Information system and website design to support the automotive manufacture ERP system

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Abstract. This research is to create an on-time production system design with Heijunka model so that the product diversity for all models could meet time and capacity requirements, own production flexibility, high quality, meet the customers’ demands, realistic in production as well as creating a web-based local components’ order information system that supports the Enterprise Resource Planning (ERP) system. The Heijunka model for equalization with heuristic and stochastic model has been implemented for productions up to 3000 units by implementing Suzuki International Manufacturing. The inefficiency in the local order information system demanded the need for a new information system design that is integrated in ERP. Kaizen needs to be done is the Supplier Network that all vendors can download and utilize those data to deliver the components to the company and for vendors’ internal uses as well. The model design is presumed effective where the model is able to be utilized as a solution so that the production can run according to the schedule and presumed efficient were the model is able to show the reduction of loss time and stock.

Keywords: Enterprise Resource Planning, automotive, manufacture, information system

1. Introduction
For over two decades Indonesian automotive industry attempted to fulfill international standard-based market demands. Developments have been made by local vendors and Heijunka method has been studied intensively as a part of the process [2], [5]. Previous researches by local automotive vendors are enough to create a base for this research that is related to the Heijunka and website based production system design. By implementing Heijunka iteration method the company can meet the consumer’s demand accurately in terms of amount and time [15], reduce excess production [6], better production planning flow for ring gear [5], better response towards changes in demand [5], reduce the stock design [6], minimize the work load imbalance between machines [15], the machine utility value for press 300 TS machine decreases by 9 working days, production duration decreases by 0.25 hour [1]. By implementing Heijunka, the machine utility value for press 400 TS machine decreases by 10 working days and production duration decreases by 5.97 hours [1]. There are some researches that underlie this research with Heijunka’s approach. Heijunka implementation can minimize the work load imbalance between machines [3], [4], [12], [13] and implementation supports the ERP system in manufacture [14], [16].

This research emphasizes on the modified Heijunka model to calculate the production of the skutik (automatic scooter) model (less than 3000 units per month, produced in 3 color lots). In order to be competitive in this dynamic global market, manufacture industry need an integrated information system with the ability to deliver comprehensive information to the management, hence delivering accurate managerial decisions. Current manufacturing information system is the Enterprise Resource Planning (ERP) that combines the Manufacturing Resource Planning system (MRP II) with accounting...
and finance system. The ERP system is an accounting-oriented information system to identify and plan the company’s resources needed to meet its customer’s orders. The ERP system is also a customer oriented manufacturing management system [11],[12],[16].

The core of the ERP is MRP II or the Manufacturing Resource Planning. The MRP II process includes: production planning, rough-cut capacity planning, master production scheduling (MPS), material requirement planning (MRP), purchasing, supply management, production activity control, and performance measurements [11].

The research conducted on the production of the 4-wheeled vehicle (R4) and 2-wheeled vehicle (R2). The 2-wheeled vehicle (R2) produced are the underbone model: Smash, Shogun, and Satria, the skutik model: Skydrive, Skywave, Nex, and Let’s, and the backbone model: Thunder. The underbone model with most demand is Satria (XB976/FU). The marketing department has revised the 2nd semester forecast for October-March for the fiscal year of April-March by approximately 30,000 units on September (end of semester 1) to 34,000-40,000 units per month. Revised marketing forecast is dominated by the Satria (FU) underbone model with production level of 60% of the total production while skutik (automatic scooter) model only produces 20% of the total monthly production and decreasing. The on time production system or often called the just in time (JIT) system is a part of the Suzuki Production System (SPS) that is supported by the Assembling Production Plan (RPA) making which in everyday intermingling operation known as Heijunka.

According to [7], Heijunka is a model that levels production in terms of volume and product mix (often called as leveled mixed production). Creating a product is not done based on the actual customer’s demand order that might be increasing or decreasing sharply, but taking the total amount of order in a time period and averaged it so that it can be produced in the same amount and mix every day. The significant difference between production ratio of the Satria model and the skutik model which is over 65% with Heijunka model currently causes a model change more than 2 times a day that eventually leads to loss time and unstable quality. In order to overcome that, a more suitable Heijunka model for the large volume model and small variant model is highly needed.

2. Methodology
The tools used to model a system are: Step one: The Heijunka Model for local content program (Figure 1). Step two: Heijunka design model building (Figure 2). Step three: Information System Architecture Design (Figure 3).

The RPA made based on the Heijunka model will be used as a reference in processing RUN MRP to issue the local component’s order. Currently, the output of the Run MRP is the Part Order Sheet (POS) that contains information on total order, forecast, and delivery plan for each part and each vendor, Part Tag (PT) as a component identity card, and Delivery Note (DN) as a delivery paper. POS is printed on A4 paper and there are about 220 pages for 108 vendors. The company needs about 40 boxes of paper both and total printing time for 10 working days. The next process is to put together the POS, PT, and DN based on the vendors, packing them into plastic bags or boxes based on the number of PT printed, before packing them into vendor boxes. Besides printing and preparation time, the problem faced is the need for a great amount of PT and DN printed paper form that has to be ordered and maintained, the need of a temporary storage area while waiting for the PT and DN to be picked up by the vendors, and re-print time needed were there are any vendor that loose its PT or DN. In the vendor’s side, a specific time is required to pick the POS, PT, and DN up in PT. SIM, the risk of lost or damaged POS, PT, and DN, and reprint request time are the problems faced. Therefore, a web-based local component order information system is a solution to those problems.

Using Heijunka model design, skutik models that were not produced daily were grouped and accessible for early access in the web-based local component order information system. This design can improve the company’s performance by accelerating every process thus resulted in the increase of company earning.
2.1. Context Diagram
Context Diagram is a standalone occurrence from a data flowchart where a circle represents the whole system. This Context Diagram must be an overview that includes basic inputs, systems, and outputs. Context Diagram is the highest level of the data flowchart and only has one process that shows the system as a whole. The process is numbered as 0.

2.2. Data Flow Diagram
Basically, the steps to form a DFD are:
1. Identify all external entities involved in the system.
2. Identify all inputs and outputs involved with the external entities.
3. Create the Context Diagram.
4. Data Dictionary
5. Process Specification
2.3. Entity Relationship Diagram (ERD)

ERD is used to interpret, determine, and document the requirements for a database processing system. It shows the whole data user and the relationship between tables. In ERD, those data is described by depicting the entity symbol. In this system design, there are several interconnected entities that provide data needed by the system.

Figure 3. Information System Architecture Design
3. ResultAnd Discussion

3.1. Heijunka Results
Methods Analysis
Assembling line 1 Heijunka was chosen based on the best method which is SIM (Suzuki International Motor) compared to Heijunka stokastik and heuristic approached[1]. Production schedule of all skutik models with less or around 3000 units.

Heijunka Model Development
1. Development of Heijunka model based on Suzuki algorithm is producing the same skutik model in one color lot less than 3000 units per month.
2. Partial production schedule of all skutik models is 3 lot (180 units) and consumes the initial 8 working days.
3. Second schedule is 3 lot based on model (in this case, skutik model was planned).
4. Partial Assembling Production Plan (Rencana Produksi Asembling/RPA) of line 1 in January is 3 lot. This condition affected the model change from 5 models per day to 3 models per day, leaded to quality stability.
5. Specific model modification is clearly presented in skutir model XE312 NE P12, P14, and XE312 NB P12 that was produced according to base model XE312 with a fixed amount of 3 lot.

3.2. Information System Design
Create For Context Diagram, Context Diagram – DFD Level 0 and Level 1

![Figure 4. Local Component Order Information System Context Diagram](image-url)
Create for ERD PART ORDER SHEET

Figure 5. DFD Level 0

Create for ERD PART ORDER SHEET

Figure 6. ERD POS

Create: ERD Part Tag and Delivery Note

Local Component Order Information System Menu Design

Creating for Web-based Local Component Order System Design Flowchart

Below is the web-based Supplier Network menu structure design:
a. User Menu Structure
The web-based Supplier Network menu structure for User can be seen in Figure 7.

Figure 7. User Menu Structure & Login Flowchart

b. PPC and Finance Department Administrator Menu Structure
The web-based Supplier Network menu structure for PPC Department Administrator.

c. Supplier Administrator Menu Structure
The web-based Supplier Network menu structure for Supplier Administrator.

3.3. Supplier Network Procedural Design
Procedural design is a design to determine detailed algorithm that is going to be implemented into the application. The procedural design for the web-based company’s Supplier Network is as followed:
1. **Login Flowchart.** It is a procedure that takes place when Administrator, PPC Department Administrator, and Vendor begin to access the application.

2. **Model Validation.** This research's model validation is conducted using the User Acceptance User (UAT), SIM User, and Supplier User.

3. **Web-based Local Component Order Information System Model**

   **POS – PART TAG AND DN**
   The Part Tag obtained is as follows

   **POS – PART TAG And DN**
   Supplier Network Website
   - Login Page

   ![Figure 8. Part Tag and Login Page](image)

   **User PPC 2W Menu Display**
   Other Website Displays include: Administrator PPC R2 Menu Display, Upload Menu Display, Download Menu Display, Download History File 2W Menu Display, Finance Menu Display, History File Finance Menu Display

4. **Model Verification and Validation**

   Model verification is conducted on Heijunka model by tracing the calculation algorithm based on the company’s Suzuki Information Management method, i.e. by paying attention to the designed model’s components and by consulting and confirming with the experts in the company which are related to the modeled system. Verification on the web-based local component order information system is conducted through the design of the supplier communication system menu, i.e. by consulting the user and supplier’s needs. Model validation is conducted using the UAT where users and experts in the company, as well as the suppliers accept results.

![Figure 9. Model Validation](image)
5. Conclusion
The Architecture design suggested to be implemented in the coming year will be displayed in the Supplier Communication System (SCS) and consisted of eight main menus. They are: Spare part for Spare Part Department, Automotive for TB II R4 plant, Motorcycle for TB I R2 plant, Engine for Cakung Engine plant, Finance for Finance and Accounting Department, Administration, and the Sign out menu. The company and supplier can work more effective and efficient so that they can perform other value adding activities as well. For Heijunka model and web-based local component ordering information system model verification and validation, a test using the user and supplier UATs are conducted and the results are verified and valid for both models.

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