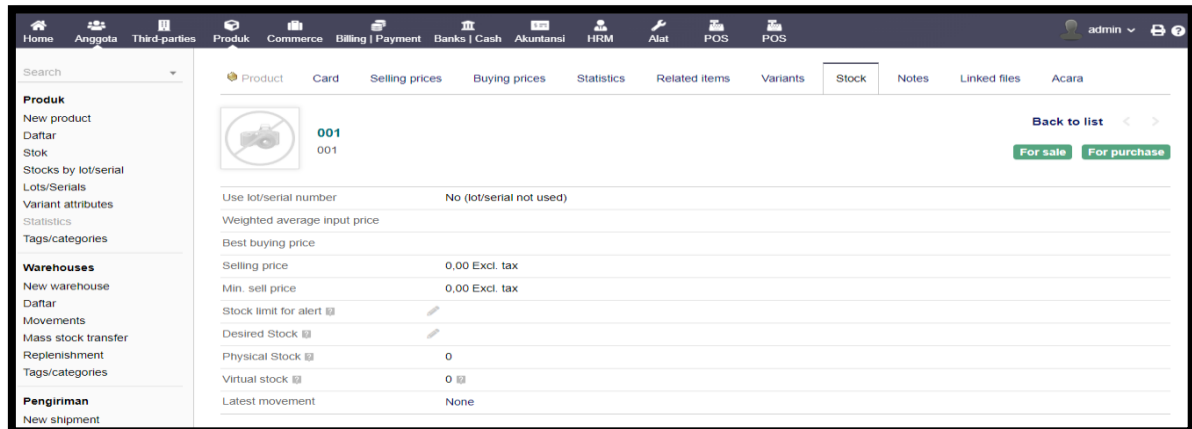

Figure 10. Inventory and Purchase Module Display

Figure 11 shows the interface of the report and dashboard module of the ERP application that monitors the development and progress of FF Company in real time. The ERP system generates various reports such as sales, finance, inventory, and others to provide important information for management in making decisions and determining business strategies. Dashboards with graphical visualizations and key metrics such as sales turnover, profit and loss, stock rotation, and the like are also dynamically displayed. Thus, the performance of FF Company can be easily monitored and evaluated at any time through the implemented ERP system.
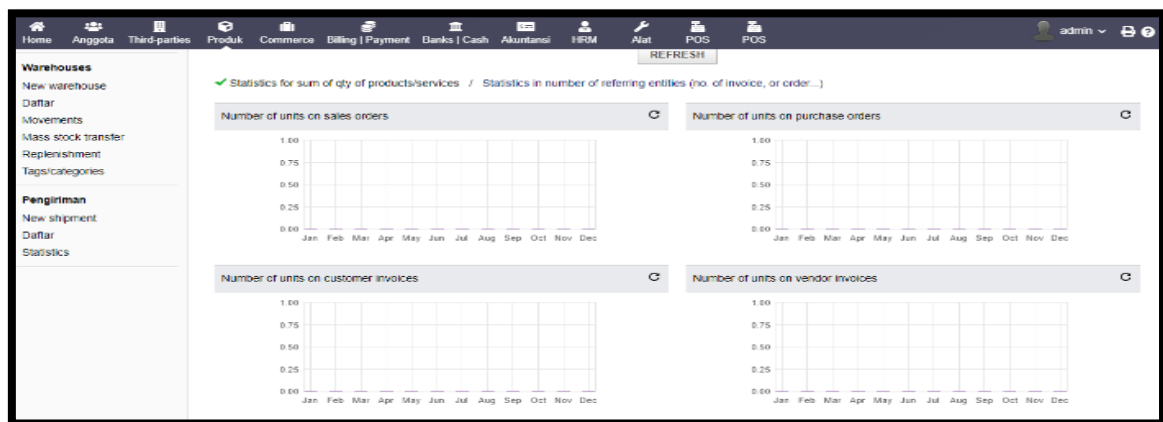

Figure 11. Company Progress Report Display

IV. CONCLUSION

This research concludes that the Enterprise Architecture Planning (EAP) method can be applied to analyze SMEs, such as FF Company, to implement an open-source ERP system. The application of EAP resulted in a complete mapping of FF Company's business processes as an MSME, its data architecture, applications, and technology. This situation is beneficial for formulating recommendations for open-source ERP modules that best support the functional needs of FF Company's business processes. By implementing this integrated ERP system, FF Company, as an MSME, can automate its computer-based operational system in real-time, starting from the database to the company's branches. Digital transformation through the implementation of open source ERP initiated by the enterprise architecture planning approach has proven to bring significant business process efficiency for the future growth of FF Company as an MSME. A similar implementation model can be a valuable reference for other MSMEs.

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