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Development of Production Information System in a Plywood Company for Monitoring Production Duration Process

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Abstract

Production activities in manufacturing companies are essential elements of the company. Recording production activities must be documented to produce information needed to make the right decisions in production and use of all existing company resources. This study focuses on developing a Production Information System in a plywood company. The company's production planning activities and monitoring are documented using Excel. This causes difficulties in monitoring the duration of production activities carried out. This study aims to develop a production information system that monitors production processes. This system includes raw material procurement, production planning, inventory control, and production process monitoring. The development methods include production process analysis, data collection, cost calculation method research, system design, implementation, testing, and evaluation. The verification process is carried out by checking all features and the progress of the production process. The validation process is carried out by interviewing and testing the system on users. As a result, the system has been able to meet company standards in managing production routing based on the duration calculations prepared so that the PPIC manager can monitor the progress of ongoing production.

Keywords: *production information system; plywood production; production monitoring process*.

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Abstrak

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Kegiatan produksi dalam perusahaan manufaktur merupakan elemen penting bagi keberlangsungan perusahaan. Pencatatan aktivitas produksi harus didokumentasikan dengan baik guna menghasilkan informasi yang dibutuhkan untuk pengambilan keputusan yang tepat dalam proses produksi serta pemanfaatan seluruh sumber daya perusahaan. Penelitian ini berfokus pada pengembangan Sistem Informasi Produksi di sebuah perusahaan plywood. Kegiatan perencanaan dan pemantauan produksi di perusahaan tersebut sebelumnya didokumentasikan menggunakan Excel, yang menyebabkan kesulitan dalam memantau durasi setiap aktivitas produksi yang dilakukan. Penelitian ini bertujuan untuk mengembangkan sistem informasi produksi yang dapat memantau seluruh proses produksi secara efektif. Sistem ini mencakup pengadaan bahan baku, perencanaan produksi, pengendalian persediaan, serta pemantauan proses produksi. Metode pengembangan meliputi analisis proses produksi, pengumpulan data, studi metode perhitungan biaya, perancangan sistem, implementasi, pengujian, dan evaluasi. Proses verifikasi dilakukan dengan memeriksa seluruh fitur dan kemajuan proses produksi. Proses validasi dilakukan melalui wawancara dan pengujian sistem kepada pengguna. Hasilnya, sistem telah mampu memenuhi standar perusahaan dalam mengelola rute produksi berdasarkan perhitungan durasi yang disiapkan, sehingga manajer PPIC dapat memantau kemajuan produksi yang sedang berlangsung.

Kata kunci: *sistem informasi produksi; produksi plywood; proses pemantauan produksi.*

INTRODUCTION

A recent study found that many manufacturing industries fail to deliver their products to end users due to inadequate scheduling that is not monitored through real-time production and control systems (Okuyelu et al., 2024). Delays in the fulfillment schedule of products consumers order can harm the company (Winarno et al., 2022). Manufacturing industries must meet customer demand while maximizing profits by avoiding emergency plant shutdowns during production (Okuyelu et al., 2024).

As part of the company's organizational function, production activities are responsible for processing raw materials into finished products that can be sold. Carrying out production functions requires a series of activities to form a production system. Three main functions of production activities

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can be identified, namely: a) Production Process, namely the methods and techniques used in processing raw materials into products b) Production Planning, which is an anticipatory action in the future according to the planned period c) Production Control, namely an action that ensures that all activities carried out in the planning have been carried out by the targets that have been set. Carrying out production functions properly requires a series of activities to form a production system. A production system is a collection of subsystems that interact with each other by transforming production input into production output (Kusmindari et al., 2018).

This research was conducted in one of the Plywood production companies in East Java, Indonesia. The production recording process is carried out using Excel. The PPIC Manager records the document-to-document production planning. Several roles with respective responsibilities carry out production activities to ensure smooth operations. The PPIC Manager is responsible for production planning, making purchase orders when there is a shortage of stock, and making sales orders when there is an order from a customer. The Head of Production manages the production needs of the item, while the Head of the Warehouse manages the flow of the company's stock in and out. MRP is a production scheduling methodology that produces production times and quantities and determines purchase orders to meet the master production schedule. MRP software helps factory managers plan production and raw material needs with activities carried out starting from sales forecasts and future sales predictions (Monk & Wagner, 2008). Material Requirements Planning (MRP) can improve operational efficiency and accuracy in production by identifying inventory needs, transaction costs, and material usage, allowing for timely and accurate warehousing actions (Martyani et al., 2019). Currently, the production implemented by the company is Make-to-Order (MTO), with an additional 5% of the estimated demand being used as Make-to-Stock (MTS) goods. In addition, the company also implements the Make-to-Assemble (MTA) system if the available raw materials are approaching their expiration date so that they are processed into semi-finished goods ready to be assembled into plywood.

Based on the activities, there are several problems such as data input errors, repetition of formula writing, and the risk of human error that often occurs. This one-way recording process makes it challenging to integrate between divisions, hindering effective coordination between various parts of the company after scheduling is made. A bill of materials (BOM) lists the raw materials (including quantities) needed to make a product. It can be used to calculate how much raw material is needed to produce a finished

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product. However, information about lead times and lot sizes is needed to determine the timing and quantity of purchase orders (Monk & Wagner, 2008). In addition, the Bill of Material (BoM) calculation is done manually, so it takes time, and if there is a change in components, it's not properly documented. The manual system allows for errors in picking goods, inaccurate reports, and delays in finding necessary data. The difficulty in obtaining information on the development of the production process makes it difficult to monitor the development of the production process so that production completion is not on time (Pratama et al., 2019; Sutrisna et al., 2022). Duplication of order data can harm the company; production of damaged products is not recorded, and many reprimands from customers due to delays in delivery times due to lack of orders, the company must rearrange the production schedule (Kania et al., 2019).

Several studies have highlighted the importance of implementing a production monitoring system to improve efficiency, quality control, and on-time delivery (Dhaniawaty et al., 2020; Octaviani et al., 2020; Sutrisna et al., 2022). There is a need for an integrated system to ensure accurate data and information flow between various departments (Jibril & Zulrahmadi, 2023; Octaviani et al., 2020). There is a need to design a web-based information system that can help companies monitor the production process according to procedures and standards (Dhaniawaty et al., 2020; Kasim et al., 2019). The company cannot ignore the advantages of real-time production control and monitoring systems in improving manufacturing efficiency (Okuyelu et al., 2024). With the design of a production monitoring system, it is hoped that the company will be more conducive, advanced, and of higher quality than the previous system (Jibril & Zulrahmadi, 2023).

This study aims to design a Production Information System that allows companies to monitor production effectively, organize production routing based on the duration calculations that have been prepared, manage purchase orders and sales orders in a more structured manner, and calculate labor costs accurately in the production process. Building a good information monitoring platform can effectively improve the company's manufacturing efficiency and help accelerate the company's information process and product management and provide convenience (Hen, 2014). In addition, the development of a real-time monitoring system

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in the production process in plywood companies to overcome the lack of a production process information system (Dirgantara et al., 2020; Kurniawan et al., 2018; Setiawan et al., 2020; Snatkin et al., 2015; Subramaniam et al., 2009). Through web-based plywood sales, customers can easily choose the product size and type (leni kardila deti & Mulyono, 2017).

The Production Information System to be designed will include essential features to support plywood production. This consists of calculating materials needed to meet customer demand, bill of materials (BOM) management and calculation, estimating production completion duration to ensure punctuality, and purchasing and sales orders. In addition, this system will support live monitoring and production routing to optimize the production process. The company is expected to respond to customer demand more quickly through this implementation. The information on the availability of raw materials and production duration can be monitored in real-time.

METHODS

This research was conducted by observing production activities and interviewing stakeholders of plywood companies. Observations were conducted for 2 days by the researcher, where the first day looked at the business process and the second day explored needs through company staff. Literature studies were also conducted to obtain similar research gaps, as well as methods that are appropriate for this research. System development was carried out using the Software Development Lifecycle (SDLC) approach by implementing a waterfall model consisting of five sequential stages: requirement analysis, system design, implementation, testing, and maintenance (Bassil, 2012; Sommerville, 2011). The diagram process can be seen in Figure 1.

Figure 1. Software Development Life Cycle Flow

This waterfall method is very suitable for developing new systems because the sequential stages will produce quality results (Wahid, 2020). The stages of analysis are divided into current needs analysis, problem analysis, and system needs analysis. The next step is system implementation after the business process flow and data design are in

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accordance. In the implementation process, the system is gradually tested on users to find out whether the system has been developed appropriately according to the company's needs. Any bugs in the testing process will be fixed until the system runs stably. However, this research ends at the testing stage only.

RESULT AND DISCUSSION

Each stage that has been carried out has produced a final product in the form of a production information system with real-time monitoring of production duration at a Plywood company. The results of each stage can be described in each of the following sub-chapters.

System Requirements Analysis

The system needs analysis was obtained by interviewing company leaders, PPIC managers, and warehouse heads at Plywood companies. To see production monitoring activities, direct observations were made at the company while Plywood production was being carried out. The current condition is that plywood companies record purchase orders, sales orders, stock management, raw material planning, and production cost calculations using paper records, online documents, and Excel. Because this documentation has not yet resulted in data integration, processing each activity takes a long time. Bill of Material calculations are also prone to errors. Daily production records are also separate so that monitoring how long each order will be completed and what activities are currently running still cannot be seen in real time. So, the system that needs to be created is a Production Information System that allows companies to monitor production duration, organize production routing based on the duration calculations that have been prepared, manage purchase orders and sales orders in a more structured way, and calculate labor costs accurately in the production process.

System Design

The researcher and company align the session by translating the needs into process and data design. The goal is for the company to be able to confirm the design that has been developed. The process design is developed using the Business Process Model and Notation (BPMN), while

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the system design is developed using Entity Relationship Diagram (ERD). BPMN can be seen in Figure 2 below.

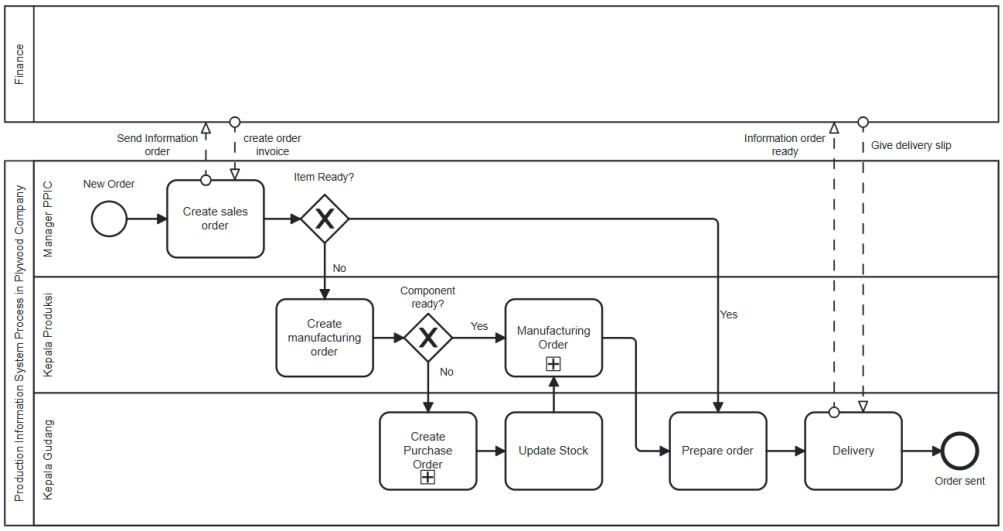

Figure 2. Production Information System Process in Plywood Company

System Implementation

The database is implemented according to the design created in the previous chapter. The design is implemented in the MariaDB Server with the help of the Laravel 8 Framework to create database tables and the phpMyAdmin database administration software. Laravel 8 is a Framework based on the PHP programming language used to build websites. A total of 37 tables/entities were created to develop this system. These entities function to store all data that will be used in the application. The following is a description of each entity that has been created.

Based on the results of the database implementation, the system was successfully created using Laravel 8. The production process begins by adding raw materials (Figure 3).

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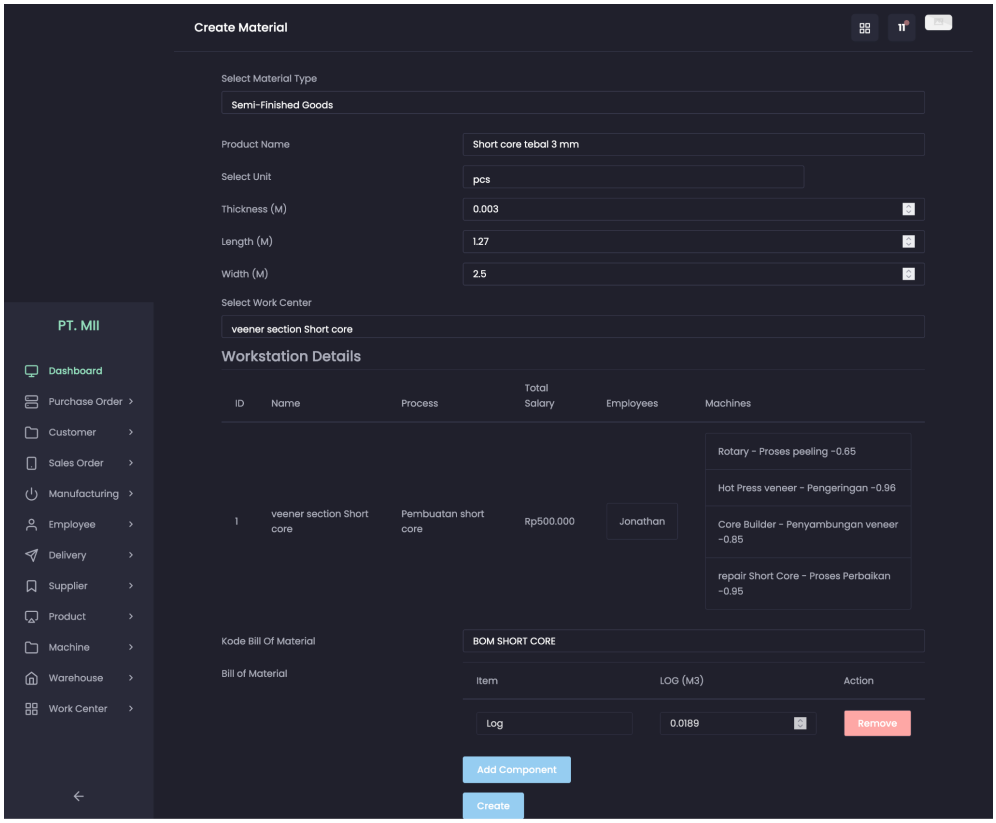

Figure 3. Create Bill of Material Plywood

The user will input the thickness, length, and width of the semi-finished goods on the material creation page. In this company, semi-finished goods consist of short-core and long-core. This page is designed to make it easier for users to accurately record and manage semi-finished goods data and ensure that the generated BOM is calculated using the predetermined depreciation value calculation. After the material is successfully created, the PPIC manager will generate a list of machines (Figure 4).

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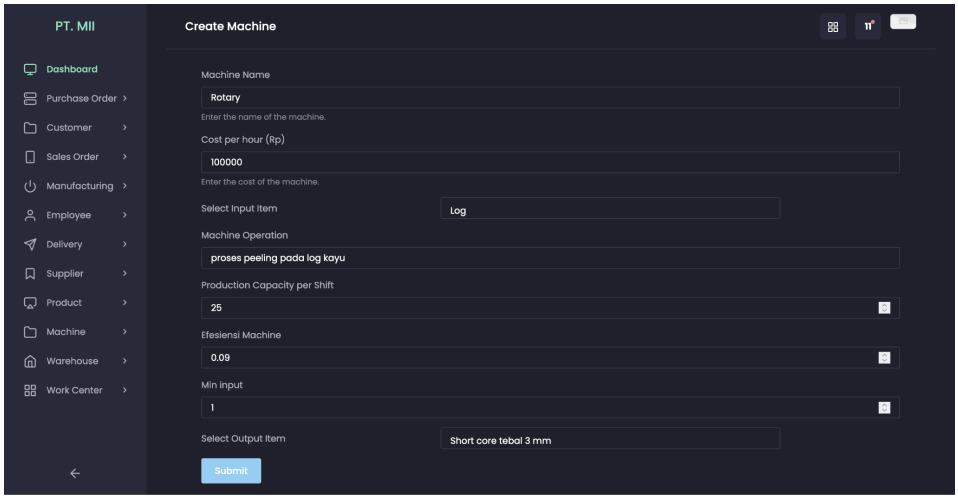

Figure 4. Creates Mechine Production

The user will input the machine name, production capacity per shift, efficiency, minimum input, number of shifts per day, machine description, and cost per hour and select the input and output items related to the machine. This page ensures that all machine data is well organized and easily accessible for production management.

Based on the material and machine data added to the system, the following process is to add semi-finished goods. On the Semi-Finished Material creation page, the user will input the semi-finished goods' thickness, length, and width. In this company, semi-finished goods consist of short-core and long-core. When the user selects a section, the Bill of Materials (BOM) will be automatically generated based on the Length * width * height value to produce Volume. Then, the volume value will be divided by the depreciation process of each machine so that the required quantity value appears. This process takes place automatically when the user selects a work center. This page is designed to make it easier for users to record and manage semi-finished goods data accurately and ensure that the BOM generated is calculated by the depreciation value that has been set. The semi-finished good configuration page can be seen in Figure 5.

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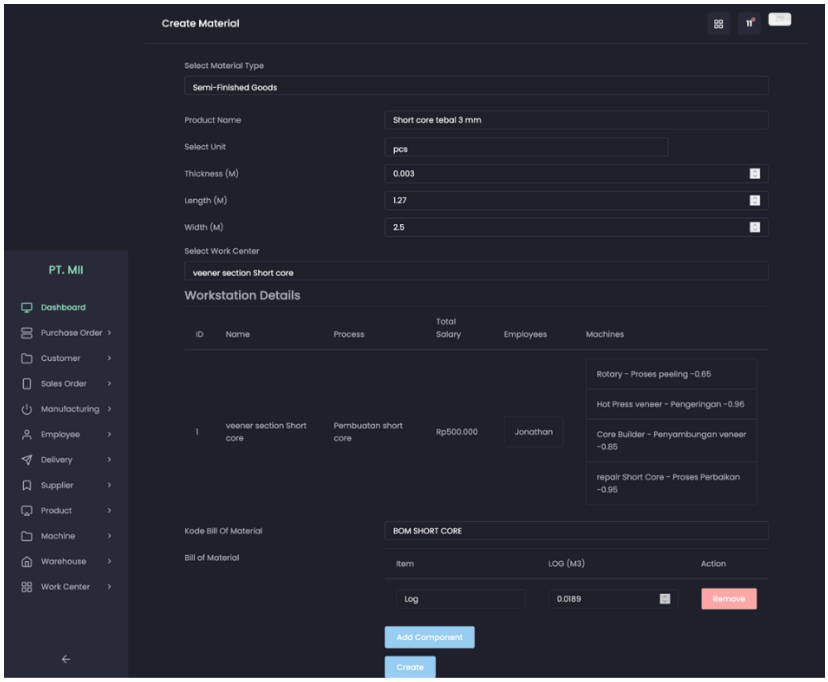

Figure 5. Create Semi Finished Goods

The result of monitoring the duration of the manufacturing order can be seen in Figure 5 below.

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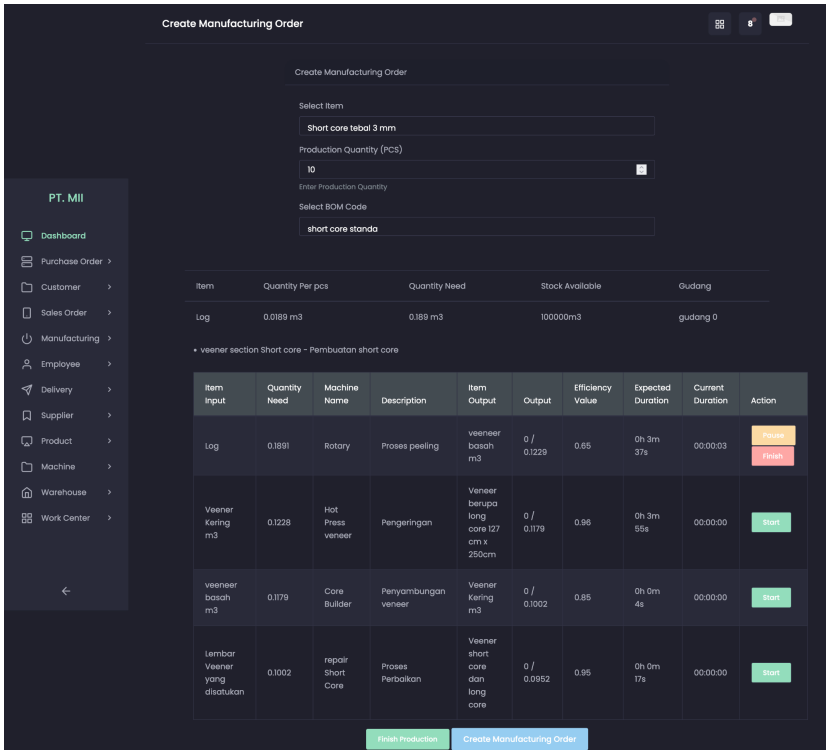

Figure 6. Monitoring Manufacturing Process

On the Create Manufacturing Order page, the BOM option will appear when the user selects an item created and inputs the quantity to be produced. When the user chooses the BOM, the system automatically generates the entire process flow on each machine. Then, the expected duration was verified using the company's current calculations. So, when the manufacturing order is successfully created, the monitoring activity of the duration of each running operation can be monitored directly.

System Testing

System testing is done by performing black box testing on all features in the production information system that has been created. The result is that the system that has been made is ready to use and has been built according to the design plan and system requirements. Testing is also done by validating system users, company leaders, PPIC managers, and production heads. As a result, the system has been able to meet company standards in managing production routing based on the duration calculations prepared so that the PPIC manager can monitor the progress of ongoing production.

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CONCLUSION

The developed production information system has proven its function in simplifying the process of calculating the BOM required for each customer request. The system has been successfully integrated well between various departments of the company. Sending request data can be done quickly and easily, while authorization issues have also been effectively resolved throughout the company. Production management in Manufacturing runs better because this system allows users to select and use the Bill of Materials (BOM) effectively. The calculation has been set to match the minimum production capacity. The resulting production information system can provide essential activities to support plywood production, including calculating the materials needed to meet customer requests, Bill of Materials (BOM) management and calculation, estimating the duration of production completion to ensure timeliness, and purchase orders and sales orders. So that production duration monitoring activities can be monitored through the system. Production duration recording is done with the help of the production team to update the system so that production duration recording depends on the accuracy and speed of the admin. The system still cannot be integrated directly with the machine in real time. For further development, this system is expected to be developed into a health monitoring machine module. Current information on machine conditions, including early warnings of potential damage, can help the production team perform preventive maintenance and optimize machine performance.

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