Design of planning model for ERP system in warehouse management: an empirical study of public hospital in Indonesia

F D Utami1* W Puspitasari1 M Saputra1

1 Information system, Industrial Engineering Department, Telkom University, Bandung, Indonesia

*E-mail: fadhilahdianutami@student.telkomuniversity.ac.id

Abstract. Public Hospital is one of the complicated information in the healthcare industry. ERP provides a concept that integrates a whole series of business processes, so they are mutually sustainable as part of business management to achieve the goals of an organization. In line with the hospital’s information system, ERP provides a solution for managing data information that runs in hospitals. As one of District Government Hospitals in Indonesia that provide health services, RSUD XYZ does not have an independent information system that manages the hospital’s vital data specifically in warehouse management yet. Procurement and management of goods on a regular basis without a system managing in terms of inventory bring through redundancy, ineffective, and inefficient management of data in the warehouse. This research focuses on the planning model system for the public hospital in inventory management business processes, developed using OpenERP at Inventory Management module and QuickStart method. The results of this study is a design of a planning model for inventory management system in the public hospital. This research explains how the ERP system can help improve health services in the public hospital under business processes that should be in the healthcare industry.

1. Introduction

Health services need a complete system to manage business processes that are quite complex and vital, such as procedures and management data of patients, availability of doctors, management of employees, medicine stock information and medical tools until the management of invoices that take a long time to maintain. Like the other industries, the healthcare industry such as hospitals expects an accurate and quick management system that can make the organization's daily operations more effective and efficient.

Rumah Sakit Umum Daerah XYZ or RSUD XYZ is a public hospital that responsible as a type C hospital in Indonesia, which is responsible for one regional area, provide limited doctor specialist and referral from Pusat Kesehatan Masyarakat (Puskesmas) (Putri et al., 2016). The absence of an information system to RSUD XYZ especially in the warehouse management division makes it difficult for RSUD XYZ to track every stock and high chance of double-entry. Moreover, RSUD XYZ use paper-based process and some in the excel to manage all of the information in the warehouse on RSUD XYZ, which makes it's difficult for warehouse staff to process warehouse data administration. The following table is types of items that are managed in the warehouse at RSUD XYZ.

| Item Type | Description |
|-----------|-------------|
| Medicine  | For patient treatment |
| Medical Tools | For patient treatment |
| Office Supplies | For daily operations |
| Equipment | For patient care |

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
Table 1. Item category of storable goods

| Number | Item                          | Total Sub Item |
|--------|-------------------------------|----------------|
| 1      | Patient Food                  | 67             |
| 2      | Staff Food                    | 6              |
| 3      | Patient’s food support        | 23             |
| 4      | Office Stationery             | 144            |
| 5      | Form                          | 156            |
| 6      | Cleaning Equipment            | 54             |
| 7      | Electrical and Electronic Tools | 66           |
| 8      | Radiology Equipment           | 6              |
| 9      | Laboratory Equipment          | 70             |
| 10     | Pharmacy                      | 2050           |

From the table above we can comprehend that the amount of goods in 10 items has exceeded 2500 items. Where each item has its procurement, management of when the good push and pull from warehouse and placement in the warehouse regularly. Without an information system that is able to manage terms in the warehouse in RSUD XYZ, warehouse staff will be overwhelmed by handling the data.

Information System is necessary because the amount of information that they rely on to carry out services is quite complex (Putri et al., 2016). Hence, the integration of different services and processes would benefit the healthcare organization and eradicate the traditional segregation of processes, which has resulted in the reduced sharing of information. Integration of data in hospitals between divisions will help the processing of existing data, because each data warehouse is created based on the needs of each other division in the hospital. Integrated systems would allow the healthcare organization to coordinate management and support the efficiency of patient care (Mucheleka & Halonen, 2015).

Larger organizations have been the main implementers of ERP systems. ERP systems provide solutions for many organizations that have successfully implemented them. The healthcare industries are also some sectors that could benefit from ERP systems implementation. ERP systems facilitate organizations using them with an opportunity to integrate individual information system while providing an organization with operational and technical benefits such as personnel reductions, service improvements, order improvements, cost reductions on logistics and procurements (Sanja, 2013)

2. Literature Review

2.1. ERP (Enterprise Resource Planning)

Enterprise Resource Planning is software intended to integrate business processes in manufacturing and production, finance and accounting, sales and marketing, and human resources into one software system (Hardjono et al., 2017). ERP collects information from all of the company’s business functions that allow companies to have a much broader range of information. Enterprise Resource Planning is an application and database solution that automates and integrates information processing of business processes and business functions in an organization [5].
Figure 1. ERP subsystem [6]

Figure 1 describes general ERP subsystem model to combine and integrate business functions in one central database.

2.2. ERP system in healthcare industry
Manufacturing industries indeed use more ERP applications than the healthcare industry that deals with patients. ERP application usage in the healthcare industry is impeded due to the lack of standardization for ERP systems in the integration of the healthcare Industry. Apart from this challenge, ERP applications can still help health service organizations to integrate various hospital functions such as human resource management, patient scheduling, hospital decision making, and workflow management [7]. Besides, ERP systems have transcended the organization and tend to focus on resources, but ERP systems also help planning such as finance, controlling, operating management, analysing and reporting and decision making tasks (Sanja, 2013).

2.3. Warehouse management
Warehousing has an important role in the supply chain in every organization whatever materials it is operating with. Effectiveness of warehousing can affect the overall business of the company and cause reorganization in the company. Nowadays warehousing processes are rapidly changing due to information systems improvement. New technologies such as ERP systems, barcodes, computerized equipment, and many others have made warehousing efficient and accurate in its operations. Also, the educational level of human resources has developed, as personnel needs to be educated enough for computer-operated processes [8].

The basic function of the warehouse is to receive user orders, take the needed product and prepare to deliver the products to the customer. There are many ways to manage this process, but the whole process in a part of the warehouse follows the general phase of warehousing activities; Receiving, pre-packing, put away, storage, order picking, and packaging, sortation, packing and Shipping, and shipment [9].

2.4. OpenERP
The open-source ERP software is ERP software that provides access and ways of working from its source code. Others can also add or subtract source code from the software. The main reasons for choosing an open-source ERP system are costs, flexibility, vendor independence and the generation of internal company knowledge [10]. Open source is open to the public, has the characteristics of flexibility, quality, adaptability, infrastructure, no hidden costs, scalable, the most important in the selection of open source ERP is suitable for all devices, such as PCs, mobiles, and others examples of such software are Odoo, Compiere, ERP5, Adempiere, OpenBravo and others.

OpenERP is an ERP software that is open source, python-based programming language. OpenERP is available in 18 languages and around 1500 developers have participated in the system development project. Until now there are more than 4000 applications that can be applied to OpenERP, based on OpenERP, the application can be classified into 6 major groups [8]:

![Diagram of ERP subsystem]
1. Front-end apps: website builder, blog, e-commerce.
2. Sales management apps: CRM, point of sales, quotation builder.
3. Business operations apps: project management, inventory, manufacturing, accounting and purchase.
4. Marketing apps: mass mailing, lead automation, events, surveys, forums, live chat.
5. Human Resources apps: employee directory, enterprise social network, leaves management, timesheet, fleet management.
6. Productivity apps: business intelligence, instant messaging, notes.

Figure 2. Architecture of OpenERP

Figure 2 shows architecture in OpenERP. Database in OpenERP uses PostgreSQL as the initial database for all of its functionality. The OpenERP server uses Python as a programming language. The OpenERP server application is released under the Aeffro GPL License. OpenERP uses web server technology to share client access. So, to access OpenERP, just use a standard browser. Besides, client access can be either as a server or as an end-user depending on the chosen point of view [10].

3. Methodology

The Method is a software implementation methodology that has 5 stages of implementation. QuickStart is recommended by Odoo for implementation in various project scopes.

Figure 3. QuickStart methodology [10]

The following stages of the QuickStart implementation [10]:

3.1. Kick-off call
At this stage, the client is explained and planning the methodology steps along with the outputs that will be obtained in this project.

3.2. Analysis
At this stage, an analysis of the conditions of existing business processes is carried out and determines the needs and shortcomings of the current business processes so that they can be improved or developed into business processes.

3.3. Configuration
After the requirements are defined at the Analysis stage. At this stage, the application customization and configuration are performed according to the business processes and needs of the RSUD XYZ obtained from Gap Analysis.
3.4. Production
This section focuses on application implementation at RSUD XYZ, including the installation and configuration of applications that have been developed and tested.

4. Analysis and Design
In this study, the researcher focuses on implementing 2 phases in QuickStart methodology, start from Kick off Call until Analysis of the system OpenERP in RSUD XYZ. The Researcher using the methodology to see fit/gap analysis in the new design.

4.1. Kick off call
In the first phase, the researcher defines all the requirement that used to initiate a project, such as the design that involve stakeholders and determines the final objective of the project.

| Table 2. Requirement to initiate the project |
|--------------------------------------------|
| Environment                                | Development              | Basic Concept                  |
| In the existing system at RSUD XYZ doesn’t have an independent and integrated system that manage warehousing. | Develop an ERP system using OpenERP warehouse management module | -Enterprise Resource Planning |
|                                           |                          | -Warehouse Management          |
|                                           |                          | -OpenERP functional & Technical Resource |
|                                           |                          | -OpenERP QuickStart            |

From table 2 the environment of business process in RSUD XYZ cannot yet fulfilled the business needs, by implementing ERP systems especially in warehouse division the purpose of RSUD XYZ can be fulfil. To achieve the purposed of the system the researcher uses 4 basic concepts to serve the suitable system.

4.2. Analysis
In this phase, the researcher analyzes the business needs, business processes that are currently running and the proposes business process with the OpenERP system.

4.2.1. Business needs of RSUD XYZ
The business need will explain requirements that are setting the direction of the design of the OpenERP system.

| Table 3. Business needs of RSUD XYZ |
|-------------------------------------|
| System                             | Application                          | Data                          | Product & Service                        |
| Software that integrated to automates work | Software that people use as a tool to improve daily operational services | Accurate information and report to Government regulation | Deliver stockable product to user and proved a real-time service |

Table 3 describe the business needs of RSUD XYZ in warehousing management can be fulfilled by implementing ERP System. Because the current system run offline in warehouse area causes process reporting take more time and staff overwhelm by repetitive work and high wrongdoing rate that lead the purposed business process cannot yet fulfill.

4.2.2. Business process with the current system
The business process existing will explain the problem that warehouse division found especially for the storable product. Warehouse management cannot be generated only by the warehouse division, but also integrated by several divisions. The procurement request process initiates by the user from each
division requests goods from the warehouse division by bringing request document. Then the warehouse division will deliver the documents to proceed by the document administration section, the person in charge, the administration, and lastly to the procurement department. Each process in purchasing will be attached one document from each section if the purchasing request approved. Warehouse staff ask for approval by coming directly to the concerned division.

When goods arrived at the warehouse, there is paper-based documents that must be complete first before the goods can enter the warehouse as well as the goods for good receipt process. The storage rules do not yet have a business management process, so the warehouse is only a storage area and there is no management product and management warehouse or locations. The following are some pro that need to be considered in the existing inventory management process

| Table 4. Business process existing of RSUD XYZ |
|-----------------------------------------------|
| Process                                      | Existing Process                                                                 |
| Purchase Requisition                         | There are no terms for minimum stock or anticipation stock so the warehouse has difficulty in controlling the storable product. |
|                                               | - Requests from users that become triggers for submission of procurement so that the concept of stock product is not actualized. |
|                                               | - The process of purchase requests among divisions is still manual (paper-based) the document goes around manually so there is no guarantor that the document reaches the intended destination. |
|                                               | - If there is one division that does not approve of procurement, there is no notification to the warehouse so the status of the item is unknown for warehouse staff. |
| Good Receipt and Good Issue                   | No system regulates the number of products in real-time conditions, the recording is still done manually and repeatedly so that the amount of goods in and out is difficult to ascertain with the real condition. |
|                                               | - repeated records document for Hospital formats and the government data formats |
|                                               | - The Good Receipt and inspection of quality goods carried out by a separate team (Good Receiving and Quality Assurance team) so that there is repeated verification that causes the time for goods to enter the warehouse longer. |
| Storage rules                                 | The warehouse only functions as a storage place, the warehouse does not have a layout rule and each item does not yet have an id number to identify. |

From the table 4 There are 3 basic processes of the warehouse and the main problems that hamper the warehouse business process in providing services in the daily operation of the RSUD XYZ.

The following are the solutions that researcher offered against the existing business process that has been interfering at RSUD XYZ.

4.2.3. Business process target

The researcher will give the solution Business process proposes a solution based on problem described in table 4.
Table 5. Business process target of RSUD XYZ

| Process                  | Solution                                                                                                                                 |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Purchase Requisition     | - Configure product and term in the warehouse. So, the system will automatically give a notification to do the procurement process.          |
|                          | - The minimum stock standard is applied for each item. The procurement will be notified if the goods run out. So, when requesting goods, the user(divisions) will immediately get it without waiting for procurement. |
|                          | - Using the OpenERP system based on information technology so that work can be executed to users who have authorization for a transaction.    |
|                          | - A notification will update automatically in real-time when a transaction is executed.                                                  |
| Good Receipt and Good Issue | - Product configuration where each item will have an item ID that will facilitate the recording of incoming and outgoing goods and the stock in the warehouse will be found in real-time. |
|                          | - Make a report that can be printed in a variety of formats.                                                                             |
|                          | - The checking process is directly carried out by the purchasing section. the warehouse only accepts the handover of goods.                     |
| Storage Rules            | - Product Configuration                                                                                                                                 |
|                          | Each Product will have an ID number to identify the terms of each item such as real-time quantities, stock sites, treatment of each item like expiration date and management of certain types of items. |
|                          | - Rules Configuration                                                                                                                                 |
|                          | Each number of products will have a rule for safety stock and a notification will appear to enable the request for procurement.               |

From table 5 the researcher proposes a solution for each problem described in table 2. Implementing an integrated information system is the key to the solution offered. Problems of procurement, management of goods in the warehouse, distribution of goods into the planning of the budget will be more easily managed with the help of information technology especially ERP.

4.3. Design
In this phase, the researcher will design the system with architecture system diagram, block system diagram and use case diagram.

4.3.1. Architecture system OpenERP in RSUD XYZ
Figure General Architecture system shows how OpenERP will implement in RSUD XYZ. This Architecture involves 4 actors from the warehouse management system.
The OpenERP architecture compatible with modern browser such as Google Chrome, Mozilla Firefox, Microsoft Internet Explorer. It is platform-operating system- and browser-agnostic [11]. The open ERP web client sends focused procedure call instructions to the server when additional data is needed. To support this system, table VI describes the requirements that will be needed when implementing OpenERP in RSUD XYZ.

| Technology       | Minimum Requirement |
|------------------|---------------------|
| Hardware         | 2x8 CPU Server      |
|                  | 8 GB RAM            |
|                  | HDD 1 Terabyte      |
|                  | Network 1000Mbps    |
| Software         | OS Ubuntu 18.04 LTS |
|                  | PostgreSQL Server   |
|                  | Phyton version 3.5  |
|                  | Apache web server   |

4.3.2. Block system
Design block system will show how this system integrate. The researcher designs a block system to explain the relation of integrated system among the division. Moreover, define the inputs and outputs such as the documents that are processed and the results of recording all transactions.

Figure 5. General block system for RSUD XYZ

Figure 5 Shows actors that integrated with the Warehouse Management module particularly for the storable product or Inventory Supplies. There are 5 Relationship, which we can itemize as follows.
• R1 and R2 (Inventory Supplies - Inventory Management – Inventory Asset)
The warehouse division manages 2 types of goods in inventory. The first is Inventory Assets such as assets in the field of nursing and medical. The second is Inventory supplies managing types of goods that are storable the category of goods can be seen in Table 1. This relationship will build Inventory Management in RSUD XYZ.

• R3 (Inventory Supplies - Purchasing)

Figure 6. Inventory supplies - purchasing integrated system

Figure 6 shows how Inventory Supplies integrated with purchasing. When the OpenERP system of the warehouse has triggered because the goods have entered the minimum stock, the OpenERP system will issue a notification to Inventory Supplies. The Inventory Supplies will receive a purchasing request. The warehouse section will issue RFQ if it has been approved by:

a. Hospital Director who will provide a letter of disposition and direction to the Administration
b. Administration section confirms the approval of the purchase
c. In Charge of commitment will confirm the availability of the budget

If the three parties above agree to purchase, the completed RFQ has been completed and made, and ready to send to the Purchasing Section as a reference for creating Purchase Order to vendors. When the goods have been received by the purchasing department, the goods will be checked whether they are suitable with the Purchase order documents that they have sent. After that the goods will be forwarded to the warehouse for storage and a handover goods report will be made. Output from this process will be record in Good Receipt Document.

The Procurement request from warehouse division. Information gathered from this process including list of items that will needed by user automatically because in the system will set the safety stock for each item, and the status of the procurement will be updated to warehouse division what part of cycle it has been done. In the Good Receipt Process Each item handled with their need and recorded in OpenERP how the storable product pulled to the warehouse.

• R 4 (Inventory Supplies - Payable)

Figure 7. Inventory supplies - payable integrated system
Figure 7 shows how Inventory Supplies integrated with finance division. At the beginning of the fiscal year, there will be a list of needed items from each division so the Finance division can make a master budget plan for that year. In the same way for the Warehouse Division will request in the form of a list of goods to the finance department to make the budget for storable goods. The Finance Division will formulate the budget plan that will be used as a limit for the warehouse.

At the procurement cycle, the transaction will complete when finance does the payment to the vendor and before finance verifies the payment, warehouse division must have verified a good receipt first. The output from this process will be recorded in the stock item document.

- **R 5 (Inventory Supplies – User (Divisions))**

```
List of item
Requested
Stock
Confirm GI
Report
GI Report
Inventory Supplies
User (Divisions)
Request Item
Good Issue
GI Document
```

**Figure 8.** Inventory supplies – user (divisions) integrated system

From the figure 8 we can conclude, when the user loses a certain stock in his division, they will send requests of items to the warehouse to meet their needs. The warehouse division will check and update stock documents and give goods with the document of Good Issue for the goods coming out to the user. This transaction will be completed when the user confirms the Document of Goods Issue. Output from this process will be record in Good Issue Document.

When the user needs a storable product, warehouse division will provide a certain way to fulfill their needs without delay the confirmation because we already have a system that records the real amount in the warehouse.

- **R6 (Inventory Supplies - Warehouse)**

```
Stock Report
Inventory Supplies
Push Goods
Pull Goods
Warehouse
```

**Figure 9.** Inventory supplies - warehouse system integration

From figure 9 shows how storage allocation managed. Warehouse division will push and pull the good from the warehouse and the output will be record in Stock Report. Stock Report have information of a real-time stock in the warehouse. RSUD XYZ does not have yet a procedure of Business Process to managed the storable goods in the warehouse.

Existing Storage Allocation do not have yet business process so the researcher suggests as follow.
Figure 10. Storage allocation business process

Figure 10 shows the flow chart of storage allocation for each product. This system will determine how to manage an item the warehouse, when the item already have the ID number the storage staff will easily take and put items in their stock site. Advantages of using an Id number will make it easier to identify each item, such as managing location, the expiration date and make Stock Opname Report.

4.3.3. Use case

Figure 11 use case diagram designed to explain the workflow of the system. Also explained for each actor such as Warehouse Division, Purchasing Division, Financial Division and user of each division. Warehouse division can create, update, delete or confirm Purchase Requisition, do configuration of
each item in the storage like manage ID number of an item, make reordering rules, request a procurement, manage good issue and good receipt. Accounting division do processes of payable like made budgeting plan and do the payment when the goods have entered the warehouse. Purchasing division directly related to the vendor, Create RFQ and Purchase Order to vendor. User of each divisions can request list of storable products that their need and confirm Good Issue report.

5. Conclusion
The Conclusion of this research is designed of planning model for ERP system in warehouse management is the solution for RSUD XYZ. OpenERP as one of ERP software is compatible with the RSUD needs. The development of RSUD XYZ uses the QuickStart methodology, and this methodology can implement the completion process on time and the costs needed can be adjusted to the project. ERP also make their business process can be accessed effectively and efficiently with warehouse module in OpenERP with customization to improve service in daily operation’s in RSUD XYZ. But still, the employee needs to learn using the new system. The researcher also give recommendation to carried out depth research regarding to another module which able to support the existing module that has been developed, it is better for quickstart methodology performed until the deployment to site and held training for OpenERP Warehousing Management user for effective and efficient planning and implementation.

Acknowledgments
We thank you to the previous researcher of related researches and special thank you to the researcher team and ERP Laboratory.

References
[1] R. R. Putri, L. Andrawina, and R. W. Witjaksono 2016 Perancangan sistem asset management berbasis odoo dengan soft system methodology di rumah sakit muhammadiyah bandung eProceedings Eng 3 3155–3162
[2] M. Mucheleka and R. Halonen 2015 ERP in healthcare international conference on enterprise information systems Proceedings 1 162–171
[3] M. M. Sanja 2013 Impact of enterprise resource planning system in health care International Journal Academic Research Business and Social Science 3 404–418
[4] C. Hardjono 2017 Perancangan dan implementasi ERP (enterprise resource planning) modul sales and warehouse management pada CV. Brada eProceedings Eng 4 4983–4993
[5] C. E. &. A. D. Kristianti 2017 penerapan sistem enterprise resource planning: dampak terhadap kinerja keuangan perusahaan Jurnal Akuntansi & Auditing Indonesia 21 139–144
[6] A. Garefalakis, G. Mantalis, E. Vourgourakis, K. Spinthiropoulos, and C. Lemonakis 2016 healthcare firms and the erp systems Journal of Engineering science and Technology Review 9 139–144
[7] M. K. Mucheleka 2014 Enterprise resource planning systems in healthcare sector university of oulu
[8] V. Titova 2016 Implementation of enterprise resource planning service: 1c logistics system in the warehouse processes in construction companies
[9] A. W. D. &. W. R. W. Mustafri 2016 Pengembangan odoo modul warehouse pada gudang PT. Tarumatex menggunakan metode rapid application development eProceedings of Engineering
[10] C. Nafianto, W. Puspitasari, and M. Saputra 2019 Development of flexible production scheduling by applying gantt charts in manufacturing module open source ERP (case study cv. xyz) international conference on sustainable engineering and creative computing: new idea
[11] Odoo ERP Modules Accessed 25 February 2020 TenthPlanet Open Source Foundation Available:https://tenthplanet.in/odoo/product/overview/
[12] D. Reis 2018 Development Essentials: Fast-track your Odoo development skills to build powerful business applications, 4th Edition, Packt Publishing Ltd