DEVELOPMENT, CONFIGURATION AND IMPLEMENTATION OPEN SOURCE ERP IN MANUFACTURING MODUL WITH ACCELERATED SAP METHOD

Agung Terminanto

Faculty of Computer Science, Universitas Indonesia, Depok, Indonesia

Achmad Nizar Hidayanto

Faculty of Computer Science, Universitas Indonesia, Depok, Indonesia

Bagus Maulana

Industrial Engineering Department, Universitas Pancasila, Jakarta, Indonesia

ABSTRACT

Industry Revolution 4.0 has changed the way we live, work and interact, creating new opportunities and challenges. To deal with these challenges, SMEs need an application that can integrate and automate SME business processes. PT. Faco Global Engineering is a manufacturing company that focuses on steel. In its production activities, the related documents are still handwritten using the existing forms, and stored in a Microsoft Excel. So that documents related to production activities and production reports cannot be accessed in real time. Odoo is an open source ERP application that provides production activity solutions in the form of manufacturing modules. This implementation using the ASAP (Accelerated SAP), with a risk that appears at a low level of 44%, medium 48%, high 8%. There are 6 form adjustments, namely product form, bill of material tab components, bill of material tab properties, work center, manufacturing orders, and work orders on Odoo. The ASAP method is chosen based on the level of efficiency for making reports of production results of 64% activity, 78% time, 100% distance, and 50% human resources.

Key words: ERP, Odoo, Production, Manufacturing, ASAP Method

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1. INTRODUCTION

Based on data from the Central Statistics Agency (BPS), the contribution of MSMEs to the Indonesian economy in 2017 dominated by 61.4%. While the absorption of MSME workforce compared to the total national workforce dominated by 97.0%. The number of MSMEs has reached 60 million units. MSMEs can play a role in increasing export opportunities through superior products produced generally based on local resources. MSMEs play a role as the backbone and drive of the country's economy through the control of most business sectors in various regions. Therefore, sustainable empowerment and development needs to be done so that MSMEs not only grow in large numbers but also develop in the quality and competitiveness of the products produced.

Global competition results in increasingly intense competition between MSMEs and Large Enterprises both locally and internationally. MSMEs must seek competitive advantages that can help them minimize costs and maximize profits. Limited financially and resource needs are one of the problems faced by MSMEs. Previous research states that most of the business processes owned by SMEs are still done manually and only a small proportion of MSMEs are able to implement applications to assist their operational activities and most of the operational activities carried out are still fragmented [4]. According to the 2016 economic census, MSMEs using internet information technology are still minimal, which is 6.23% using the internet for marketing, 3.02% for marketing, and the remaining 90.75% do not use the internet.

Enterprise Resource Planning (ERP) is a business management software that integrates corporate functions so that companies can collect, store, organize and analyze data that aims to improve company performance (Jalal, 2011; Ram & Corkindale, 2014; Rajnoha et al, 2014; Jayawickrama & Yapa, 2013). ERP applications can be one solution to help MSMEs in simplifying, integrating and automating MSME business processes. The purpose of utilizing ERP applications is to reduce operational costs and improve business performance, such as improving consumer services, integrating data, and so on.

ERP system implementation is very expensive and high risk. The price of the software is expensive and also the cost of consultation. Gartner Research conducted research that in 2014 the failure rate of ERP implementation was high by 72%, therefore ERP implementation was high risk. Gartner conducted research in 2015, the ERP project ranked third in the expenditure of Information Technology (IT) companies.

Hauge, Sørensen, & Conradi (2008) found that some MSMEs in Europe adopted OSS ERP because of financial and human resource limitations. In the study of Raymond, Bergeron, & Blili (2005) it was found that MSMEs adopted because of ease and customization. According to Levenburg (2005) MSME motivation adopted OSS ERP because of the limited human resources that are reliable in IT. Kim & Boldyreff (2005), MSMEs are more adaptable to business changes. This is a capital in the implementation of OSS. On the other hand, MSMEs must also be efficient in operating a business with the aim of reducing operational costs and increasing market share. Still according to Kim & Boldyreff (2005) . The development of a modular OSS supports the implementation of OSS ERP for MSMEs in Indonesia. Snider, Silveira, & Balakrishnan (2009) also examined ERP adoption in five Canadian MSMEs, the motivation for adoption was to integrate with the legacy system and to deal with business growth. The study said that there were successful and failed MSMEs. Successful MSMEs because there are internal team aspects, documentation, using consultants and training. In another part Leina, Tiejun, Guoyan, & Chengbin (2008) conducted Compiere customization research on MSMEs in China, and proved that OSS ERP can reduce costs and make the system more transparent, independent of one vendor and more flexible in facing business competition.

In another part Baharum, Ngadiman, & Haron (2008; 2009) conducted a study of two Malaysian MSMEs in adopting ERP OSS. The motive is financial benefits and customization capabilities. While the obstacles are database migration, software synchronization of workflow compay, user interface development, user support and third-party software integration. Olson & Staley (2012) examined the success of a USA MSME company adopting OSS ERP which implies that OSS ERP has the potential to be applied in MSMEs in other countries. Olson & Staley (2012) analyzed OSS ERP implementation in MSMEs with 6 risk dimensions proposed by Poba-nzaou, Raymond, & Fabi (2012).

At present the research is only about ERP studies on MSMEs and on-premise ERP implementation. Saputro et al. (2010) only researched and made a long-term plan map of the ERP research agenda for MSMEs in Indonesia. This is to answer the needs of MSMEs to expand market share and improve competitiveness. MSMEs need an application that can integrate and automate MSME business processes. Indonesian MSMEs' awareness of the ERP concept is still lacking, which is just under 20%, which has implications for the still large market opportunities in Indonesia for ERP applications. The study of (Wahid & Iswari, 2007) on 146 MSMEs in Yogyakarta shows that only a small proportion of MSMEs have adopted IT. The main barriers they experience in adopting IT are the limited funds they have and the need for IT to support their operational activities. Handayani and Hariyaty (2011) analyzed the comparison of OSS ERP functionality in the development of learning modules for business processes of sales, distribution and procurement. Furthermore, Handayani, Hidayanto, and Budi (2013) conducted research on the requirements for implementing ERP in MSMEs, especially aspects of the Business Process in marketing and distribution, procurement and production process. Hasibuan (2015) conducts research on project initials that aim to choose an ERP package that is suitable for an MSME company. Of all these studies, it can be concluded that there is no research on the adoption of OSS ERP by MSMEs in Indonesia.

PT. Faco Global Engineering (PT. FGE) is a manufacturing company engaged in steel fabrication. Products produced include basic ingredients of Mild Steel, and Stainless Steel. In its production system, PT. FGE applies the Make-to-Order (MTO) system.

Figure 1. On-Time Delivery of PT. FGE 2016

Based on the problems at PT. In the current production section, FGE requires an integrated information system that can be accessed in real time. The information system used is Enterprise Resource Planning (ERP). The ERP system is expected to help companies to manage the

recording of production documents regularly and also accelerate the flow of information in the company so that decision making can be done more quickly and precisely.

ERP is a software program used by companies to integrate and coordinate information in all areas of the company's business. ERP applications support efficient operation of business processes by integrating tasks related to sales, marketing, manufacturing, logistics, and accounting. Functional cross-integration is the core of an ERP system.

One ERP application is Odoo (formerly called OpenERP). Odoo is a company management software open source practical and easy-to-use designed to address company needs, and help improve business performance. In the Odoo application, the module used as a production process controller is a module manufacturing.

The application of systems manufacturing to Odoo can be more successful if supported by the use of appropriate methods. In this study the method used is the adaptation of the Method Accelerated SAP (ASAP). The selection of the ASAP method is based on the level of time efficiency and the minimal costs incurred compared to other methods.

2. LITERATURE REVIEW

2.1. PT. Faco Global Engineering

PT. Faco Global Engineering (PT. FGE) is a manufacturing company engaged in steel fabrication. PT. FGE was established and operates since 2009 under the name PT. Cipta Serasi and located in Kec. Kelapanunggal, District. Bogor. Existing production activities include purchasing raw materials, warehouse management, production and sales. The products produced include Drill Cutting Box, Pumping Unit, Greting Basket 10 FT, Iso tank Fabrication, Transformers Tank Assy, Office Containers, etc. In its production and sales system, PT. FGE applies the Make-to-order (MTO) system.

2.2. Business Process Business

Process is a set of instruments for organizing an activity and for increasing understanding of the interrelationship of an activity.[1] Another understanding of business processes is a set of activities or activities designed to produce a particular output for a particular customer.[2] Business processes are a set of activities that take one or many inputs and create an output that is useful for the customer.[1]

The business process consists of a series of activities carried out in coordination in the business and technical environment. This series of activities together embodies a business strategy. A business process is usually applied in an organization, but can also interact with business processes carried out by other organizations.[1]

The activities of this business process can be done either manually or with the help of information systems.[1] In a business process, it must have (1) clear objectives, (2) input, (3) presence of output, (4) use of resources, (5) have a number of activities in several stages, (6) can affect more than one unit in the organization, and (7) can create value or value for consumers.[2]

2.3. Enterprise Resource Planning (ERP)

Enterprise Resource Planning (ERP) is a business process management software that helps organizations use a set of integrated applications for business management and automate some of the functions of the back office related to technology, services, and human resources.[3]

Some definitions of ERP can provide an overview of the basic concepts contained in ERP, namely: Enterprise Resource Planning system (ERP system) is an effort to create product integration that manages most of the operations in the company. The difference between ERP

systems is to integrate all functions to create a single and integrated system.[4] An ERP system is a computer-based system designed to process organizational transactions and facilitate integrated and planning real-time, production and customer response. In certain ERP systems it will be assumed to have certain characteristics.[5] ERP is complete software for enterprise business solutions. The ERP system consists of modules that support software, such as: marketing and sales, field services, product design and development, production and inventory control, distribution procurement, management, industrial facilities, process design and development, manufacturing, quality, resources human, financial and accounting, and information services.[6] Enterprise Resource Planning (ERP) is a cross-functional enterprise system driven by a set of integrated software modules that support the basic internal business processes of each company.[7]

Several other definitions included in several books include basic ERP concepts, namely: ERP consists of a package software commercial that ensures seamless integration of all information flows in the company, including finance, accounting, human resources, supply chains, and consumer information.[4] An ERP system is an information system package that can be configured, which integrates information and information-based processes inside, and crosses functional areas within an organization.[5]

Figure 2. Basic Concepts of ERP

The history of the development of Enterprise Resource Planning according to Leon (2008) is divided into 4 stages, namely : Material Requirement Planning (MRP), Closed-loop MRP, Manufacturing Resource Planning II (MRP II), and Enterprise Resource Planning (ERP)

Some of the benefits of using this ERP system are:

1. ERP offers an integrated system within the company, so that the process and decision making can be done more effectively and efficiently.
2. ERP not only integrates data and people, but also eliminates the need for updating and correction of data on many separate computer systems.
3. ERP allows management to manage operations, not just monitor them.
4. ERP helps accelerate the implementation of management supply chain with the ability to integrate it.

2.4. Manufacturing

Manufacturing is a production process to produce tangible products. In a narrow sense, manufacturing is converting raw materials into physical products through a series of activities that require energy, each of which creates changes in the physical or chemical characteristics of the material.

The International Conference on Production Research (ICPR) in 1983 defined manufacturing as a series of interconnected operations and activities which included design (design), material selection (planning planning), manufacturing, quality assurance.), as well as management and marketing of products.

2.5. Odoo Application

Odoo is a software or business application that has a complete module, namely sales, warehouse, manufacturing, human resource management, inventory management, procurement of accounting, finance and so on.[6]

Odoo has a specific needs database, PostgreSQL. PostgreSQL is an open source, cross-platform Object Relational Database Management System (ORDMS). Probably not popular on the scale of Microsoft SQL server or MySQL, PostgreSQL is a company-class database server with many sophisticated features. In fact, PostgreSQL stacks are very good against much more expensive databases such as Microsoft SQL server and Oracle Database. Odoo's main programming language is Python. Like other technologies underlying Odoo, the Python language is open source and runs on all major contemporary (modern) operating systems.

2.6. Odoo Module Manufacturing Application

The Manufacturing module is used to assist companies in planning, ordering, stocking and manufacturing or assembling products from raw materials and components. In addition, the module manufacturing also handles the use and production of products in accordance with the bill of materials (list of material needs) and the operations required on the machine, equipment or human resources in accordance with the route. The service is truly integrated with all software. In this module there is a double-entry stock that makes easier traceability, controls the costs and margins of the project, products, and partners, and easily uses them.

The module manufacturing on Odoo works to do some things like the following.

1. Producing several products from one order manufacturing.
2. Manage product repairs.
3. Manage manual retrieval to fulfill manufacturing orders.
4. Generate procurement in real time.
5. Manage routes and work orders.
6. Allows detailed planning of work orders.
7. Determine manufacturing in the product.
8. Use the property of each product of the bill of material.

The following features are available in the module manufacturing Odoo:

1. Manufacturing Order (MO), this feature has the function to order the production of a finished product. This feature defines:
 - a. Product name, which contains the name of the product to be produced.
 - b. Product quantity, containing the number of products to be produced.
 - c. Schedule date, which contains the date of production plan.
 - d. Bill of Material, contains the name of the BoM used for finished products.
 - e. Routing, which contains the production lines defined in the BoM.
 - f. Responsible, which contains the name of the user who is responsible for the production process.
 - g. Source document, containing the initial source of the document.
 - h. Raw materials location, containing the name of the location of the raw material.
 - i. Finished product location, containing the name of the finished product location when MO is finished.

2. Order Planning, this feature has a function to schedule production according to order planning.
3. Bill of Material (BOM), this feature serves as a list of product components of raw materials and the amount of raw materials needed to produce finished products. This feature defines:
 - a. Product name, which contains the name of the product that the will make BoM.
 - b. Quantity, containing the number of finished products.
 - c. Routing, which contains the selection of production lines needed when producing a product.
 - d. Name of BoM
 - e. Reference
 - f. BoM type, containing type BoM that is normal BoM or sets / phantom.
 - g. Components, which contain the components contained in the product when we define BoM.
4. Work Centers, this feature serves to record and manage production work units. This feature defines:
 - a. Name of work centers, which contain the names of work centers that are used in the production process.
 - b. Resource type, which contains the work schedule used to make production.
 - c. Code, which contains the code of the work center in the production process.
 - d. Active, which determines whether the work center to be used for the production process is still active or not.
5. Routing, this feature serves to create and manage production lines that must be passed in order to produce a finished product consisting of several work centers.
6. A Work Order is a detailed work that must be done for each manufacturing order (MO). When the work order first starts, the MO will automatically change the status to "production started".

2.7. SAP Accelerated Method (ASAP)

ASAP Methodology is SAP's recommended approach to implementing software ERP in various types of companies to produce a best practice that has been tested for success based on their experience. ASAP Methodology helps that ERP implementation provides effective, efficient and optimal results, especially in terms of time, cost, quality, suitability with the needs and utilization of available resources.[7]

Figure 3. ASAP Roadmap

Comparison of ASAP methods with other software development methods commonly used in designing ERP systems using Odoo.

Table 1. Comparison of Software Development Methods[8]

Features	Accelerated SAP	Waterfall	Spiral
Flexibility	Medium	Low	Medium
Documentation	High	High	High
Sizeable	High	High	Low
Ease-of-use	Medium	High	Low
Structured	Structured	Structured	Hybrid
Stakeholder participation	High	Low	High
Prototyping	Low	Low	High

The following is an explanation of the different aspects of each methodology.

1. Flexibility: the ability to change requirements during the project. ASAP and Spiral during iteration allow changes in requirements, while Waterfall does not allow changes to requirements.
2. Documentation: the number of documents created during the project. ASAP provides many templates that can be used in projects, Waterfall requires documentation before implementation, while Spiral requires a review of each phase.
3. Sizeable: ASAP and Waterfall can be used for large and small scale projects, while Spiral is not suitable for small scale projects.
4. Ease-of-use : To use ASAP it takes experience to work on the project, Waterfall is easy to use, while Spiral requires experience in risk management.
5. Structured: The ASAP method is step-based so that it is a structured methodology, Waterfall also uses a structured approach, while Spiral uses a approach hybrid because it runs in a structured cycle.
6. Stakeholder participation: ASAP provides the role of each stage and this role requires stakeholders, in Waterfall stakeholders are involved only in the initial stages, while in Spiral requires stakeholders to review the end of each stage.
7. Prototyping: the number of prototypes given to customers. ASAP and Waterfall only give the finished product in the final stage of the project, while Spiral provides a prototype of the final product at each stage.

3. RESEARCH METHODOLOGY

3.1. Conceptual

Model The conceptual model will help simplify the problem by reducing the number of properties that must be included, so that it is easier to focus on the essentials.[12]

The conceptual model of this study. In this conceptual model there are three main parts to produce an ERP system, Manufacturing namely input, process, and output.

In the stage, input data is needed in the form of product, work center data, and documents sales order. The product is the identity data of the item to be produced, the work center is the identity data of the work station, and the sales order is a document for the goods request from the customer.

Then the data is processed through the following process.

1. Bill of material: make a list of the raw material requirements used for production.
2. Routing: make a work order based on the work center that has been created.
3. Manufacturing Order: Process sales orders to make them as production orders.
4. Work Order: controls the production process that is running in the company.

After the data that has been entered is processed, the output resulting is in the form of finished products, and production orders report.

3.2. Systematic Problem Solving

Research systematics is a sequence pattern used by researchers to make a study so that it is structured logically and systematically in accordance with the environment around the researcher. In this study, the sequence in the study is in accordance with the ASAP method, which consists of the stages of project preparation, the blueprint business, stage the phase realization, and the stage final preparation.

1. Project Preparation

The initial activity carried out is to determine the formulation of the problem and the purpose of the study. Then literature studies and field studies at PT. FGE in the production section. Next is an analysis of the company's production business processes.

2. Business Blueprint

This stage is considered very important because it determines the success of implementing an ERP system. The process carried out is to carry out a risk analysis before the system is implemented. and analysis of Odoo's production business processes. Then a analysis is conducted gap / fit to find out the difference between the company's current production business process and the production business process at Odoo. The results of the gap / fit are then used to design the proposed business process. After that, make use case diagrams to illustrate how the system will run.

3. Realization

This stage has two stages: first is the Baseline Configuration which contains the design of the form proposal that will be used by the company after implementation. Then the second is Final Configuration which contains system configuration, system adjustments manufacturing, and module usage procedures manufacturing.

4. Final Preparation

This section tests Odoo's system. Tests carried out consist of integration testing, and user acceptance test. When the test is complete, then the data is migrated from the system that runs into the system that has been designed.

5. Final Stage of Research

After all stages are completed, then conclusions are made which answer the objectives of the study. Then after getting a conclusion, given suggestions that can be used for subsequent research.

4. RESULTS AND DISCUSSION

4.1. Risk Analysis

The purpose of risk assessment is to obtain a list of risks that have been assessed as the level of impact and likelihood of occurrence, then sorted based on the overall level of risk so that the risks that need to be prioritized are handled.

Table 2. Possible Risks

Risk Code	Risk			Average Likelihood	Level	Average Impact	Level
	Level 1	Level 2	Level 3				
R1	Operational Risk (OR)	In General (OR1)	OR1.1 Operational employees are not willing to use ERP systems	2	Unlikely	1	Minor
R2			OR1.2 Operational employees enter the wrong data into the ERP system	2	Unlikely	2	Moderate
R3		Material and production area (OR2)	OR2.1 ERP systems contain inaccurate or complete bill of material	3	Possible	2	Moderate
R4			OR2.2 ERP systems keep inaccurate inventory / stock records	2	Unlikely	2	Moderate

The mapping results can be seen in table 3.

Table 3. Results of Mapping Impacts and Possibilities to Occur

Almost Certain [5]					
Likely [4]					
Possible [3]	R16, R17	R3, R20, R21, R24, R25	R8, R12, R13, R22	R11, R14	
Unlikely [2]	R1	R2, R4, R5, R7, R9, R10	R15, R19, R23		
Almost Nevel [1]			R6	R18	
Likelihood / Impact	Minor [1]	Moderate [2]	Severe [3]	Major [4]	Worse Case [5]

Next, mapping based on the level of risk and determining the percentage of each level. This is useful to determine the feasibility of system implementation in the company. The following are the results of data processing based on the level of risk.

Table 4. Risk Assessment Based on Levels of

Level	Risk	Percentage
Very Low	0	0%
Low	11	44%
Medium	12	48%
High	2	8%
Extreme	0	0%

From the results that the risk that appears in the low level is 44%, medium is 48% and 8% high. In the absence of risk in extreme levels, this implementation can be said to be feasible for implementation.

4.2. Business Process PT. FGE Bizagi

Diagram level 1 describes the flow of business processes at PT. FGE as a whole. Level 2 diagram illustrates the process that occurs at PT. FGE, where all parts are integrated with each other. Level 3 describes the processes that occur in the production section, making actual production reports.

4.3. Business Process Analysis of Business Processes Odoo

On Based on its function, Odoo is divided into several modules. Suitable modules for managing and controlling the production process on Odoo are Modules Manufacturing.

Figure 4. Cycle of the Modul Manufacturing Odoo

1. Product is goods related to the production process, can be either raw materials or finished goods. Data products consist of product name, product type, product unit, and product code.
2. Work Center is a work station that is used to carry out the production process. Data work center consists of name, type and code work center.
3. Routing is a path of production activity. data Routing consists of names routing, codes routing, and production locations. Routing consists of one or more work centers.
4. Bill of Material (BOM) is a list of raw material requirements for producing finished goods. The data Bill of Material consists of the name of the finished product, the number of finished products, and the constituent components.
5. A Manufacturing Order is an order to be produced. The data manufacturing order consists of product name, number of products, work schedule, bill of material used, routing used, and location of raw materials and finished goods. Manufacturing Orders are made based on the Sales Order of the customer. The production process can be done after the Manufacturing Order has been confirmed.
6. A Work Order is a detail of a Manufacturing Order based on the work center that works on it, so that each manufacturing order can consist of several work orders according to the number of work centers in the routing. data Work order consists of names work order, references manufacturing order, production sequences based on sequences

routing, work centers that work on. Work Order can be done after the raw material has been received by the production department.

7. Production Order Report is a report on production produced by the system and can be printed after the production is completed.

4.4. Gap / Fit Analysis

Gap analysis between actual production business processes at PT. FGE with the module business process Manufacturing on Odoo. The information fulfillment in the GAP analysis, including: N (Non), meaning that Odoo's business process does not meet the user at all. P (Partial), meaning that Odoo's business processes only fulfill some of the user's needs. F (Full), meaning that Odoo's business process has fulfilled the user's full needs.

Table 5. Gap Analysis

No	Business Process	Needs	Fulfillment			Information	Solution
			N	P	F		
1	Collection of production goods	There needs to be a system that records goods data	☐	☐	☐	Currently: All item data is recorded manually Odoo: All data items are stored in the system	Using the Product feature that is on Odoo, with some adjustments.
2	Data collection of raw materials for products to be produced	There needs to be a system that records the list of raw material needs and quantity for the goods to be produced	☐	☐	☐	Currently: If there is a demand for raw materials for production, the amount of raw material supplied by the warehouse of raw materials to production uses estimates Odoo: The raw material data used to make a product is stored in the system	Use the Bill of Material feature on Odoo, with some adjustments.
3	Data collection machinery	There needs to be a system that records the production system	☐	☐	☐	Currently: Production machine data is still recorded manually Odoo: Production machine data is stored in the system	Use the Work Center feature that is on Odoo, with some adjustments.
4	Workflow data collection carried out during the production process	There needs to be a system that regulates the production process workflow	☐	☐	☐	Currently: Workflow data is still determined manually Odoo: Workflow data can be determined automatically through the system	Use the Routing feature that is on Odoo
5	Making order work orders	There needs to be a system that can process customer orders	☐	☐	☐	Currently: Work order creation is done manually	Use the Order Manufacturing feature

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No	Business Process	Needs	Fullfilment			Information	Solution
			N	P	F		
	according to customer orders	directly into production orders				Odoo: Manufacturing orders can be generated directly from sales orders	that is on Odoo, with some adjustments.
6	Monitor the production process	There needs to be a system that can monitor the extent of the production process	☐	☐	☐	Currently: The development of the production process cannot be directly seen. Odoo: The development of the production process can be seen directly through the system	Using the Work Order feature that is on Odoo, with some adjustments.
7	Data collection of production and raw materials used	It is necessary to have a system that can automatically make order reports according to the production process that has been carried out.	☐	☐	☐	Currently: Every operator working on an order will fill a production card. Then the production manager will make a report on the execution of the order. Odoo: Work order report	Use the Production Order Report feature on Odoo.
8	See the production schedule	There needs to be a system that documents the production time of production work	☐	☐	☐	Currently: To see the production schedule, you need to check the production orders manually Odoo: To see the production schedule can be seen through the system	Use the Order Planning feature that is on Odoo.
9	Make a production report	There needs to be a system that can make production reports based on production that has been done and can be accessed in real time	☐	☐	☐	Currently: The production manager makes semi-manual reports that are done using Microsoft Excel Odoo: Production reports can be displayed directly in the system	Use the Work Order Analysis feature that is on Odoo.

4.5. Proposed Business Process Design Proposed

Business processes are the results obtained from gap analysis which aims to facilitate the user in managing the production process. The designed production system is an Odoo-based production system by implementing a module Manufacturing

Figure 5. Business Process Proposed Level 3 Business Process Creating Results Reports Production

4.6. Use Case Diagram

The proposed business process is used as a reference to produce a use case diagram which is an activity carried out by actors in the system.

Use case diagram is a description of the expected functionality of a system that is emphasized on what the system does. Use case diagrams describe system requirements from a user point of view, describe the relationship between use case and actor.

Users are users of systems that have different access rights depending on their position and duties in the company.

Table 6. Functional Requirements User Module Manufacturing

User	Functional Needs
Manager Manufacturing	Making Product Data
	Change Product Data
	Removing Product Data
	Make a Bill of Material Data
	Change the Bill of Material Data
	Deleting Bill of Material Data
	Creating a Data Work Center
	Change Data Work Centers
	Deleting Data Work Centers
	Creating Data Routing
	Change Data Routing
	Removing Data Routing

Based on functional requirements user in modules manufacturing, it takes as many as 2 users consisting of manufacturing managers and manufacturing staff. Use case diagram that describes the system functionality needs can be seen in figure 6.

Figure 6. Use Case Diagram Module Manufacturing

4.7. Activity Diagram

Activity diagram is a diagram that illustrates the various flow of activities in the system being designed, how each flow starts, decisions possible happened, and how they ended. Activity Diagram is a description of the business process and sequence of activities in the entire process : Creating a Data Product, Creating a Data Bill of Material, Data Work Center, Routing, Manufacturing Orders, Operating a Work Order, Work Order, Order Planning

Figure 7. Creating a Data Product

4.8. Proposed Form Design

In the product form, the customization done is to eliminate fields that are not needed. The settings made for the product form are, removing the field EAN13 Barcode. Removal is Field done because the company does not use barcodes on each product. There are many proposed Form Design such as Design Product Form, Form Bill of Materials, Form Routing and Manufacturing Order.

Figure 8. Proposed Design Product Form

Figure 9. Product Form after Customization

In the bill of material form, the customization done is to eliminate fields unnecessary. As for the arrangements made for the bill of material form, namely Remove reference fields; Remove columns product rounding, valid from, valid until, variants, and properties on the Components tab ; Eliminating sequence fields, valid from, valid until, product rounding, and properties in the Properties tab; Removal is Field done because the data for the field is not used to compile a list of raw material needs in the company.

4.9. Final Configuration

Final Configuration is a fine-tune to ensure that the results of the analysis and design that have been carried out in the previous stages are in accordance with the company's business needs. In the configuration user, the user is required to operate the system. There are final configuration such as User Staff Manufacturing, User Manager Manufacturing, Company Configuration, Fig 1. Configuration Module Manufacturing, Setting Access Rights User Manager, Setting Access Rights User Staff

Figure 10. Configuration User Staff Manufacturing

In the configuration of the module master setup, arrangements are made regarding the use of the Module Manufacturing according to the needs of the company.

Fig 1. Configuration Module Manufacturing

4.10. Integration Testing (IT)

Integration testing is done with the intention to see how the combined between several functions in the system can run correctly and ensure that the data entered by the user does not change when the system runs in accordance with existing business processes.

Table 7. Integration Testing

No.	Process	Scenario	Test Case	Expected Result	Result
1	Create Product	Making product data to be produced	Manufacturing product data : Jumbo Bag Cap 1, product type, unit of measure, internal reference	Product data: Jumbo Bag Cap 1	☐
2	Create Bill of Material	Making data on the bill of material used for production	Data for making bill of material: data Jumbo Bag Cap 1, quantity, components	Bill of material data: Jumbo Bag Cap 1	☐
3	Create Work Center	Making work center data used for production	Work center creation data : Mesin Shearing, resource type, code, capacity information	Work center data: Mesin Shearing	OK

No.	Process	Scenario	Test Case	Expected Result	Result
4	Create Routing	Making routing data used as production workflows	Routing creation data: Pembuatan Jumbo Bag, code, production location, work center operations	Routing data: Pembuatan Jumbo Bag	OK
5	Create Manufacturing Order	Manufacture of manufacturing order documents as production orders	Manufacturing manufacturing order data: data product, quantity, scheduled date, bill of material, routing, responsible, source document	Manufacturing order data: Dokumen MO00001	OK
6	Create Work Order	Making work order documents: as a production process controller	Work order creation data: data manufacturing order MO00001	Work order data: work order reference from manufacturing order MO00001	OK
7	Work Order Analysis	Mapping of production reports that come from work orders that have been done	Work order analysis data: data work order MO00001	Work order analysis data: data work order MO00001	OK

4.11. User Acceptance Test (UAT)

UAT is a test carried out by the user of the system to ensure that the functions in the system are running properly and in accordance with user needs. There are many item test such as General Testing, User Form Testing, Companies Form Testing, Product Form Testing, Bill Of Materials Form Testing, Work Center Form Testing, Routing Form Testing, Tabel 2. Manufacturing Order Form Testing, Work Order Form Testing, and Production Order Report Form Testing.

Table 8. General Testing

No.	Identification	Description	Testing Procedure	Input	Expected Output	Obtained Results	Conclusion
1	Application Access	Test whether the application can run properly on a web browser application	1. Open a web browser 2. Application Browse to localhost address	url: localhost:8069	Applications can be accessed properly until the application's initial view is visible	Applications can be accessed properly until the application's initial view is visible	☐
2	Login	Test whether the application can be accessed by users that are already on the system	1. Select a database 2. Enter user User ID and password	User ID and password	Users can enter the system	Users can enter the system	☐
3	Logout	Test whether users can	1. Select the user menu 2. Choose logout	-	Users can exit the system	Users can exit the system	☐

No.	Identification	Description	Testing Procedure	Input	Expected Output	Obtained Results	Conclusion
		exit the system					
4	Menu and submenu	Test whether the application can display menus and submenus	1. Login into the system	User ID and password	The application can display menus and each module	The application can display menus and each module	☐
5	Error message	Test whether the application can display an error message when an error occurs	1. Login into the system	User ID and password	The application can display an error warning if an error occurs	The application can display an error warning if an error occurs	☐

4.12. Analysis after System Implementation

The results of system trials can be described through the process flow map below. Comparison of actual business processes with proposals can be seen in table 32.

Table 9. Comparison of Business Processes for Production Results Reporting

	Business Process for Making Production Results Reports				
	BPM		Process Flow Map		Efficiency Percentage
	Actual	Proposal	Actual	Proposal	
Number of Activities	11	4	11	4	64%
Amount of Time (minutes)	49	11	49	11	78%
Amount of Distance (m)	29	0	29	0	100%
Number of Actors	2	1	2	1	50%

$$\% \text{ Business Process} = \frac{\text{Proposed Business Process} \times 100\%}{\text{Actual Business Process}}$$

$$\text{Efficiency} = 100\% - \% \text{ Business Process}$$

Based on the comparison of actual business processes with the proposed production report, good use BPM and using the process flow map, it can be seen that the improved efficiency is:

- Number of activities

In the business process the report on production results the number of activities can be reduced from 11 activities to 4 activities. Activities 2, 3, 4 and 5 in the actual business process, namely searching for documents and retrieval of data in the field, are changed to activity 2 in the proposed business process, namely selecting data on manufacturing systems. Activities 6, 7 and 9 in the actual business process that is entering data in the template and approval by the proposed production manager is replaced using an ERP system. By using an ERP system, the process of reporting production results is more efficient at 64%.

b. Amount of Time

In the business process of reporting production results with reduced activity with the ERP system, the proposed business process can reduce the amount of time from 49 minutes to 11 minutes. An efficiency increase of 78% occurred.

c. Amount of Distance

The distance traveled in the business process reports actual production results of 29 meters can be reduced by the presence of an ERP system to be no distance. Because previously they have entered data in the database, and have been verified by the production manager. Improved efficiency by 100%.

d. Number of Human Data Sources

In the business process the report on production results suggests the number of human data sources can be reduced from 2 actors to 1 perpetrator. Activity 7 in the actual business process, approval by the production manager becomes non-existent. The production manager has verified the document when the data is entered into the ERP system. 50% efficiency increase.

e. Data Accuracy

Data accuracy in the business process of making actual production reports is not effective. Many documents that are not integrated consequently the documents are messy, and it can be said that the data is not valid. With the ERP system documents are integrated, and more effective for data accuracy.

5. CONCLUSIONS AND SUGGESTIONS

The conclusions obtained from the research that have been done are, among others.

1. Previous problems that occurred in the company were that the documents could not be accessed in real time. By using the ERP concept that applies the Odoo application, all data about the product, the list of constituent materials, machine data, and production flow are clearly documented and stored in the database. When making work orders, the system will call the data needed to support the process, and when the production process is complete, production reports can be directly made based on previous work orders.
2. The process of integration between parts of production and sales, warehouse and production, starts when the sales department confirms the sales order. This document sales order automatically produces a manufacturing order for the production part. This happens because the production system applied by the company is MTO (Make to Order), so that the production process and the purchase of raw materials is done when there are orders from customers only. After getting the purchase order, then the direct purchase section purchases the item. After the raw materials are purchased and sent by the supplier, the warehouse will provide raw materials to production and direct production can be done in accordance with the manufacturing orders that have been made.
3. To produce reports on production using an ERP system, it can improve activity efficiency 64%, time 78%, distance 100%, and human resources by 50%.
4. The design of the form proposed in Odoo in this study 6 customizations namely product form, bill of material form (tab components), bill of material form (tab properties), form work center, form of order manufacturing, and work order forms.

Suggestions for further research are as follows.

1. If there is further development, a special module can be made for documentation of work drawings so that it can support the entire production process.
2. If there is further development, integration of modules related to the can be done Manufacturing module module Sales,, namely Purchase, modules Warehouse modules and modules Accounting. So that the Odoo system can be used to support the entire business process in the company.

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