Development of Integrated Warehouse Application for Retail Business with Multi-Echelon Demand using Open-source ERP System

by **Universitas Internasional Semen Indonesia**

Submission date: **11-Oct-2023 01:44PM (UTC+0700)**
Submission ID: **2192224503**
File name: **1._Full_Peper_Dev.pdf (1,015.97K)**
Word count: **5151**
Character count: **29658**

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Abstract

The Integrated Warehouse Application (IWA) is a platform that combines inventory management, order management, warehouse operations, shipping, logistics, and reporting and analysis. It helps users manage their inventory to meet supply and demand requirements. Although many large companies use IWA to increase operational efficiency, its complexity, technology, and customization requirements make it too expensive for small and medium-sized enterprises (SMEs). Our research centers on small and medium-sized enterprises (SMEs) operating in the retail industry. Fast and precise order processing is crucial for satisfying and retaining customers. Therefore, we aim to discover strategies that cater to the diverse demands of different retail levels. The method for this study was conducted in four stages. The first stage involved preparation and planning by mapping out the initial process and identifying the relevant system based on the existing condition. The second stage focused on gathering data from the previous system through process and analysis. The third stage involved designing and developing the system, including prototyping, confirming, and adjusting it. Finally, the system was delivered in the fourth stage, and training was provided for each user. To create the system interface, we utilized an open-source ERP system called Odoo, which helped develop the IWA. Our findings show that implementing an integrated warehouse inventory system like the one provided by Odoo can offer real-time visibility into inventory levels, orders, and shipments. Automating manual processes enhances speed and accuracy, which improves customer service and business performance.

Keywords: Integrated Warehouse Application; Odoo; Retail Business; Retail; SMEs

Introduction

Small and Medium Enterprises (SMEs) play a vital role in the global economy (Alaskari et al. 2021). Nearly all businesses (99%) in Indonesia fall under micro, small, and medium enterprises (MSME). With 816,000 SMEs contributing to 27% of the GDP, they significantly contribute to the country's economy (ILO-PROMISE IMPACT project 2019). Additionally, small and medium retail businesses make up 60% - 70% of the Indonesian retail market and have the potential to proliferate (Hasegawa

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and Tani 2022). Some SMEs in retail businesses have branches in various locations or function as distribution centers with multiple stock points. However, these retailers face challenges managing inventory, balancing supply and demand, and simultaneously overseeing retail and warehouse operations (Quona Capital 2021). These challenges in SMEs in retail business can be handled using Information and communication technologies (ICT) that can assist through Enterprise and Resource Planning (ERP).

In modern business, the needs of ERP are crucial. Businesses use ERP software to manage various business activities, such as accounting, procurement, project management, risk management, compliance, and supply chain operations. Additionally, the ERP suite includes Enterprise Performance Management software that assists with financial planning, budgeting, forecasting, and reporting (Yulianto et al. 2020). ERP systems can be both complex and costly. The price is determined by factors such as their level of customization, implementation, acquisition, long-term support, and overall complexity (Malhotra and Temponi 2010). Small and medium-sized retail businesses need help to become more flexible and adaptable (AlMuhayfith and Shaiti 2020).

Studies have shown that implementing an ERP system in SMEs can bring numerous benefits (Estébanez 2021; Rupčić 2021; Tambovcevs and Tambovceva 2022). This solution can enhance business effectiveness, improve functionality, and lead to satisfied users. However, it may also come with increased implementation costs, complexity, and expenses for upgrades. In practice, companies often choose to customize their ERP system and adapt their business processes accordingly (Hansen et al. 2023; Hustad and Stensholt 2023). This also applies to SME businesses such as retail businesses. Small and medium-sized retailers need to adopt an ERP system. It keeps the balance of supply, demand, and distribution to maintain the availability of items.

In the retail industry, an ERP system should be capable of managing inventory, generating analytics and reports, managing customer and vendor relationships, fulfilling orders, and facilitating point-of-sale transactions (Davyn Limited 2023). Small and medium-sized retail businesses can benefit from using an Open-source ERP system that is customizable, easy to maintain, and cost-effective. This solution is ideal for SMEs to streamline their operations and maintain their business while maintaining their budget.

In the past, various studies have utilized Open-source ERP systems in the retail industry. Suryo et al. (2021) implement Odoo modules, such as sales, purchase, accounting, point of sale, CRM, and marketing, for a food retail business in Jakarta. Navalina et al. (2021) concentrated on an accounting information system to enhance customer service and satisfaction while considering demand in retail. Alghazali and Ageeli (2020) focused on inventory management within a retail company, considering the relationship between information and effective decision-making processes.

Other studies such as Antari et al. (2014); Bakhri (2019); Retnasari (2021); Suryantoro (2021); and Tongsuksai et al. (2022) also have used ERP systems to manage retail needs in small and medium-sized enterprises (SMEs), in most cases, the inventory being managed is for retail purposes, and the single source demand comes from retail (shops). It gets more complicated when there are multiple sources of demand, such as a Distribution Center (DC) that serves as a warehouse, stocks retail located in different areas (branches) and serves customers directly. These retail branches also have their inventory that needs to be managed. This study takes into account this added complexity when implementing its Open-source ERP system.

The goal of this research is to create an Open-source ERP System that will benefit small and medium-sized retail businesses. This software is called Integrated Warehouse Application (IWA). Unlike previous studies, our research focuses on the various sources of demand, including multi-echelon demand from Distribution Centers, individual customers, and customers who visit the retail branch shops. It is important because the software will connect the Distribution Center (DC) with customers and retailers, improving the efficiency of ordering, planning, and distribution. The purpose of using an Open-source ERP system for SMEs in Retail business is to gain flexibility in business with lower cost. This study is divided into four sections: Section 2 outlines the methodology, Section 3 presents the results, Section 4 is discussion, and Section 5 provides conclusions.

Methodology

Dunaway (2012) explains that ERP systems use a flexible company-driven approach to implementation that can be tailored to meet the unique requirements of each project. The current study also utilizes a simplified company-driven methodology outlined in Figure 1 and consists of four stages: planning and preparation, analysis and processing, design and production, and delivery and training. These four phases have been modified and improved upon by (Ibrahim et al. 2022).

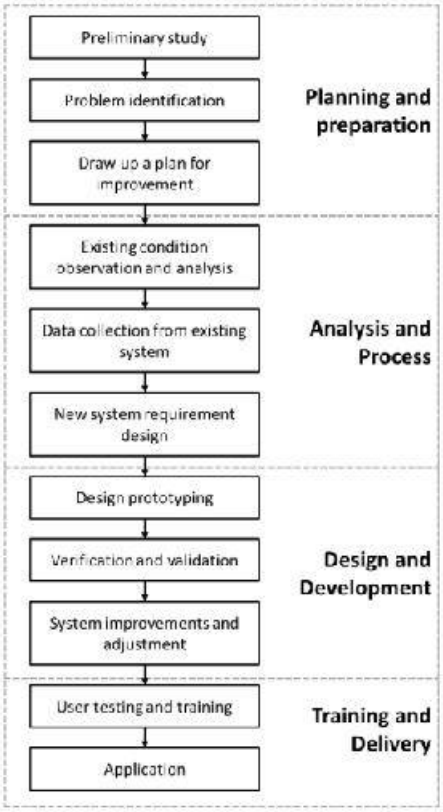

Figure 1. Flowchart for Research Method

Preparation and Planning System

In the initial phase, there are three tasks to be completed. The first task involves conducting a preliminary study, which includes a literature review and field research. The literature review focuses on ERP and information systems that are relevant to the retail industry. The field research is conducted to validate the requirements of retail businesses and lays the foundation for system development. The second step is to identify the problem, which involves analyzing current conditions, collecting initial data from the current information system's output, comparing the data with the distribution center's needs, and designing new system requirements. The last step in this phase is to create an improvement plan. This involves brainstorming ideas, conducting literature reviews to establish the base of the problem, and mapping the idea into a written plan. This plan outlines the scenario for improving the system.

Process and Analysis

During the second stage, process, and analysis, we focused on analyzing the existing condition of the object of study by observing its working sequence. The object of study already had their warehouse system called ePOS. ePOS, also known as electronic point of sale, is a computerized system used in retail shops to record sales. It includes functionalities such as payment processing, customer interaction, and data storage. However, the current system has a problem - the information is not connected to the head office, which is the distribution center. As a result, the product information, including the order needs from retail, stock, inventory, and retail orders, is not connected to the DC. Retail needs to manually update the stocks and sales information to the distribution center daily by extracting the sales data and sending it to the DC. Only after that can the DC decide whether to add more stock to the existing retail stock.

In the second stage, the focus is on gathering data from the current ePOS system. This is necessary to develop a new information system for retail businesses. The data collected will include sales data, product data, sales documents, stock data, company workflow processes, and the role of each department in the company. Providing these details is essential to developing the requirements for the new system development process.

Design and Development

The third phase of the project involves design and development, which consists of three tasks. The first task is to create a prototype design using an Open-source ERP system application. Once the initial design is completed, the second task is to confirm it with users by conducting forum group discussions and interviews with each department. If any adjustments are needed, the system will be fixed and adapted to meet the user's needs.

Delivery and Training

Once the information system is fully developed, it enters the delivery and training stage. The IT department responsible for the system receives training to maintain the system for later. Next, the integrated system, which combines various departments such as distribution center (DC), accounting, purchasing, retail, and warehouse, is handed over to the user for testing and training. Once the system has been adjusted according to user feedback, it requires confirmation from the operation manager before it can be connected to the company server and used as an integrated warehouse application (IWA).

Results and Discussion

This sub-chapter will explain the results of the analysis and creation of an information system using an Open-source ERP system as follows:

Preliminary Studies

To conduct our research, we need to conduct preliminary studies which consist of understanding the object business and then understanding the current state of the ePOS system as follows.

Scope of study

This study focuses on a retail chain with a single distribution center (DC) and four retail locations. Demands for products come from both the DC and the retail stores, which are located in Surabaya, Lumajang, Tuban, and Bojonegoro. Customers have the option to purchase products directly from either the DC or retail stores. Although the number of customers varies, demands are received daily from both the DC and retail locations. For further information, see Table 1.

Table 1. Scope of the Object of Study

No	Information	DC	Retail
1	Demand	Individual customers, retail chains	Individual customer
2	Number of employees	12 /DC	2~4 /retail
3	Job responsibility (department)	Accounting, procurement, purchasing, warehouse and delivery, operation manager, IT department, retail manager	Retail manager, inventory manager, sales (cashier)
4	Demand's arrival	Daily	Daily
5	Time for delivery of goods to retail	Twice a week (Tuesday and Thursday)	-
6	Update stock	Daily (manually after getting the information from retails)	Daily (update the stock manually and send the emails to DC)

Current state assessment

Once the problems in the research object are identified, the next step is to assess the research object's current state or existing state. The initial plan for the new information system involves integrating the distribution center - including the accounting, purchasing, DC staff (admin), warehouse, and delivery departments - with retail operations. This new system is called an Integrated Warehouse Application (IWA). To clarify the current situation in the industry, we analyzed two primary locations: distribution centers which can be seen in Table 2, and retail which can be seen in Table 3.

Table 2. Distribution Center Existing Business Process

No	Activity	Actor	Output Document
1	Making orders to the supplier	Procurement staff	Purchase Order
2	Re confirm the order	Purchasing staff	Item packing list documents
3	Contact supplier for product confirmation	Purchasing staff	-
4	Receiving; Checking arriving product	DC Staff	Good Receipt Note
5	Making payment	Accountant	Payment notes
6	Input new inventory data	DC Staff	New product document
7	Make a shipment note to the retail	Accountant	Remittance Note
8	Creating data and returning goods to the supplier	Accountant	Return Note
9	Stock updates	Procurement staff	Documentation of product

The DC being observed serves as the primary warehouse for multiple retailers both inside and outside the city. It also serves as a retail which sells products directly to customers. Despite having a vast inventory of around 3,500 items, the roles and responsibilities of employees are not clearly defined causing conflicting tasks. When employees are assigned conflicting tasks, it can become unclear what their actual assignments are.

Table 3. Retail Existing Business Process

No	Activity	Actor	Output Document
1	Make orders to DC	Warehouse staff	Purchase Order
2	Reconfirm the order	Purchasing staff	Item List Packing Document
3	Contact DC for product confirmation	Purchasing staff	-
4	Receiving; Checking arriving product	Warehouse staff	Notes of receipt of goods
5	Input new inventory data	DC Staff	Input document goods
6	Make receipt note for DC	Cashier (accountant)	Payment notes of goods
7	Creating data and returning goods to DC	Cashier (accountant)	Return note
8	Doing stock updates	Procurement and warehouse staff	Documentation of product

The observed object comprises retail stores located both within and outside the city has already been explained in the sub section Scope of study, with a warehouse stock controller in the form of a DC. The DC is tasked with the crucial responsibility of determining the suppliers, number of orders, and type of goods ordered, while the retail stores are responsible for sales and stock updates. To order sales products, the retail stores place orders at the DC. In addition, they manually enter daily stock updates into the ePOS system as the information systems at retail and DC are not connected. Upon receipt of the reports from the retail stores, the DC performs manual checks before confirming the stock update process with the retail stores. Based on this information, the DC determines which products must be sent to the retail stores, with deliveries scheduled twice a week to avoid stock shortages.

Existing Object Condition Analysis

Existing condition analysis is carried out by analyzing the relationship between ideal conditions based on user expectations, current conditions, and proposed solutions (Ibrahim et al. 2022). This relationship can be seen in Table 4 below.

The gap between Supplier, DC, and Retail has caused inefficiency and inflexibility. Any updates to the information in the system cannot be detected in real-time and cause delays in responses.

Conceptual model for the business process

To determine the requirements for a new information system, we analyzed the existing conditions and conducted a gap analysis. Based on this, we created a conceptual model focusing on the supply chain's three elements: suppliers, distribution centers, and retail. The To-Be Business process, a conceptual model, is divided into two processes. The first business process is for issuing the products or items from DC, as shown in Figure 2. The second business process is for planning and receiving products in DC, as shown in Figure 3. The explanation is as follows:

To-Be Business Process for issuing the Products or Items from the Distribution Center

The product issuing process involves three parties: Retail, DC, and customers, as depicted in Figure 2. The Sales and Purchasing, Procurement, and Warehouse departments at the DC are all involved in this process. Open-source software is utilized by the system to connect all parties, resulting in increased efficiency. The real-time updates feature is the primary differentiating factor from previous conditions. Both Retail and DC can now update and track the movement of stock in and out of both parties simultaneously.

Table 4. Gap Between Ideal, Existing, and Recommendation for DC and Retail

No	Activity	Ideal Condition based on User expectation	Existing Condition	Proposed Solution
1	Making orders to the supplier/ DC	Create purchase order documents in real-time through the Procurement Division.	To place an order, one must wait for a manual request for goods notes from the procurement department.	Utilize software to prepare and submit purchase order documents, allowing for real-time receipt of information.
2	Re-confirm the order	The order information and packing list are recorded and verified and can be accessed by the Purchasing Division.	Currently, gathering order information and creating packing lists is manual and not real-time, which causes delays in confirmation.	Utilize software to submit and verify orders swiftly.
3	Contact supplier/ DC for product confirmation	Direct order information is marked and confirmed and can be seen by the Purchasing Division.	The process of submitting information is currently done manually and is not linked together.	Easily submit information with the proposed software with no delays or time-consuming steps.
4	Receiving; Checking arriving product	Direct checking when the ordered goods come according to the purchase agreement	It is necessary to wait for the product receipt from the purchasing division to check the goods manually.	Use integrated software to check incoming goods and view arrival information directly.
5	Making payment	Make payments directly and or according to the goods purchase agreement	Manual payment notes can lead to number notation errors that are difficult to communicate	Prepare and submit payment receipts in real-time using software tools, which help us to integrate with related divisions.
6	Input new inventory data	Generate additional input documents for purchased goods.	Incoming goods are entered manually, requiring manual recalculations and adjustments to stock levels.	The software enables direct and real-time input of goods data into the inventory master data of the DC.
7	Make a shipment note to the retail	Create a Packing List (Packing List) of goods to be sent to the customer retail according to the request.	Using manual notes to track goods shipments results in a significant amount of time wasted on receiving and confirming orders.	By integrating software tools with the relevant divisions, packing lists can be made, and products can be delivered in real-time.
8	Creating data and return of goods returns to the supplier/ DC	Create a record of requested returns of goods to be sent directly to the supplier/ DC.	Using manual return notes can be time-consuming, leading to delays in receiving and confirming orders.	Creating return notes for products is easier with integrated software tools that allow for real-time submission to the relevant divisions.
9	Stock updates	Create and update the new stock of goods in the DC Master Data Inventory directly.	The update is a manual process that is time-consuming and does not directly update the DC inventory master data.	Utilize integrated software tools to update the inventory in real time and ensure it is properly stored and maintained.

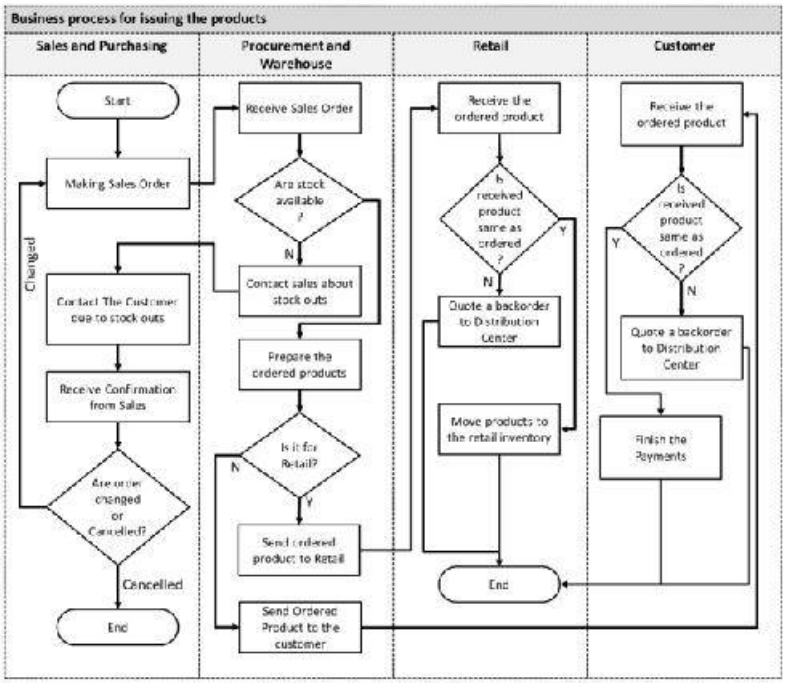

Figure 2. To-Be Business Process for issuing the Products or Items from the Distribution Center

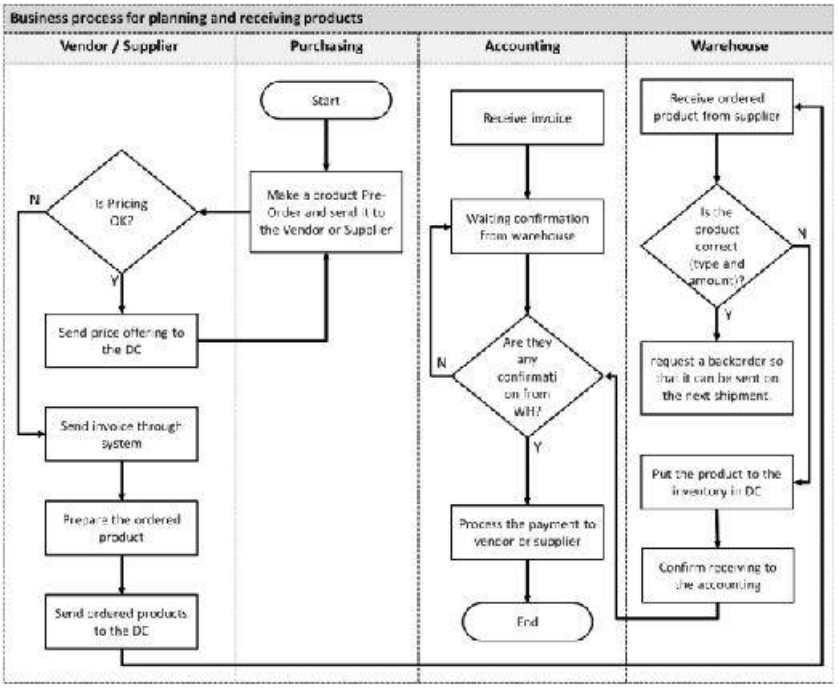

Figure 3. To-Be Business Process for planning and receiving products in the Distribution Center

To Be Business Process for planning and receiving products in the Distribution Center

Figure 3 illustrates the process of planning and receiving the product. In the previous method, the product was planned and received manually, leading to a higher chance of errors. The purchasing department had to manually input additional products into the system after checking the received product. However, in the newly developed system, the warehouse processes the product received from the vendor and submits it to the system directly, allowing for direct input of product amount and faster payment processing by the accountant. This new system reduces manual processes and increases efficiency for each department, enabling them to work more effectively.

Implementation of Open-source ERP System for Integrated Warehouse Application (IWA)

To create the integrated warehouse application, we utilized the Open-source ERP system Odoo. To begin the process, we determined the number of users and modules required, as shown in Table 5, before creating the interface.

To accommodate needs in DC and retail, there are seven identified user types and four necessary modules. The user types include administration/IT support, head of accounting, purchasing department, accounting staff, head of operations, warehouse and shipping staff, and retail staff. The four modules needed are sales, inventory, purchase, and invoicing, which are specific to certain sections. Every section has control over the Module that is generated, with three types of authority: Support, Admin, and User. The Support authority is responsible for the application system, allowing the Administrator/IT Support to manage the system, add user data for login purposes, and ensure server security. The Admin status authority allows for editing, changing, and adding components within the authorized Module. Meanwhile, the user is only able to view module components. Once the user enters the system, they will be directed to the main display.

Table 5. User Rules for the Open-source Application

No	User	Module			
		Sales	Inventory	Purchase	Invoicing
1	Administrator/IT Support	Support	Support	Support	Support
2	Head of Accounting	Admin	Admin	Admin	Admin
3	Purchasing department		Admin	Admin	
4	Staff Accounting	User			Admin
5	Head of Operational	Admin	Admin	Admin	
6	Warehouse and Delivery Staff		User		
7	Retail staff		User		

Figure 4 displays the homepage of the application. Access to different modules is based on user authority, as detailed in Table 5. The inventory module has visibility between warehouses and facilitates the warehouse's receipt and issuance of goods to retail and direct customers, as shown in Figure 5 and Figure 6. Meanwhile, the Purchase module supports the purchase of goods from DC to vendors/suppliers, as seen in Figure 7. Figure 8 displays the product master data, which can be modified based on availability in the warehouse. It includes product name, quantity, and price. Lastly, Figure 9 depicts the sales module utilized by DC and Retail for direct customer sales.

Efficiently providing real-time information optimizes the user experience. The new system has been divided into four modules, each tailored to meet the specific needs and responsibilities of each department. In the previous system, there were gray areas in terms of responsibilities, with some jobs duplicated across departments. However, the new system eliminates redundant work by streamlining each department into its respective module and preventing overlapping tasks.

Figure 4. Homepage Display

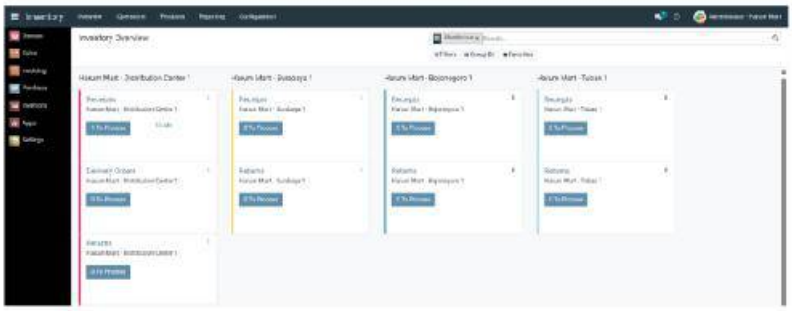

Figure 5. Inventory Module Dashboard

Figure 6. Inventory Module for Product Receiving

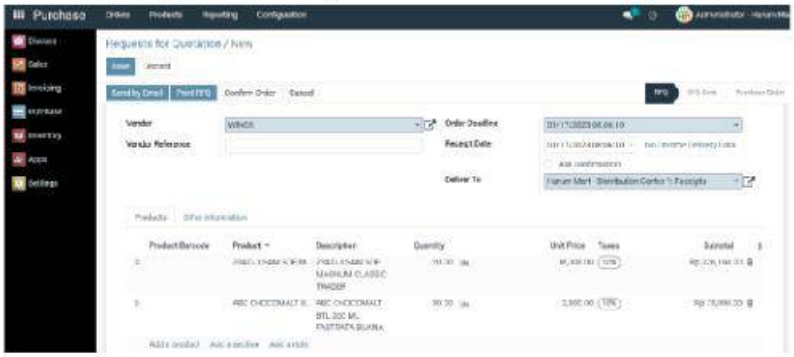

Figure 7. Purchase Module for Product Receiving

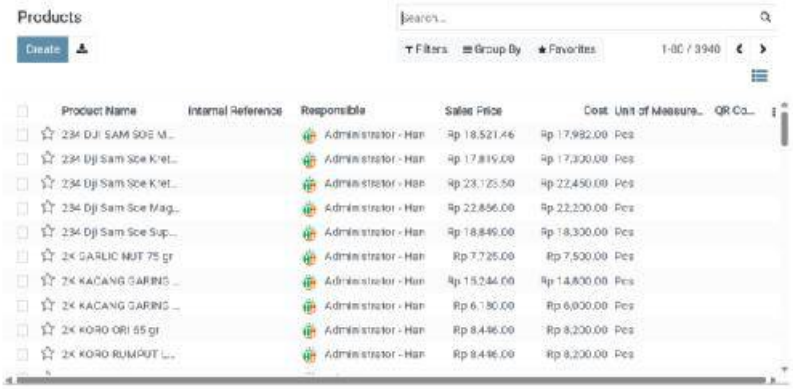

Figure 8. Master Data Product

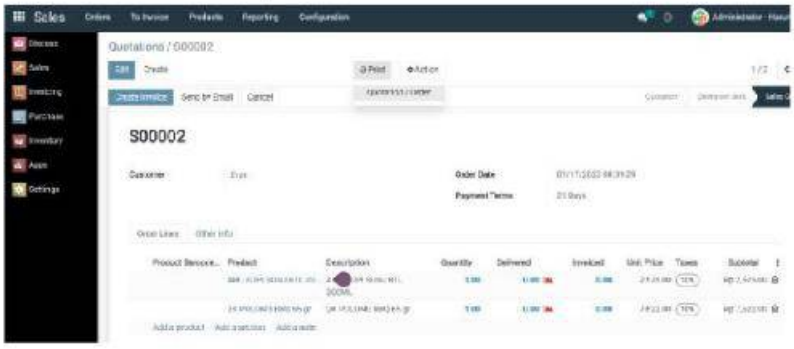

Figure 9. Sales Module

Conclusion, Implication, and Recommendation

Previously, data entry for the object of study had to be done manually since there was no real-time connection between the distribution center (DC), vendors/suppliers, and retail outlets. This led to updates being delayed and the process being time-consuming. Additionally, there were often errors due to human mistakes. To address these issues and improve the real-time process, an Open-source ERP system has been successfully implemented to integrate DC and retail warehouse activities in real time. This research aims to implement the new system and connect the DC, Retail, and Vendor/Supplier by analyzing the current condition and validating it through the object.

This research has implications for our object of study. We have developed a new Integrated Warehouse Application (IWA) system that utilizes Open-Source ERP software. The IWA system provides detailed and real-time visibility of stock items across our one DC and three retail locations. Our approach is flexible and company-driven, tailored to meet your specific needs in four stages: planning and preparation, analysis and processing, design and production, and delivery and training. The new system is designed to provide real-time processes and updates throughout the entire supply chain. It enables users to make an order to the supplier/ DC, re-confirm the order, contact the supplier/ DC for product confirmation, receive and check arriving products, park payment, input new inventory data, make a shipment note to retail, create data and return of goods returns to the supplier/ DC and also stock updates. All administrative processes related to product supply from the DC to each retailer, as well as reverse logistics, are carried out in one integrated system. One key feature of the IWA system is its ability to automatically issue orders based on predefined Reorder Points. This enables more effective and efficient processes, as well as better inventory management. Moreover, as the implementation has just begun, the system provides real-time information that assists management

in making quick and accurate decisions.

IWA offers instant data updates to streamline exchange processes. However, future research could expand the system's capabilities to include retail sales at the Point of Sale (PoS). Additionally, a more flexible connection between a company's financial and inventory data is necessary for precise decision-making based on updated data patterns. This would create a comprehensive system for businesses, covering everything from procurement, finance, and inventory management to warehouse management, fulfillment, and PoS.

Acknowledgment

This research has received funding from PT. Aula Utama Berkah NU (Harum Mart) Distribution Center Surabaya and support from Universitas International Semen Indonesia. Additionally, we would like to thank Research Assistants Dimas Adi Prayoga and Kharisma Hayuninglyas Pramesti for their contributions.

References

Alaskari, O., Pinedo-Cuenca, R., and Ahmad, M. M. 2021. "Framework for Implementation of Enterprise Resource Planning (ERP) Systems in Small and Medium Enterprises (SMEs): A Case Study," *Procedia Manufacturing* (55), pp. 424–430.

Alghazali, A. M., and Ageeli, U. M. 2020. "The Role of ERP Information to Support Decision Making Process: Field Study on Panda Retail Company (Mobile Inventory Management System)," *International Journal of Interactive Mobile Technologies (IJIM)* (14:16), p. 133.

AlMuhayfith, S., and Shaiti, H. 2020. "The Impact of Enterprise Resource Planning on Business Performance: With the Discussion on Its Relationship with Open Innovation," *Journal of Open Innovation: Technology, Market, and Complexity* (6:3), p. 87.

Antari, D. D., Sukarsa, I. M., and Bayupati, I. P. A. 2014. "Implementasi Proses Bisnis pada Perusahaan Retail Menggunakan Software Adempiere," *Jurnal Ilmiah Merpati* (2:1).

Bakhri, S. 2019. "Evaluasi Faktor-Faktor Yang Mempengaruhi Performa Implementasi SAP ERP Di Industri Retail," *Walisongo Journal of Information Technology* (1:2), p. 111.

Davyn Limited. 2023. "The Retailer's Roadmap: Why Do I Need ERP," *Davyn*, April 3. (https://davyntt.com/the-retailers-roadmap-why-do-i-need-erp, accessed May 27, 2023).

Dunaway, M. M. 2012. "Chapter 4: ERP Implementation Methodologies and Strategies," in *Readings on Enterprise Resource Planning*, pp. 46–58.

Estébanez, R. P. 2021. "Assessing the Benefits of an ERP Implementation in SMEs. An Approach from The," *Scientific Annals of Economics and Business* (68:1), De Gruyter Open, pp. 63–73.

Hansen, H. F., Haddara, M., and Langseth, M. 2023. "Investigating ERP System Customization: A Focus on Cloud-ERP," *Procedia Computer Science* (219), pp. 915–923.

Hasegawa, T., and Tani, S. 2022. "Indonesia's Small Shops Attract Big Interests amid Digital Wave," *Asia Nikkei*, March 27. (https://asia.nikkei.com, accessed May 29, 2023).

Hustad, E., and Stensholt, J. 2023. "Customizing ERP-Systems: A Framework to Support the Decision-Making Process," *Procedia Computer Science* (219), pp. 789–796.

Ibrahim, M. F., Yogantara Setya Dharmawan, and Ngatini. 2022. "Implementation of Open Source ERP-Based Fleet Management System on SMEs Transportation Service Provider," *Jurnal RESTI (Rekayasa Sistem Dan Teknologi Informasi)* (6:5), pp. 883–890.

ILO-PROMISE IMPACT project. 2019. *Financing Small Businesses in Indonesia: Challenges and Opportunities*, ILO. (https://www.ilo.org/jakarta/whatwedo/publications/WCMS_695134/lang--en/index.htm).

Malhotra, R., and Temponi, C. 2010. "Critical Decisions for ERP Integration: Small Business Issues," *International Journal of Information Management* (30:1), pp. 28–37.

Navalina, I. L. P., Djajanto, L., and Kamayanti, A. 2021. "Designing Accounting Information Systems for Primary Cash Receipts and Expenditures in Open ERP-Based Retail Units (ODOO)," *Open Access Indonesia Journal of Social Sciences* (4:2), pp. 199–208.

Quona Capital. 2021. "Reinventing the Way Small Shops across Indonesia Get Their Inventory," *Quona Capital*, March 18. (https://quona-capital.medium.com, accessed May 28, 2023).

Retnasari, T. 2021. "Pemodelan Enterprise Resource Planning Pada Perusahaan Ritel," *Informatik : Jurnal Ilmu Komputer* (17:1), p. 17.

Rupčić, N. 2021. "Implementing Enterprise Resource Planning in SMEs: The Consultants' Perspective," *International Journal of Business Information Systems* (37:4), p. 467.

Suryantoro, E. H. 2021. "Faktor Keberhasilan Dan Kegagalan Implementasi ERP-SAP Pada Industri Retail di Indonesia," *Jurnal Teknologi Informasi* (6:2), pp. 130–138.

Suryo, D. A., Abdullah, S., and Siswanto, T. 2021. "Odoo ERP Implementation Point of Sale Module at Mc Cake," *Inselmatics* (1:1), pp. 26–31.

Tamboveevs. A., and Tamboveeva, T. 2022. "ERP System Implementation: Benefits and Economic Effectiveness," *International Journal of Systems Applications, Engineering & Development* (16), pp. 14–20.

Tongsuksai, S., Mathrani, S., and Weerasinghe, K. 2022. "Cloud ERP Adoption in SMEs of New Zealand Retail Industry: Exploring CSFs and Risks," in *2022 IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE)*, Gold Coast, Australia: IEEE, December 18, pp. 1–8.

Yuhanto, N., Anon, M., Prabowo, H., and Hidayanto, A. N. 2020. "ERP System Selection for Small Medium Enterprises (SMEs): A Systematic Literature Review," *International Journal of Mechanical Engineering and Technology (IJMET)* (11:12), pp. 1–11.

How to cite:

Meilanitasari, P., Ibrahim, M. F. 2023. "Development of Integrated Warehouse Application for Retail Business with Multi-Echelon Demand using Open-source ERP System," *Jurnal Sistem Informasi (Journal of Information System)* (19:2), pp. 48–60.

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