Designing a computerization management production system in PT Akrilik Kurnia Kencana using barcode

Rudy Vernando Silalahi 1*, Ishak 2 and Marciello 3
1,2,3 Industrial Engineering Study Program, Pelita Harapan University, Tangerang, Indonesia

*E-mail : rudy.silalahi@uph.edu

Abstract. As technology develops, the production process of each industry also develops to become more sophisticated and modern. Barcode is a form of technological development in the production process and is useful for manufacturing companies to be able to store data so that it can be well integrated in a system. PT Akrilik Kurnia Kencana (AKK) is one of the companies engaged in manufacturing EPS (Expanded Polystyrene) and has a problem in finished goods warehouse where the company does not have a good system due to warehouse capacity inadequate. This study aims to identify current system implemented at PT AKK and develop a new system to solve the problems experienced by PT AKK. Data collection is done by the method of observation and interviews with the company to get the necessary data. After being collected, the data will be processed in such a way that it can be interpreted properly. Then, the data will be used as an input in designing a production management system-based application using the System Development Life Cycle (SDLC) waterfall model. By using this system, users can monitor the presence of each finished goods that has been produced and enter the warehouse through the information contained in the barcode.

1. Introduction
Manufacturing industry is a business field that produces a product through several production processes. As technology develops, the production process of each industry also develops to become more sophisticated and modern. This is very influential, because the industrial sector is one of the mainstay sectors in the Indonesian economy [1]. One form of application of technology in a production process is the use of barcodes in the production flow. Barcodes are useful for storing various information needed regarding related products such as manufacturing date, machine number, order quantity, and operator.

PT Akrilik Kurnia Kencana is a company engaged in manufacturing EPS (Expanded Polystyrene). This company has been established since 1990 and now has 80 employees working in 3 shifts for 24 hours. In a day, the company were able to produce around 2 tons of EPS which is divided into two types of products namely EPS Box and EPS Protector. The company has a smooth production process, but there are flaws in the production and warehouse division. According to the employees, the company's warehouse does not have enough area to accommodate a big number of daily productions, so the warehouse is not well-organized. The consequence of this is the number of finished goods that are damaged due to the existence of these products is not known by the company so that it becomes a potential loss for the company.

In addition, the cause of this problem is also because the company uses the Make to Order (MTO) and Make to Stock (MTS) methods simultaneously, so that the company stores too many items requested by customers as the company's safety stock. This is due to the absence of a warehouse system that is
capable to organize and store the warehouse data, resulting in irregular placement of finished goods. Then, the company does not have a clear Standard Operating Procedure (SOP) for its application so a lot of operators and employees do not do their jobs effectively. To solve these problems, the company needs to develop a new kind of system in the company's warehouse that were able to record and organize finished goods warehouse properly in order to overcome the limited warehouse area.

2. Methodology

The following is the methodology used in this study:

**Prior Research**
An initial study was carried out on the production management system.

**Problem Identification**
Identifying the problems that exist within the company as a whole. The problems that were formulated included irregular warehousing as a result of production exceeding warehouse capacity resulting in a large number of unregistered products.

**Research Objective**
Determine the research objectives of the problems that have been formulated, in order to identify and design a production management system.

**Data Collection**
Data that will be used for research are collected in this stage. There are two types of data, namely primary data and secondary data.

**Primary Data**
Job description per division, activity standard, business process, warehouse distribution layout.

**Secondary Data**
Production data, machine data, historical order data, company organizational structure.

**Theoretical Basis**
Searching for information on existing theories by reading journals, books, and scientific research to support this paper.
2.1. Prior Research
In this section, the initial studies were conducted on problems experienced or the desire of company to improve performance in certain areas. This is done by making a direct visit to PT Akrilik Kurnia Kencana with the aim of seeing the situation and the actual conditions on the ground. Then, followed by a direct interview with the General Manager of the company, the head of production staff, the head of the warehouse staff, the staff of the production department, and the staff in the warehouse. After getting a picture of the problem, an initial literature study was conducted to ensure that this research could be carried out scientifically.

2.2. Problem Identification
The phase that will be carried out after getting the problem, is to formulate the problem clearly and concretely. This is necessary to find the root of the problem that is the cause of the problem while finding a way or solution to solve the problem. The problems experienced by the company are finished goods warehouses that do not have enough area to accommodate the production results, and warehouses that do not have information systems that result in many finished goods being damaged due to their presence unknown to the warehouse. This resulted in losses for the company and made it difficult for warehouse staff to find the needed stock. In addition, the company also complained about the productivity of the work of operators who did not meet company standards in general. This is caused by the fact that the company itself does not have clear standards or written rules regarding the activities that operators must carry out every day.

Figure 1. Methodology procedure scheme
2.3. **Research Objective**
Determining the purpose of research is the stage carried out after successfully formulating the problem. The purpose of this research is to identify the current system and design an information system that can overcome the problems in PT Akrilik Kurnia Kencana's finished goods warehouse.

2.4. **Theoretical Basis**
In this stage, a theoretical search and scientific information on the elements of the topic being investigated are carried out. This is necessary so that this research has the support of statements or arguments from other studies that have been done before on similar topics in order to strengthen the basis of this research. The aim is that the results of this study can be scientifically proven by comparing the theories with the results from this study.

2.5. **Data Collection**
In collecting data needed in research, there are two types of data collection methods used, including:

2.5.1. **Observation.**
Data collection is carried out by looking directly at the condition of the company and recording the data needed. In this method, the data collected is primary data. Where some of the data needed to make observations are:
- Job Description for each division in the company.
- Activity standards that must be done by each division.
- Company’s Business Processes.
- Warehouse Layout Allocation.

2.5.2. **Interview.**
Data collection is done by conducting interviews directly to the General Manager, production staff, production staff, and warehouse staff to get secondary data from the company about the company's condition and the problems experienced in the field. In addition, interviews were also conducted to obtain the necessary data, including:
- Data on all materials and finished goods used in production.
- Data on the number of production machines.
- Historical order data (Name, Address, Telephone Number, Order Date, Delivery Date, Quantity).
- Employee data and titles.
- Company Organizational Structure.

2.6. **Data Collecting and Processing**
In this chapter, data collection is needed based on the data collection methods described in the previous chapter. The data obtained will be processed in such a way so that it can be input into the system so that the data can be interpreted properly so that it can then be analyzed at the next stage.

2.7. **System Analysis and Development**
In this section, we will design an application based on a production management system using Microsoft Access. This system contains data that has been processed in the previous section so that it can describe the information needed by the system user easily. In addition, in this stage, the modelling and structural modelling behaviour and the interface layer of the system will be explained.

2.8. **Conclusion**
In this part, the overall conclusions will be drawn from the results of the study as well as the shortcomings that there are several suggestions included for newer studies that take similar topics.
3. Result and Discussion
The following is the result and discussion of the data used in this study:

3.1. Current System Analysis
In a company, of course there are several problems that result in a production process that is not running optimally because of the following problems:

| No. | Problems | Cause | Consequence |
|-----|----------|-------|-------------|
| 1.  | No instructions or activity standards for each operator. | The company did not set any rules or standard operational procedure for specific activities. | Operator is not being productive because they are not working the way they should. |
| 2.  | Warehouse is not well organized and recorded. | Incapable warehouse area and the implemented system are not good. | A lot of finished goods that are not recorded went missing and caused a loss for the company. |
| 3.  | Inventory Staff having a hard time to search for certain finished goods. | The company only used several kind of coloured plastics to group and package the finished goods. | Some of the different customer orders are using the same coloured plastic as a packaging so it’s difficult to differentiate each order. |

3.2. Warehouse Layout Allocation
The area of the warehouse owned by the factory is around 100 m x 23.5 m. In the following figure, the warehouse layout will be divided into several blocks to illustrate the division of locations in the factory warehouse:

![Figure 2. Factory warehouse layout block allocations](image)

3.3. Planning
When developing, the first stage that must be passed is the planning stage. In this stage, a system feasibility study will be discussed as well as an analysis of the system requirements that need to be carried out to ensure this project is feasible. The following are some important points the objectives that must be achieved by this system, among others:

- Data storage of finished goods that are well recorded and ordered in the system in accordance with the input from the warehouse.
- The warehouse division can monitor stocks easily through display reports on the system and be able to distinguish between old and new stocks.
- The production division were able to record and track each finished goods in the warehouse.
- The sales division can view orders that have been input into the system and monitor the order's operation.

In this section, a feasibility analysis will also be conducted using two analytical methods, namely technical and operational feasibility analysis. Inside the technical feasibility analysis, it will show about
how the condition of technical equipment owned by the company makes it possible to implement this system. The technical requirements in this case are divided into two types, which is hardware requirements and software requirements.

### Table 2. Hardware requirements

| Product Name | Specifications | Remarks |
|--------------|----------------|---------|
| Laptop ASUS UX303UB | Processor: Intel® Core™ i7-6500 CPU @2.50 GHz (4 CPUs) Memory: 8192 MB RAM VGA: NVIDIA GeForce 940M | Laptop are used to run the system so that it can input the data and also required to see the output from system. |
| Mouse Wireless Logitech | | Mouse is used for navigation on the laptop’s screen |
| Router, Switch, Ethernet cable | | Needed to establish an internet connection for the laptop. |
| Printer EPSON L360 | | Printer is needed to print the barcodes and reports. |
| Barcode Scanner EPPOS EP1020M | Lighting: 650 nm visible laser diode Decode ability: 1 Dimension & GS1 Databar Speed: 300 scan/s Laser Range (Length): 15 cm Laser Range (Width): 5 cm – 30 cm | Barcode scanner is needed so the system will be able to read the barcode label and display the stored information within it. |

### Table 3. Software requirements

| Product Name | Specifications | Remarks |
|--------------|----------------|---------|
| Operating System (OS) | Windows 7, 8, or 10 | OS is needed for the laptop to work and capable to run the system |
| Microsoft Office (Microsoft Excel, Visio, dan Access) | Microsoft Office 2010 - 2016 | Excel and Access are required to make data tables that is used to fill information on the system. Whereas Visio is needed to make various diagrams in designing the system |
| Adobe Acrobat Reader | | Required so that the laptop is able to display reports from the system in PDF file types form. |
| DRPU Barcode Label Maker | | Required to generate a barcode so that it can be printed and pasted on the product. |

Furthermore, in determining the feasibility of the system operationally, there are several factors that can affect the feasibility of this system in company operations, including:

- The ability and knowledge of the user who will be the operator in carrying out the company's system activities as well as computerized systems.
- Availability of adequate human resources and have the desire to learn this new system.

When carrying out company activities, the information system is not a strange thing for the company so that enough employees and operators are familiar and able to run a system that has been computerized. The operators that have been chosen to run this system are the people who are doing the current activities...
usually using Microsoft Excel to do company data collection and are not accustomed to using Microsoft Access.

3.4. Requirements
There are two types of requirement that need to be identified include functional and non-functional requirements. The following are some points regarding functional requirements that must be met by the system:

- All users registered inside can log into the system using their respective usernames and passwords.
- All system users are able to open product data through the product menu on the system.
- Users can input product data in the form of item names, item codes, prices, and product information.
- Users can search products by product name.
- Users can change and delete product data.
- The system can calculate the amount of existing stock based on production data and sales data to customers.
- All system users can open and print sales reports through the report menu on the system.
- All system users can open and print product inventory reports through the report menu on the system.
- All system users can open and print production reports by date, weekly, monthly, and yearly through the report menu on the system.

The following are some points regarding non-functional requirements that must be met by the system:

- The system can be operated on a computer that uses OS Windows 7, 8, and 10 by using the Microsoft Access application
- The system can be connected to the printer so that reports can be printed.
- The system can be connected to a barcode scanner so that barcode scanning can be performed.
- The system must have a security system using a username and password to protect the data that is stored.
- The system must be able to accommodate data for at least one year during the system's operation so that an annual report can be printed.
- The system can be accessed at any time when needed.

3.5. Normalization
These are the steps to normalize a database, including:

3.5.1. Unnormalized Form (UNF).
Initial data set that still does not have a format, there is still repeated data and incomplete data. The data collected is purely based on the input that has been obtained.

3.5.2. 1st Normal Form (1NF).
Collection of data that are interconnected between one another, there is no repeating data, each data has only one understanding, and each table already has a specified Primary Key.

3.5.3. 2nd Normal Form (2NF).
A collection of data in which all attributes other than key attributes depend on the Primary Key but not more than one Primary Key.

3.5.4. 3rd Normal Form (3NF).
Data sets where the attribute is not a key that is in one field must not have transitive dependencies, that is, there is no data in the table that is associated with a field that is not a Primary Key. All data that is not a key in a relation depends only on the Primary Key in that relation.
The following is the system’s data normalization table starting from UNF (unnormalized form) up to 3NF:

| UNF | 1NF | 2NF | 3NF |
|-----|-----|-----|-----|
| Kode Produk | TABEL PRODUK | TABEL PRODUK | TABEL PRODUK |
| Nama Produk | Kode Produk | Kode Produk | Kode Produk |
| No Mesin | Nama Produk | Nama Produk | Nama Produk |
| Remarks | Remarks | Remarks | Remarks |
| Harga Jual | Harga Jual | Harga Jual | Harga Jual |
| Stok | Stok | Stok | Stok |

3.6. Behavior Modelling

Behavior modelling is a model that describes and outlines aspects of internal logic that support a system to run. In this paper there are two diagram techniques that will be used to describe the system to be made, including use case diagrams and activity diagrams.
Use case diagram is a diagram that aims to illustrate the functional needs of the system in the form of a series of actions (Use cases) that will be run by the system when interacting with users (actors). This diagram consists of use case tables that are used for each activity that can be carried out by the system, so that each activity has its own use case. The use case table is as follows:

**Figure 4. Use Case Diagram**

**Use case Table**

| Use case Name | ID | Priority |
|---------------|----|----------|
| Login         | 1  | High     |

**Actor**: All user that have access to the system

**Description**: This use case describes how the user can access the system through the security system using username and password to enter the system.

**Preconditions**:
1. Users login were authenticated.
2. The user does not have username or password.

**Normal Course**:
1. All users must fill in the name and title given to the manager.
2. The manager enters the user's profile into the system and creates a username and password.
3. The manager determines the Security Level for each user in order to limit certain user access to data in the system.
4. The user enters the username and password in accordance with what has been given by the manager into the system.
5. User logged in the system

**Postconditions**: Employees successfully enter the system by using a username and password into the system

**Summary Inputs**

| Source | Destination |
|--------|-------------|
| Manager | strEmpName |
| Manager | strEmpPassword |

**Figure 5. Use Case Table**
While on the other hand, Activity Diagram is a diagram that aims to describe the workflow (activity) or business process of a system.

![Figure 6. Activity Diagram](image)

3.7. Structural Modelling
Structural Modelling is modelling that illustrates the contents of the data structure of the system in accordance with existing business processes. In this paper, the diagram technique that will be used is the class diagram. The following is a class diagram to illustrate the existing classes, including:

![Figure 7. Class Diagram](image)
### 3.8. Table Structure
Table structure is very necessary because it is useful in describing the contents of the table to be used such as the name of the data, the type of data, the size of the data, as well as a description of the data.

#### 3.8.1. Product
- Name: tblProducts
- Primary Key: Product_ID

| No | Field Name   | Data Type    | Field Size | Remarks          |
|----|--------------|--------------|------------|------------------|
| 1  | Product_ID   | Auto Number  | Long Integer | Product Code     |
| 2  | Product_Name | Short Text   | 50         | Product Name     |
| 3  | Remarks      | Short Text   | 50         | Remarks          |
| 4  | Unit_Cost    | Number       | Double     | Price            |
| 5  | Adjusted_Qty | Number       | Long Integer | Stock           |

#### 3.8.2. Production
- Name: tblProduction
- Primary Key: Production_ID_(Barcode)

| No | Field Name                | Data Type | Field Size | Remarks          |
|----|---------------------------|-----------|------------|------------------|
| 1  | Production_ID_(Barcode)   | Number    | Long Integer | Production Code  |
| 2  | Machine_ID                | Number    | Long Integer | Machine Number   |
| 3  | Qty_Prod                  | Number    | Long Integer | Production Total |
| 4  | Date_Prod                 | Date/Time |            | Production Date   |
| 5  | User_ID                   | Number    | Double     | Employee Code    |

#### 3.8.3. Employee
- Name: tblEmployees
- Primary Key: IngEmpID

| No | Field Name       | Data Type     | Field Size | Remarks      |
|----|------------------|---------------|------------|--------------|
| 1  | IngEmpID         | Number        | Long Integer | Employee ID  |
| 2  | strEmpName       | Short Text    | 10         | Employee Name|
| 3  | strAccess        | Short Text    | 20         | Job          |
| 4  | Username         | Short Text    | 10         | Username     |
| 5  | strEmpPassword   | Short Text    | 10         | Password     |
3.8.4. Customer.
- Name: tblCustomers
- Primary Key: Customer_ID

**Table 7. Customer table**

| No | Field Name          | Data Type    | Field Size  | Remarks            |
|----|---------------------|--------------|-------------|--------------------|
| 1  | Customer_ID         | AutoNumber   | Long Integer| Customer ID        |
| 2  | Customer_First_Name | Short Text   | 25          | Customer Name      |
| 3  | Customer_Email      | Short Text   | 30          | Customer Email     |
| 4  | Customer_Phone_Number | Short Text | 15          | Customer Phone     |
| 5  | Customer_Address    | Short Text   | 80          | Customer Address   |

3.8.5. Warehouse.
- Name: tblWarehouse
- Primary Key: Warehouse_ID
- Foreign Key: Production_ID_(Barcode)

**Table 8. Warehouse table**

| No | Field Name                  | Data Type     | Field Size  | Remarks          |
|----|-----------------------------|---------------|-------------|------------------|
| 1  | Warehouse_ID                | AutoNumber    | Long Integer| Warehouse ID     |
| 2  | Production_ID_(Barcode)     | Number        | Long Integer| Production Code  |
| 3  | Date_Received               | Date/Time     |             | Received Date    |
| 4  | Location_ID                 | Short Text    | 3           | Location ID      |
| 5  | User_ID                     | Number        |             | Employee Code    |

3.8.6. Sales.
- Name: tblSales
- Primary Key: Sale_ID
- Foreign Key: Customer_ID

**Table 9. Sales table**

| No | Field Name        | Data Type     | Field Size  | Remarks          |
|----|-------------------|---------------|-------------|------------------|
| 1  | Sale_ID           | AutoNumber    | Long Integer| Sale ID          |
| 2  | Customer_ID       | Number        | Long Integer| Customer ID      |
| 3  | Product_Name      | Number        | Long Integer| Product Code     |
| 4  | Quantity_Sold     | Number        | Long Integer| Total Sales      |
| 5  | Transaction_Date  | Date/Time     |             | Sales Date       |
3.9. Barcode
In this system, the use of barcodes is used as production codes. This is necessary so that the barcode can store data and information needed by warehouse staff who sometimes have difficulty finding products in the warehouse. The process is carried out by the production staff who will put a barcode sticker each time the product is finished packing, then enter the relevant information into the production menu. Then the goods are handed over to the warehouse, then the warehouse storage data is re-entered into the system.

![Barcode Image](image_url)

**Figure 7.** Barcode that are used in the system

The barcode used is Code 128 type and to determine the barcode value on the barcode the rule used is the first six digits is the date when the production is done with the DDMMYY format, then followed by the next four digits which means the product number produced at that day (1 - 9999). So overall the barcode uses 10 digits number. All of these numbers can be generated automatically using the DRPU Barcode Label Maker application or using data that was created in Microsoft Excel beforehand. System users must print this barcode every day before starting production activities.

4. Conclusion
The conclusion that can be drawn from this paper is the design of a system made for PT Akrilik Kurnia Kencana using Microsoft Access, after going through a system feasibility analysis it can be stated that the system designed is suitable for use.

Then operationally, the company has sufficient resources to operate the system within the company. This system as a whole is able to cover the deficiencies that exist in the system implemented by the company at this time, especially in the company's warehouse that has problems in storing finished goods, namely the product placement rules.

In addition, this system can also be useful for monitoring production results so that necessary information - information contained in a barcode can be input into this system.

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